INTERNATIONAL CONFERENCE ON PHYSICS-2022

19 – 21 May 2022

Theme: Physics for 4th Industrial Revolution and Beyond

PROGRAMME & ABSTRACTS

Venue: Atomic energy Centre Dhaka

Organized by

Bangladesh Physical Society

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Sessions List

Sl. No.	Session Name	Session Number	Date	Time
1.	Plenary Session	I	19 May 2022	**12:10 – 13:10**
2.	Theoretical & Computational Physics-I	IIA	"	14:30 – 16:00
3.	Electronics and ICT	IIB	"	14:30 – 16:00
4.	Health and Radiation Physics	IIIA	"	16:20 – 18:10
5.	Materials Science-I	IIIB	"	16:20 – 18:10
6.	Nanomaterials-I	IVA	20 May 2022	9:00 – 11:00
7.	Theoretical & Computational Physics-II	IVB	"	9:00 – 11:00
8.	Reactor and Nuclear Physics	VA	"	11:20 – 12:50
9.	Thin Film	VB	"	11:20 – 12:50
10.	Materials Science - II	VIA	"	14:30 – 16:20
11.	Medical Physics	VIB	"	14:30 – 16:20
12.	Composite and Polymer Physics	VIIA	"	16:40 – 18:20
13.	Meteorology and Atmospheric Physics	VIIB	"	16:40 – 18:20
14.	Environmental Science	VIIIA	21 May 2022	9:00 – 10:50
15.	Nanomaterials-II	VIIIB	"	9:00 – 10:50
16.	Physics Education	IX	"	11:00 – 12:00
17.	Poster Session		"	12:00 – 15:00
18.	US-Bangladesh Education Collaboration Program	X	"	15:00 – 16:30

Sessions Chair List

Sl. No.	Session Name	Session Number	Date	Time	Session Chair and Co-chair/Discussant
1.	Plenary Session	I	19 May 2022	12:10 – 13:10	Prof. Mesbahuddin Ahmed Prof. Abu Hashan Bhuiyan
2.	Theoretical & Computational Physics-I	IIA	"	14:30 – 16:00	Prof. Saleh Hasan Naqib Prof. Alamgir Kabir
3.	Electronics and ICT	IIB	"	14:30 – 16:00	Dr. Md. Shakil Ahmed Dr. Imtiaz Ahmed
4.	Health and Radiation Physics	IIIA	"	16:20 – 18:10	Dr. Syed Mohammod Kamal Prof. Suranjan Kumar Das
5.	Materials Science-I	IIIB	"	16:20 – 18:10	Dr. Engr. Sheikh Manjura Hoque Dr. Md. Khorshed Alam
6.	Nanomaterials-I	IVA	20 May 2022	9:00 – 11:00	Prof. Shibendra Shekher Sikder Dr. M. Khurshed Alam
7.	Theoretical & Computational Physics-II	IVB	"	9:00 – 11:00	Prof. G. M. Bhuiyan Prof. Ratan C. Gosh
8.	Reactor and Nuclear Physics	VA	"	11:20 – 12:50	Dr Shafiqul Islam Bhuiyan Dr. Md. Kabir Hossain
9.	Thin Film	VB	"	11:20 – 12:50	Prof. Abu Talib Md. Kaosar Jamil Dr. Md. Tareq Chowdhury
10.	Materials Science - II	VIA	"	14:30 – 16:20	Prof. Md. Manjurul Haque Prof. Jahirul Islam Khandaker
11.	Medical Physics	VIB	"	14:30 – 16:20	Dr. Md. Shakilur Rahman Prof. Abu Sayem Karal
12.	Composite and Polymer Physics	VIIA	"	16:40 – 18:20	Prof. Md. Aftab Ali Shaikh Prof. Sajal Chandra Mazumdar
13.	Meteorology and Atmospheric Physics	VIIB	"	16:40 – 18:20	Dr. Samarendra Karmakar Dr. Md. Abdul Mannan
14.	Environmental Science	VIIIA	21 May 2022	9:00 – 10:50	Dr. Bilkis Ara Begum Dr. Muhammad Abul Kalam Mallik
15.	Nanomaterials-II	VIIIB	"	9:00 – 10:50	Dr A K M Abdul Hakim Prof. Md. Mohi Uddin
16.	Physics Education	IX	"	11:00 – 12:00	Prof. Mesbahuddin Ahmed Prof. Shamima K. Chowdhury Prof. Shibendra Shekher Sikder
17.	Poster Session		"	12:00 – 15:00	

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International Conference on Physics – 2022 19-21 May 2022

PROGRAMME

19th May 2022 (Thursday)

Venue: Atomic Energy Centre Dhaka
Time : 9:00 AM
Registration of the Participants

Inaugural Session : 11:00 – 12:00
Venue : Auditorium, Atomic Energy Centre Dhaka

Session (I): Plenary Session

Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 12:10– 13:10

Chair : Prof. Mesbahuddin Ahmed
Discussant : Prof. Abu Hashan Bhuiyan

Plenary talk: [30+30 minutes]

PT-01: Nanotechnology and 4th Industrial Revolution: Bangladesh Perspective; **A. K. M. A. Hakim, BUET**
PT-02: Nuclear Power Program and Development: Bangladesh Perspective; **Mohammad Shawkat Akbar, BAEC**

Lunch and Prayer Break: 13:10 – 14:30

Technical Sessions Programme

Session (IIA): Theoretical and Computational Physics-I
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 14:30 – 16:00

Chair : Prof. Saleh Hasan Naqib
Co-Chair : Prof. Alamgir Kabir

Invited Talk [20 minutes]

IT- IIA: Signature of Segregation in the Transport Properties of Liquid Binary Alloys: **G M Bhuiyan, University of Dhaka**

Contributory Papers [10 minutes per paper]

TCP-01: Wigner Rotation in Different Space-time; **Md. Tarek Hossain**

TCP-02: Study of a Thunderstorm Event over Cox's Bazar, Bangladesh Using WRF Model; **Mohammed Mozammel Hoque, Syed Jamal Ahmed, S.M. Quamrul Hassan, M.A.K. Mallik, Md. Omar Faruq**

TCP-03: Vortex Configurations of a Nano-sized Superconducting 3D Pyramidal Confinement; **Abul Hasnat Rubel**

TCP-04: A Study of Volume Dependence Second and Third Order Grüneisen Parameter for Solid; **Sumal Chandra**

TCP-05: How H463R variant turns hKv1.5 into a loss of functional channel: A MD simulation study; **Md Harunur Rashid**

TCP-06: Possible Inconsistencies of Schwarzschild metric to Study Black Holes; **Sheikh Jafrul Hassan**

TCP-07: Consequences of Quantum Effects in Superconductor; **M.R. Islam**

Session (IIB): Electronics and ICT
Venue: Classroom, Atomic Energy Centre Dhaka
Time: 14:30 – 16:00

Chair : Dr. Md. Shakil Ahmed
Co-Chair : Dr. Imtiaz Ahmed

Invited Talk **[20 minutes]**

IT-IIB: Active Integrated Array Antenna for Next Generation Wireless Communication Systems − Challenge to Advanced Antenna Utilizing Spatial Parameter of Radio Wave: **Ichihiko Toyoda, Saga University, Japan**

Contributory Papers **[10 minutes per paper]**

EICT-01: A Secured Steganography Technique to Concealed Data Within Image; **Mohammed Asraf Uddin, Md. Shamimul Islam, Md. Haidar Ali, Nayan Kumar Datta, Md. Imran Hossain Showrov, Md. Shafiqul Islam**

IECT-02: Threat Minimization in Email Using Data Mining In Banking Sector; **Md. Haidar Ali, Md. Imran Hossain Showrov, Md. Shamimul Islam, Mohammed Asraf Uddin, Nayan Kumar Datta, Md. Shafiqul Islam**

EICT-03: Implementation of E-Learning Using Moodle in Nuclear Education; **Md. Shamimul Islam, Imran Hossain Sowrov, Nayan Kumar Datta, Md. Haidar Ali, Mohammed Asraf Uddin**

EICT-04: A Private Cloud Configuration to Overcome the 'Big Data' Challenges of Bangladesh Atomic Energy Commission (BAEC); **Nuba Shittain Mitu, Md Dulal Hossain**

EICT-05: Apache Hadoop Platform: A 'Big Data' Storage and Management Solution of the Data Warehouses; **Nuba Shittain Mitu, Karim Ouazzane**

EICT-06: Channel Estimation and Signal Detection in OFDM system using Deep Learning and its performance on Digital Modulation; **Md Matiqul Islam, Md Ashraful Islam, Md Najmul Hossain**

EICT-07: Problematic/Excessive phone, computer, and online use among Bangladeshi Nationals amid COVID-19: the role of psychological well-being and pandemic related factors; **Munima Haque, Md. Kamrul Hossain, Md. Quamruzzaman, Md. Shohag Hossain**

Tea Break : 16:00 – 16:20

Session (IIIA): Health and Radiation Physics
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 16:20 – 18:10

Chair : Dr. Syed Mohammod Kamal
Co-Chair : Prof. Suranjan Kumar Das

Invited Talk **[20 minutes]**

IT-IIIA: The role of Nuclear Data for Production of Diagnostic and Theranostic Radionuclides: **Mayeen Uddin Khandaker, Sunway University, Malaysia**

Contributory Papers **[10 minutes per paper]**

HRP-01: Experimental Research on Net Vapor Generation Point Under In-Vessel Retention Conditions; **M. A. Rafiq Akand, M. K. Basher, S. M. Amir-Al-Zumahi, M. Shah Alam and M. A Sayid Haque**

HRP-02: Characterization of LiF:Mg,Ti Crystal Dosimeters (MTS-100) for the Dosimetry of ^{60}Co Photon Beam; **M. J. Hossain, N. Arobib, T. Siddiquab, S. Purohit, H. M. Jamil, M. M. H. Bhuiyan, AKM M. H. Meaze, M. S. Rahman**

HRP-03: Measurement of Natural Radioactivity Levels in Soil, Sediment, and Water Samples Collected from the Padma River around Rooppur, Bangladesh; **Aurpon Sen, Shampa Paul, M. A. Haydar, Kanij Fatema, Kutub Uddin**

HRP-04: Temporal Variation of Natural Radioactivity and Evaluation of Radiological Hazards in Sediment Cores of Sundarban, Bangladesh; **Shaiful Kabir, Mohammad Amirul Islam, UmmaTamim, Mohammad Belal Hossen**

HRP-05: GIS Predictive Mapping of Absorbed Dose Rate and Activity Concentrations of NORMs in Bangladesh; **Md. Ashik Azad Khan Anik, Nighat Sultana Reshma, AKM Saiful Islam Bhuian, Quazi Muhammad Rashed Nizam**

HRP-06: γ-radiation Induced Hydrogels in Removal of Dyes and Heavy Metals; **Tanvir Ahmed, Md. Saifur Rahaman, Shah. Md. Marzuk Hasnine, Salma Sultana**

HRP-07: Synthesis of Proton Exchange Membrane by Radiation Grafting; **Shahnaz Sultana, Nazia Rahman, Md. Nabul Sardar, Rahim miah, Humaun Kabir**

HRP-08: Commissioning of Co-60 Teletherapy Machine at SSDL, Bangladesh: Verification and Measurements of Imperative Machine Parameters during Installation; **M. A. Aziz, T. Siddiqua, H. M. Jamil, N. Arobi, M. M. H. Bhuiyan, S. Purohit, AKM M. H. Meaze, M. S. Rahman**

HRP-09: Determination of Gross Alpha Radioactivity in Surface Water Collected from Twenty-Three Major Geographical Regions from Central Point of Dhaka City: **M. F. Kabir, N. Sultana, J. Ferdousy, N. Hassan, S. Banik, S. Pervin, M.M.M Siraz, S. Yeasmin**

Session (IIIB): Materials Science-I
Venue: Classroom, Atomic Energy Centre Dhaka
Time: 16:20 – 18:10

Chair : Dr. Engr. Sheikh Manjura Hoque
Co-Chair : Dr. Md. Khorshed Alam

Invited Talk **[20 minutes]**

IT-IIIB: Designing the smallest bandgap proper ferroelectric material: **D. D. Sharma, IISC, India**

Contributory Papers **[10 minutes per paper]**

MS-01: Study on the Effectiveness of Polyimide and Polyester Polymer for Radiation Shielding in A Spacecraft Forlong Term Space Mission; **Md. Abdullah Al Zaman, Md. Rafiqul Islam, H. M. A. R. Maruf, Quazi Muhammad Rashed Nizam**

MS-02: Chemical Vapor Deposition Synthesis of Lead-Free All-Inorganic $Cs_3Sb_2I_9$ Perovskite Microplates for Ultra-Fast Photoconductive Response and Robust Thermal Stability; **Sujit Kumer Shil, Fei Wang, Kin Man Yu**

MS-03: The Influence of Magnesium Doping on $BaZr_{0.5}Y_{0.5-X}MgxO_3$ Perovskite Oxide for Applications in Solid Oxide Fuel Cell; **Zerin Tasnim, Fariha Tasnim, I. N. Esha, J. Maudood, M. S. Islam, M. N. I. Khan, M. A. Mamun, S. Hossain, Kazi Hanium Maria**

MS-04: Effect of Samarium on Electrical Properties of Lanthanum Ferrite Nanoparticles; **Shovan Kumar Kundua, Dhiraj Kumar Rana, Soumen Basu**

MS-05: Impact of Yttrium and Lanthanum on Structural, Optical, Electrical and Magnetic Properties of Cobalt Ferrites nanoparticle; **Nazia Khatun, Sajib Ahamed, Mohammad Sajjad Hossain, Md. Al- Mamun**

MS-06: Validate the Improvement of Footprint of the Female Connector on PCB Surface by Using HFSS; **Md. Ashraful Islam, Md. Matiqul Islam , Md. Firoz Ahmed, Md. Najmul Hossain, Md. Hasnat Kobir**

MS-07: A Systematic Study of Structural, Electronic and Optical Properties of $MoTe_2$ in Bulk and 2D Monolayer Structures; **M. Kamruzzaman, M. Khuku Moni, M. Hossain, M. Aktary**

MS-08: Study on Hydrogen Isotopes Behavior in Proton-Conducting Oxides by TDS and $TMAP_4$ Simulation; **M. Khalid Hossain, Kenichi Hashizum**

MS-09: Study of the Structural, Electrical, And Magnetic Properties of $(Fe_{95}Ti_5)_{75}P_{15}C_{10}$ Amorphous Ribbon; **A. Mortaza, M. Aminul Islam, R. Rashid, M. N. I. Khan and M. K. Alam**

20th May 2022 (Friday)

Session (IVA): Nanomaterials-I
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 9:00 – 11:00

Chair : Prof. Shibendra Shekher Sikder
Co-Chair : Dr. M. Khurshed Alam

Invited Talk **[20 minutes]**

IT-IVA: Innovations through Poor Man's Nanotechnology: From the Lab to the Market: **Sunandan Baruah, Assam University, India**

Contributory Papers **[10 minutes per paper]**

NM-01: Synthesis and Characterization of pH Controlled Biogenic Silver Nanoparticles Using Szygium cymosum Leaf Extract and Investigation of Their Potential Biomedical Applications; **Kazi Mustafa Mahmud, Md. Ashraful Hasan, Satya Ranjan Sarker, Mohammad Mahfuz Ali Khan Shawan, Masato Takikawa, Shinji Takeoka, Md. Salman Shakil, Md. Monir Hossain, Shakil Ahmed Polash, Mahruba Sultana Niloy, Md. Forhad Uddin, Morshed Alam**

NM-02: Investigation of antimicrobial activity and biocompatibility of biogenic silver nanoparticles synthesized using Syzygium cymosum extract; **Kazi Mustafa Mahmud, Md. Monir Hossain, Shakil Ahmed Polash, Masato Takikawa, Md. Salman Shakil, Md Forhad Uddin, Morshed Alam, Mohammad Mahfuz Ali Khan Shawan, Tanushree Saha, Shinji Takeoka, Md. Ashraful Hasan, Satya Ranjan Sarker**

NM-03: Study of the Influence of Annealing Temperatures on CdS Nanoparticles Synthesized by Chemical Precipitation Method; **F. T. Z. Toma, K. M. A. Hussain, M. S. Rahman, H. Das, M. N. I. Khan**

NM-04: Co_3O_4 decorated three dimensional MoS_2 nanoflower for stable supercapacitor electrode with improved capacitive performance; **Md. Hasive Ahmad, Rabeya Binta Alam, Muhammad Rakibul Islam**

NM-05: Effects of Cr doping on the structural and electromagnetic properties of Cu Mg nanoferrites prepared by the sol gel method; **Sumi Akter , M.N.I. Khan , Faria Ferdous, R. Hasan, H. N. Das, Ishtiaque M. Syed**

NM-06: Sol-gel synthesized double perovskite Nd_2FeCrO_6: Structure and magnetic properties; **Fahmida Sharmin, Ferdous Ara, Rana Hossain, Subrata Das, M.D.I Bhuyan, and M. A. Basith**

NM-07: Effect of sintering temperature on dielectric and optical properties of Na-montmorillonite supported $NiFe_2O_4$ nanocomposites; **M. A. Dipty, M. Shorifullah, S. Islam, N. Khatun, N. I. Tanvir, S. K. Sen, T. C. Paul, P. Bala**

NM-08: Microstructural parameters analysis of hydrothermally synthesized Mg-doped SnO_2 nanoparticles with Debye-Scherrer, Williamson-Hall and Halder-Weigner methods; **Pooja Sarker , Sapan Kumer Sen, Abdul Al Mortuza, M. S. Manir, M. Razibul Hasan**

NM-09: Natural Antioxidant Based Synthesis of Magnetic Silver Nanoparticles Using Some Medicinal Leaves And Their Applications Against Cancerous Cell And Multidrug-Resistant Strains: **M. F. Kabir; M. Z. Rahman; J. Ferdousy; A.K.M. Atique Ullah; M. M. Rahman; M.N.I. Khan**

Session (IVB): Theoretical and Computational Physics-II
Venue: Classroom, Atomic Energy Centre Dhaka
Time: 9:00 – 11:00

Chair : Prof. G. M. Bhuiyan
Co-Chair : Prof. Ratan C. Gosh

Invited Talk **[20 minutes]**

IT-IVB: Fluctuation diamagnetism in Y123: implications on the origin of the normal state pseudogap: **Ayesha Siddika Borna, R. S. Islam, S. H. Naqib, University of Rajshahi**

Contributory Papers **[10 minutes per paper]**

TCP-08: Electronic, magnetic, and optical properties of the Heusler compounds $NbMn_2$(Si, Ge) using TB-mBJ potential; **Mohammad Abdur Rashid, Md. Ohiduzzaman**

TCP-09: Structural, electronic and optical properties of Sn doped cubic ZnS solid solution: First-principles study; **Md. Borhanul Asfia, Mohammad Abdur Rashid**

TCP-10: Influence of M atomic species on physical properties of MAX phases M_2TlC (M= Ti, Zr, Hf): a DFT calculations; **M. Sohel1, M. A. Ali, M. M. Hossain, S. H. Naqib, A. K. M. A. Islam, M. M. Uddin**

TCP-11: Ternary Scandium based Antiperovskites Sc_3GaX (X=B, N): DFT Study; **Istiak Ahmed, F. Parvin, A.K.M. A. Islam**

TCP-12: Band gap engineering of cubic halide $RbSrCl_3$ perovskite under pressure: insights from DFT; **Sahadat Jaman, Md. Borhanul Asfia, Mohammad Abdur Rashid**

TCP-13: An ab initio approach to understand the structural, thermophysical, electronic, and optical properties of binary silicide $SrSi_2$: A double Weyl semimetal; **Suptajoy Barua, B. Rahman Rano, Ishtiaque M. Syed, S. H. Naqib**

TCP-14: DFT insights into the new Hf-based chalcogenide MAX phase Hf_2SeC; **M. A. Alia, Muhammad Waqas Qureshib**

TCP-15: Potentials for $\alpha+^{50,52,53}Cr$, $\alpha+^{63,65}Cu$, $\alpha+^{64,66,70}Zn$ and $\alpha+^{70,72}Ge$ Elastic Scattering at 25.0 MeV; **Mohammad Ullah, M. Nure Alam Abdullah**

TCP-16: Elastic, electronic, bonding, optoelectronic and thermos physical properties of $SnTaS_2$: comprehensive insights from ab-initio calculations: **M. I. Naher, M. Mahamudujjaman, A. Tasnim, S. H. Naqib**

Tea Break : 11:00 – 11:10

Session (VA): Reactor and Nuclear Physics
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 11:20 – 12:50

Chair : Dr Shafiqul Islam Bhuiyan
Co-Chair : Dr. Md. Kabir Hossain

Contributory Papers **[10 minutes per paper]**

RNP-01: Sodium-cooled Long-life Fast Core Burnup Study with Serpent; **S. M. Shauddin, Toru Obara, Hai-kun, Nishiyama-sensei, M. J. H. Khan**

RNP-02: Particle Sedimentation and Bed Formation Behavior in Severe Accident of Nuclear Reactors; **Md Abdur Rob Sheikh, Md Maidul Islam**

RNP-03: Internal Morphology Study of Madupur Clay Based Cox's Bazar Beach Sand and Minerals Incorporated Indigenous Radiation Shielding Composites by Thermal Neutron Imaging Using TRIGA Mark-II Research Reactor; **M. Mahfujur Rahman, M. Shamsuzzaman, R. A. Ramon, Mohammad Rajib, M. Al-Mamun, S. Sultana, Shakhawat H. Firoz**

RNP-04: Radiological Dose Assessment Using RASCAL 4.3 Code for Postulated Severe Accidental Conditionsof VVER-1200 Type Reactor; **M. Abu Khaer, S. Sultana Shiuli, M. Mominul Islam, M. Ajijul Hoq, M. Tareque Chowdhury, M. Mizanur Rahman**

RNP-05: Coupled neutronics and thermal-hydraulics calculations for VVER-1000 pin cell benchmark; **Mohammad Abdul Motalab, Saad Islam**

RNP-06: Extension of the length of operation cycle of the TRIGA MARK II by compacting reactor core with fuels; **M. H. Altaf, M. S. Mahmood, S. M. Shauddin, M. A. Motalab and M. J. H Khan**

RNP-07: Numerical Studies of Plasma Pinch Properties in a Mega Joule Plasma Focus Device Using Lee Model Code; **M N Huda, M A Malek, M K Islam**

RNP-08: On Fuel Loading Strategy of BAEC TRIGA Research Reactor (BTRR); **M. A. Motalab, M. S. Mahmood, J. H. Khan**

RNP-09: Supply Chain system for Sustainable Nuclear Power Plant in Bangladesh; **Mohammad Ashraful Huq, Md Saadbin Chowdhury, Rajib Goswami, Mohammad Shawkat Akbar**

RNP-10: Application of NAA for elemental analysis of sediments from the Padma river adjacent to Rooppur Nuclear Power Plant area: **Abu Sayed Mohammed Sayam, Mohammad Amirul Islam, Kamrun Naher, Rahat Khan, Umma Tamim, Mohammad Monzur Hossain Khan**

Session (VB): Thin Film
Venue: Classroom, Atomic Energy Centre Dhaka
Time: 11:10 – 12:50

Chair : Prof. Abu Talib Md. Kaosar Jamil
Co-Chair : Dr. Md. Tareq Chowdhury

Invited Talk **[20 minutes]**

IT-VB: Materials for Stable Perovskite Solar Cells: Advances, Challenges and Opportunities: Md. Akhtaruzzaman, **The National University of Malaysia, Malaysia**

Contributory Papers **[10 minutes per paper]**

TF-01: Fabrication of Cu_2ZnSnS_4(CZTS) thin films by ultrasonic spray pyrolysis at a low substrate temperature and effect of tin concentration on the characteristics of the CZTS thin films; **Munira Sultana, Ayesha Siddika, Syed Shafquat Mahmood, and M. S. Bashar**

TF-02: Antimicrobial effect of GO@CuO nanostructured thin film coated leather with enhanced durability against abrasion; **Khandaker Tanzim, M. Nuruzzaman Khan, and Mohammed Mizanur Rahman**

TF -03: Investigation of structural, optical and electrical properties of calcium substituted barium titanate thin films for various optoelectronic applications; **Abdul Barik, A. Ahad, M.H. Babu, J. Podder and M. Sharmin**

TF -04: Synthesis and Characterization of $BaTiO_3$ Thin Films from Ball-Milled derived Nanopowder and Precursor Solution by Spin Coating; **M.S. Habib, N.I. Tanvir, M. N. A. Bitu, M.S. Islam, S. Islam, N. Khatun, and S.F.U. Farhad**

TF -05: Copper nano-particle doped PEDOT: PSS assisted to enhance the hole transport in thin film perovskite solar cells; **Md. Johurul Islam, Mohammad Jellur Rahman, Md. Shahriar Bashar, Munira Sultana, M. M. Alam;**

TF -06: Comparative Studies on the Properties of Nanoparticle and Precursor Solution Derived Wide Bandgap SnO_2 Thin Films Grown by Spin Coating; **M. N. A. Bitu, N.I. Tanvir, M.S. Islam, Md. Saidul Islam, M. S. Quddus, S. Islam, and S.F.U. Farhad**

TF -07: Dye sensitized solar cells based on ZnO thin films deposited by ultrasonic spray pyrolysis **A. Rahman, F. Ferdous, M. S. Bashar, S. I. Liba, M. A. Bhuiyan, I. M. Syed**

TF -08: Coffee Ring Free CAAC ZnO Thin Film by Spray Pyrolysis for High Performance Thin Film Transistor; **Jewel Kumer Saha, Jin Jang**

Lunch and Prayer Break : 12:50 – 14:30

Session (VIA): Materials Science - II
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: Time: 14:30 – 16:20

Chair : Prof. Md. Manjurul Haque
Co-Chair : Prof. Jahirul Islam Khandaker

Invited Talk **[20 minutes]**

IT-VIA: Emergence of Dirac Materials in Carbon Family: **Debnarayan Jana, University of Calcutta, India**

Contributory Papers **[10 minutes per paper]**

MS-10: Investigation through structural, electrical, and magnetic properties of the Al^{3+} ions doped Ni-Zn-Co nano-spinel ferrites; **N. Jahan, M. N. I. Khan, H. N. Das, R. Hasan, S. Manjura Hoque and J. I. Khandaker**

MS-11: Structural and Magnetic Properties of Dy Substituted Mg-Cu-Zn Ferrites; **M. Hassan, S. Manjura Hoque, H. N. Das, M. N. I. Khan, F. A. Khan, M. Samir Ullah**

MS-12: Ab Initio Study of Structural and Physical Properties of Cd-Based Chloroperovskite $XCdCl_3$ (X=Ag, K) Structures; **Kamal Hossain, F. Ahmed, S. S. Sikder**

MS-13: Influence of reaction temperatures on the particle size of V_2O_5 synthesized by facile hydrothermal technique and their auspicious photocatalytic performance in dye degradation **M A Jalil, M.N.I. Khan, S. Mandal, S. I. Liba, F.-U.-Z. Chowdhury, M.M. Hossain, D. Jana, M. S. Alam, M.M. Uddin**

MS-14: X-ray diffraction analysis by Williamson-Hall, Size-Strain Plot and Halder-Wagner methods of $Ni_{0.48}Cu_{0.12}Zn_{0.40}Gd_{0.06}Fe_{1.94}O_4$- a comparative study; **Bablu Chandra Das, Harinarayan Das, F. Alam, A. K. M. Akther Hossain**

MS-15: Influence of Gd^{3+} Substitution on Microstructural, Temperature Dependent Permeability and Electrical Properties of Mn-Ni-Zn Ferrites; **M. Nazrul Islam, Rakibul Hassan, M. N. I. Khan, A. K. M. Akther Hossain**

MS-16: Synthesis and compositional analysis of ZnO powder using different chemical precursors: **Mst. Ummay Sumaya, F. T. Z. Toma, I. N. Esha, Arup Kumar, M.A. Zubair, M. N. I. Khan, M. Tarek Chowdhury, M. S. Bashar, Kazi hanium Maria**

MS-17: Improvement in structural stability and electronic properties of Perovskite oxide $SrZr_{0.5}Y_{0.5-x}Ca_xO_3$ by doping Calcium for Solid oxide fuel cell application: **Fariha Tasnim, Zerin Tasnim, I. N. Esha, J. Maudood, M. S. Islam, M. N. I. Khan, M. A. Mamun, S. Hossain, Kazi Hanium Maria**

MS-18: Semiconducting to Metallic Phase Transition in $AgCdCl_3$ Perovskite under Hydrostatic Pressure: **Kamal Hossain, F. Ahmed, S. S. Sikder**

Session (VIB): Medical Physics
Venue: Classroom, Atomic Energy Centre Dhaka
Time: Time: 14:30 – 16:20

Chair : Dr. Md. Shakilur Rahman
Co-Chair : Prof. Abu Sayem Karal

Invited Talk **[20 minutes]**

IT-VIB: Scope of Neuroimaging for the Diagnosis of Schizophrenia: Machine Learning-based study as the future of clinical Study**: Indranath Chatterjee, Tongmyong University, South Korea**

Contributory Papers **[10 minutes per paper]**

MP-01: Early Detection of Breast Cancer using Rectangular Patch Microstrip Antenna; **M. Firoz Ahmed, M. Hasnat Kabir and M. Ashraful Islam**

MP-02: An Overview on 211At for Targeting Alpha Therapy; **A.K. M. Rezaur Rahman, Kamrul Hasan Nayem, Mahathe Hasan Babu, Mustofa Khalid Ovi**

MP-03: Synthesis and characterizations of nanohydroxyapatite (nHAp) from eggshells waste by novel hydrothermal route for biomedical applications; **Md. Hasibuzzaman Rabbi1, Mirza H. K. Rubel, Abu Mahmud, Md. Shariful Islam, M. K. Hossain, A. El-Denglawey**

MP-04: Dosimetry of High Energy Electron Beam Delivered from Medical LINAC: A Study of Small Fields; **Santunu Purohit, Md Shakilur Rahman, Md Abul Hasnat, AKM Moinul Haque Meaze**

MP-05: Measurement of Dosimetric Errors of TPS Calculations for Radiotherapy Using CIRS Thorax Phantom; **Sultan Mahmud, Md Mokhlesur Rahman, Md Shoorjo Islam Khan, Md Anwarul Islam, Rajada Khatun, Shirin Akter, A N Monika, M M Rahman, M M Ahasan, G A Zakaria**

MP-06: Development a dose escalation of IMRT protocol of HN cancer patient based on SBRT treatment procedure; **Farjana Yeasmin, M Jahangir Alam, Kaniz Fatema Kakolee**

MP-07: Observing Tumor Ablation of Numerous Soft Tissues using High Intensity Focused Ultrasound Setup; **Anika Tun Naziba, Manika Tun Nafisa and Mohammad Nasir Uddin**

MP-08: Effects of physiological parameter evolution on the dynamics of tonic-clonic seizures; **F. Deeba, P. Sanz-Leon, P. A. Robinson**

MP-09: Effects of sugar concentration on the electroporation in giant lipid vesicles: **Malay Kumar Sarkar, Md. Kabir Ahamed, Marzuk Ahmed, and Mohammad Abu Sayem Karal**

Tea Break : 16:20 – 16:40

Session (VIIA): Composite and Polymer Physics
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 16:40 – 18:20

Chair : Prof. Md. Aftab Ali Shaikh
Co-Chair : Prof. Sajal Chandra Mazumdar

Invited Talk [20 minutes]

IT-VIIA: Smart materials for future technology: Magnetoelectric coupling and Multiferroic composites: **A. K. M. Akther Hossain, BUET**

Contributory Papers [10 minutes per paper]

CPP-01: Extraction, optical properties and ageing effect of natural dyes and its impact on the power conversion efficiency of dye-sensitized solar cells; **S. J. Shahrina , M.M.H.Bhuiyan, M.S. Manir, S M Amir-Al Zumahi, F..Kabir, N. Arobi, Md. Khairul Islamd, M. I. Uzzal, M.S. Rahman, M. A. Rafiq Akand, M Mahbubur Rahman**

CPP-02: Enhancing the power conversation efficiency of Dye sensitized solar cells by using an alternative electrolyte to conventional Electrolyte; **M. I. Uzzal, M. M. H. Bhuiyan, M. S. Manir, M.S. Rahman, F. Kabir, S. J. Shahrin, R.K.Mazumdar, R. A. Khan**

CPP-03: Preparation of cellulose nanofiber-leather waste biocomposites for footwear components; **Jannatul Ferdaus, Taslim Ur Rashid, Mohammed Mizanur Rahman**

CPP-04: Comparing the Structural, Magnetic and Transport properties of $Ba_{0.8}Ca_{0.2}Ti_{1-x}Nb_xO_3$ and $Ba_{0.8}Ca_{0.2}Ti_{1-x}Y_xO_3$ based on frequency; **Tasnia Jabin, Md. Abu Raif, J. U. Ahamed, M. N. I. Khan**

CPP-05: Preparation of Amine Functionized Gma-G-Non Woven Pe Fabric And It's Application In Anionic Dye Removal; **Nazia Rahman, Nirmal Chandra Dafader, Shahnaz Sultana, Md. Nabul Sardar**

CPP-06: Removal of Toxic Cr (VI) Ions Using Amidoximated Acrylonitrile Grafted Non-Woven Polypropylene Fabric; **Md. Nabul Sardar, Nazia Rahman, Shahnaz Sultana, Nirmal Chandra Dafader**

CPP-07: rGO-CuO Nanocomposite Incorporated Chitosan/PVA Electrospun Nanofiber Mat for pH Sensitive Adsorption of Organic Dyes; **Tanvir Siddike Moin, M. Nuruzzaman Khan, Mohammed Mizanur Rahman**

CPP-08: Exploring the Coupling Effect of Ferromagnetic, $Co_{0.8}Zn_{0.2}Fe_2O_4$ with the Ferroelectric, $La_{0.5}Ba_{0.5}TiO_3$ at Different Concentrations in Composite Multiferroics: **Umme Habiba, I. N. Esha, M. N. I. Khan, H. N. Das, M. S. Bashar, Kazi Hanium Maria**

Session (VIIB): Meteorology and Atmospheric Physics
Venue: Classroom, Atomic Energy Centre Dhaka
Time: 16:40 – 18:20

Chair : Dr. Samarendra Karmakar
Co-Chair : Dr. Md. Abdul Mannan

Invited Talk **[20 minutes]**

IT-VIIB: Statistical Analysis of Long-term temperature trends in Bangladesh; **Md. Mahbub Alam and A. S. M. Mahtab, KUET**

Contributory Papers **[10 minutes per paper]**

MAP-01 Sensitivity of Microphysics in WRF-ARW Model for the Simulation of Tropical Cyclones 'Amphan' and 'Bulbul' over the Bay of Bengal; **Md. Idris Ali and Md. Mahbub Alam, KUET**

MAP-02 Heat Wave in Bangladesh- dynamics and predictability; **Md. Abdul Mannan, Fatima Akter, Samarendra Karmakar, Md. Abdul Mannan Chowdhury**

MAP-03 Comparison of High Resolution Satellite-Derived Sea Surface Temperature with Observed SST from Buoy over Indian Ocean; **S.M. Quamrul Hassan, Syed Jamal Ahmed , Razia Sultana, Kazi Jebunessa**

MAP-04 Sensitivity of Cumulus Physics Schemes in WRF-ARW Model for Predicting Thunderstorm Events over Bangladesh; **Fariha Tabassum, M. A. K. Mallik**

MAP-05 Sensitivity of WRF microphysics schemes for predicting Severe Thunderstorm event over Bangladesh-Through validation approach; **Tanjina Akram and M. A. K. Mallik**

MAP-06 Tropical Cyclone Structure Analysis using Satellite Observations; **Md. Shaheenul Islam**

MAP-07 Study of Vertical Structure of Tropical Cyclones using Numerical Weather Prediction Model over the Bay of Bengal; **Kh. Hafizur Rahman, M. A. Taher**

MAP-08 Predictability of Monsoon Depression over the Bay of Bengal using NWP Models; **M. A. K. Mallik, Md. A. E. Akhter, S. M. Quamrul Hassan, Md. Arif Hossain, Md. Omar Faruk**

MAP-09 Prediction of lightning Activity over Bangladesh Based on diagnostic and Explicit Lightning Parametrizations of WRF Model: **M. M. R. Paramanik, K. M. G. Rabbani, A. Imran and I. M. Syed**

Cultural Program : 18:30 – 19:30

Conference Dinner : 19:30 – 21:00

21th May 2022 (Saturday)

Session (VIIIA): Environmental Science
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 9:00 – 10:50

Chair : Dr. Bilkis Ara Begum
Co-Chair : Dr. Muhammad Abul Kalam Mallik
Invited Talk **[20 minutes]**

IT-VIIIA: Sustainable Management of Water Resources Using Isotope Techniques: Opportunities and Active Research Areas in Bangladesh: **Nasir Ahmed, BAEC**

Contributory Papers **[10 minutes per paper]**

ES-01: Appraisal of Environmental Pollution Indices and Subsequent Human Health Risks of Groundwater in an Industrial Zone of Southwest Part of Bangladesh; **F. T. Ahmed, M. M. Hossain, M. R. K. Milan, M. T. Islam, A. H. A. N. Khan, M. M. Rahman, N. C. Dafader, M. O. Rahman, and S. Sultana**

ES-02: An Approach towards Human Health Risk Assessment and Source Apportionment of Potentially Toxic Elements (PTEs) in Some Contaminated Fish Species; **Khan M. Mamun, Yeasmin N. Jolly, Jamiul Kabir, Shirin Akter, S. Hossain, K. J. Fatema, Arafat Rahman**

ES-03: Sensitivity Study of PBL Schemes on the Simulation of Tropical Cyclone Titli Over the Bay of Bengal Using WRF Model; **Saifullah, Md. Idris Ali**

ES-04: Effect on Oxidation on the Leaching Behavior of Cesium (Cs) and Strontium (Sr) from Nonmarine and Marine Sediment: An Approach of Sequential Extraction Method**; Sushmita Hossain, Takashi Ishiyama, Shoichi Hachinohe, Chiaki T. Oguchi**

ES-05: Study of Bioaccumulation and Potential Risk from Food Crops Cultivated with Pesticides in Pre-Selected Sites of Bangladesh; **Md. Nur E Alam, Md. Shahidur Rahman Khan, M. Mozammal Hosen, Md. Azizul Maksud, Lutfun Nahar Lufta, Tasrina Rabeya Choudhury, Shamshad Begum Quraishi**

ES-06: Design and Development of an Industrial Chiller for Heat Removal in Process Plant Operations; **Farhana Nurjahan Ahmed, Md. Forhad Hossain, Nahid Jahan, Md. Ali Zinnah, Md. Robiul Alam**

ES-07: Assessment of Contamination Level, Pollution Risk and Source Apportionment of Heavy Metals in the Halda River water, Bangladesh; **Moumita Dey, Asma Akter, Saiful Islam, Shaikat Chandra Dey, Tasrina Rabia Choudhury, Konica Jannat Fatema, Bilkis Ara Begum**

ES-08: Heavy Metal Contamination from Soil to Vegetables: Case Study at the Industrial Zones of Dhaka District, Bangladesh; **M. M. Hosen, B. Ahmed, M. N. Alam, M. A. Maksud, S. R. Khan, L. N. Lutfa, A. K. M. R. Alam, S. B. Quraishi**

ES-09: Seasonal Variation and Chemical Characterization of Ambient Fine Particulate Matter at an Industrial Area in Dhaka city: **M.M. Hasan, M.A.M. Sarkar, M.S. Rahman, B.A. Begum**

Session (VIIIB): Nanomaterials-II
Venue: Classroom, Atomic Energy Centre Dhaka
Time: 9:00 – 10:50

Chair : Dr A K M Abdul Hakim
Co-Chair : Prof. Md. Mohi Uddin

Invited Talk **[20 minutes]**

IT-VIIIB-01: Modulation of metal-insulator transition properties in the three-dimensionally controlled nano-micro space; **Azusa N. Hattori, Osaka University, Japan**

IT- VIIIB -02: Hydrogen induced phase transition on perovskite nickelate thin films ⁓ Analysis and Design for nanoscale protonic oxide devices: **Hidekazu Tanaka**, **Osaka University, Japan**

Contributory Papers **[10 minutes per paper]**

NM-11: Colour-tunable Light-emitting Diodes Based on Ga-doped ZnO Nanorods; **M. Azizar Rahman, Cuong Ton-That**

NM-12: Titanium di Oxide (TiO_2) Based Nanostructure: Synthesis, Characterization and Photocatalytic Application; **Md. Kamal Hossain, Umme Sarmeen Akhtar, Kyung Byung Yoon**

NM-13: Enhanced Solar light Driven Photocatalytic Activity of Gd^{3+} Doped Bismuth Ferrite Nanostructures; **Fahmida Sharmin, M. A. Basith**

NM-14: Annealing Effect on the Soft Magnetization and Structural Grain Growth and Nanocrystalline $(Fe_{0.9}Co_{0.1})_{73.5}Cu_1Nb_3Si_{13.5}B_4$ Metallic Glass; **K. Sarkar, A. Said Sikder, M. A. Hossain, H. N. Das, M. N. I. Khan, S. S. Sikder**

NM-15: Synthesis and Structural Characterization of $R_{2-x}B_xMn_2O_6$ and $R_{1-x}B_xMnO_3$ (R= La, Sm and B= Ca, Sr) nanoparticles; **Mst. Arjumanara Bagum, Rimi Rashid, Arup Kumar, Harinarayan Das, Mohammed Nazrul Islam Khan, F.-U.-Z. Chowdhury, Sheikh Manjura Hoque**

NM-16: Characterization and Study the Magnetic Hyperthermia Effect of Iron Oxide (Fe_3O_4) Nanoparticles Synthesized via Thermal Decomposition Method; **Md Kamal Uddin, Nandita Deb, Harinarayan Das, Rimi Rashid, Arup Kumar, Sheikh Manjura Hoque, Ishtiaque M. Syed**

NM-17: Synthesis and Characterization of Nickel Oxide Decorated Molybdenum Disulfide Nanomaterials for Energy Storage Application; **Md. Wahidujjaman Bari, Muhammad Rakibul Islam**

NM-18: Dextran Coated Co-Mg Ferrite Nanoparticles: Investigation as temperature sensitive drug carriers: **Tamanna Hoque, Sheikh Manjura Hoque, I. N. Esha, Aminul Islam, Arup Kumar, Rimi Rashid, Kazi Hanium Maria**

NM-19 Step Annealing Effect of crystallization Behavior and Transport Properties of $Fe_{30}Ni_{50}B_{20}$ Metallic Glass Ribbon: **S. Yasmin Tisa, S. D. Nath, S. Liba, H. N. Das, M.N. I. Khan and S. S. Sikder**

Tea Break : 10:50 – 11:00

Session (IX): Physics Education
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 11:00 – 12:00

Contributory Papers **[10 minutes per paper]**

PE-01: Which is more elastic? Iron, or Rubber?; **Md. Nazmuzzaman Shifat, S M Hafizur Rahman**

PE-02: A Research Proposal for Pedagogical Analysis and Development on Quantum Mechanics; **Sumit Bhowmick**

Panel Discussion **[30 minutes]**

Panel Discussant : Prof. Mesbahuddin Ahmed
: Prof. Shamima K. Chowdhury
: Prof. Shibendra Shekher Sikder

Poster Session : 12:00 – 15:00

Lunch and Prayer Break : 13:30 – 14:30

Session (X): US-Bangladesh Education Collaboration Program
Venue: Auditorium, Atomic Energy Centre Dhaka
Time: 15:00 – 16:30

Speaker-01:	John Gomes
Speaker-02:	Ms. Raihana Sultana, Cultural Affairs Specialist, U.S. Embassy Dhaka
Speaker-03:	Dr. Sharon Hart, Higher Education Senior Consultant
Speaker-04:	Muhammad Sohel Iqbal, EducationUSA Director, U.S. Department of State
Speaker-05:	Prof. Sultana N. Nahar, The Ohio State University, USA
Speaker-06:	Dr. Charles Clark, National Institute Standards and Technology, USA

Tea Break: 16:30 – 16:45

Closing Ceremony: 16:45 – 17:15

AGM: 17:15 – 18:00

List of Posters for Presentation

PP-01 Relativistic Study on the Scattering of $e^{\pm}$ from Neutral Aluminum Targets: **M. Raihan Islam, M. M. Haque, A. K. Fazlul Haque, Mahmudul H. Khandker, M. Masum Billah and M. Alfaz Uddin**

PP-02 Half-metallic behavior with high magnetic moment of half-Heusler alloys MCrPb (M = Hf, Zr): insights from DFT: **Kanij Fatima, Salma Zahan, Mst. Shahida Afrin, Mohammad Abdur Rashid**

PP-03 Structural, electronic, magnetic and optical properties of full-Heusler alloy Zr_2NiB: **Mst. Shahida Afrin, Mohammad Abdur Rashid**

PP-04 Electronic and Optical properties of Nb doped rutile TiO_2: A DFT study**: Salma Zahan, Mohammad Abdur Rashid**

PP-05 Comprehensive ab-initio insights into the mechanical, optoelectronic, thermo physical, and lattice dynamical properties of binary $BaGa_2$ compound: **M. I. Naher and S. H. Naqib**

PP-06 The electronic, magnetic and optical property of Lanthanum Phosphide and Cerium Phosphide using first-principle calculation: **Al Mojahid Afridi, Nasrin Afroz Nipa, Mohammad Abdur Rashid**

PP-07 Quantum Gravitomagnetic Clock Effect for Spinning Particle Orbiting Kerr Black-Hole: **Nazwa Chowdhury, Md. Shihab Uddin and S. B. Faruque**

PP-08 Half-metallic behavior of SmP in the zinc-blende structure is revealed by first-principles study: **Mst. Dil Afroj, Nasrin Afroz Nipa, Mohammad Abdur Rashid**

PP-09 Relativistic Massless Simple Harmonic Oscillator in Dirac Equation: **Md. Shihab Uddin, Nazwa Chowdhury & Dr. S. Badiuzzaman Faruque**

PP-10 A DFT investigation of the effect of metals (Ag, Au, Cu) on the charge transport characteristics of BCP-metal complexes: **Md Rakib Hossain, Ahsan Ullah, Sadia Khanam and Nazia Chawdhury**

PP-11 Investigating the Origins of Quantum Indeterminism: **Raisa Nawar Saleh, Antara Labiba Rafa**

PP-12 Density functional theory based ab-initio insights into the pressure dependent physical properties of Mo_3P: **Md. Sohel Rana, Razu Ahmed, Md. Sajidul Islam, Md. Mahamudujjaman, S. H. Naqib**

PP-13 Density functional theory based investigation of mechanical, electronic, optical and thermal properties of AC (A = Nb, Ta, Ti) binary metallic carbides: **Razu Ahmed, Md. Sohel Rana, Sajidul Islam, Md. Mahamudujjaman, S. H. Naqib**

PP-14 Structural, elastic and optoelectronic properties of $CaZn_2X_2$ (X = N, P, As) semiconductors: density functional theory based investigations: **Md. Sajidul Islam, Md. Sohel Rana, Razu Ahmed, Md. Mahamudujjaman, S. H. Naqib**

PP-15 Effect of hydrostatic pressure on elastic, electronic, and optical properties of $CaCuO_3$ and $SrCuO_3$ in comparison with superconducting $BaCuO_3$: **M. Monira, M. A. Helal, M. N. H. Liton, M. Kamruzzaman, A. K. M. Farid ul Islam, and S. Kojima**

PP-16 Screen the mechanical and optoelectronic properties of $NbFeTe_2$: A DFT study: **M. Aktary, M. A. Helal, M. N. H. Liton, M. Kamruzzaman, and A. K. M. Farid Ul-Islam**

PP-17 Density functional study of pressure dependent structural and physical properties of SnS and Sb_2S_3 : **Ayesha Tasnim, Md. Mahamudujjaman, Md. Asif Afzal, R.S. Islam, S.H. Naqib**

PP-18 Hydrostatic Pressure Dependent Structural, Elastic, and Optoelectronic Properties of $ScCuO_3$: A DFT study: **S. A. Shupra, M. A. Helal, M. N. H. Liton, M. Kamruzzaman, and A. K. M. Farid Ul-Islam**

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PP-147 Preparation and Study of Structural and Electrical Properties of Vanadium Doped-Bismuth Europium Ferrite ($Bi_{0.90}Eu_{0.10}Fe_{1-x}V_xO_3$) for Multiferroic Applications: **T. Ahamed, A. Ahad, A. Taher, M. K. Das, R. Hasan, Arup Kumar, M.N.I. Khan**

PP-148 In-core fuel management of TRIGA reactor optimizing performance and safety: **Altaf M. Hossen and Mohammad Sayem Mahmood**

PP-149 Development And Characterization of Cellulose Based Food Package Coated With Chitosan And Containing TiO_2 And Ag/TiO_2 Nanoparticles: **Sourav Kumar Singha**

PP-150 Investigation of the structural, electrical and temperature dependent magnetic properties of $(Fe_{90}Cu_{10})_{75}P_{15}C_{10}$ ribbon: **M. Aminul Islam, A. Mortaza, R. Rashid, M. N. I. Khan and M. K. Alam**

PP-151 Structure, Surface Morphology and Magnetic Properties of Cu^{2+} ion Substituted Ni-Co ferrites: **Sharmin Aktar Mukta, Probal Roy, M. N. I. Khan and S. S. Sikder**

PP-152 Structure, Dielectric and Magnetic Transport Properties of Rare Earth Y^{3+} Doped Mn-Zn Ferrites: **S. S. Acharjee, S. K. Shil, M. A. Hossain, M. N. I. Khan and S. S. Sikder**

PP-153 Biosorption of heavy metals (zinc and lead) by tea leaves: **Debosmita Chowdhury, Aminul Islam Chowdhury, Santunu Purohit**

PP-154 Thyroid Uptake of Tc-99m for Evaluation of hyperthyroid function and its comparison with I-131: **Md Kaiyum Rabbi, Md Mahbubul Haque, Most. Rubina Akter, Md Selim Reza, Rajada Khatun, K. A. Khan**

PP-155 Change of Temperature at different Meteorological Stations over Bangladesh during 1961-1990 and 1991-2020: **A. S. M. Mahtab and Md. Mahbub Alam**

PP-156 Establishing an Emergency Management System of Rooppur NPP for Nuclear and Radiological Emergency**: Md Al Mamun, M. Aliuzzaman, Md Sabbir Ahsan, Sabikun Nahar Sadia, Md. Shawkat Akbar**

PP-157 Impedance spectroscopy and conduction mechanism of $x Ni_{.50}Zn_{.40}Mn_{.10}Fe_2O_4$·$(1-x)Bi_{0.9}La_{0.1}Fe_{0.93}Eu_{0.07}O_3$ composites: **A. Kaiyum, M.A. Hossain, S. M Hoque, H. N. Das, M. A. Hakim and M. N. I. Khan**

PP-158 Impact of V substitution on the physical properties of Ni-Zn-Co ferrites: structural, magnetic, dielectric and electrical properties: **M. D. Hossain, A. T. M. K. Jamil, H. N. Das, S. I. Liba, M. A. Hakim, M. N. I. Khan**

PP-159 Synthesis and characterization of Mn doped Ni-Zn ferrites: **M. M. I. Khan, S. J. Ahmed, M. N. I. Khan, R. Rashid and A. T. M. K. Jamil**

INTERNATIONAL CONFERENCE ON PHYSICS – 2022

19 – 21 May 2022

Theme: Physics for 4th Industrial Revolution and Beyond

INVITED & CONTRIBUTTORY ABSTRACTS FOR ORAL PRESENTATION

Venue: Atomic Energy Centre, Dhaka

Bangladesh Physical Society

19th May 2022 (Thusday)

Session (I): Plenary Session

PT-01: Nanotechnology and 4th Industrial Revolution: Bangladesh Perspective

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21st century is the age of advanced materials with multitude functionalities to combat the requirements of the SDG 2030, focusing towards 2041 to become a developed nation, such as- energy for all, water and food security and efficient devices/machineries that are compatible to advance towards the requirement of 4th Industrial Revolution (IR 4.0). The IR 4.0 is based on the integration of efficient machineries, materials, devices and their integrated effort with the advanced information and communication technology. The Department of Glass and Ceramic Engineering (GCE) proposesto strengthenthe capability of synthesizing, characterizing and fabricating efficient devices and components to enhance technological development compatible with the needs of 21st century. Through this endeavor, quality of the higher education and high-end research capabilities of the academics would be consolidated to meet the challenge of the present days. The crucial challenges of this new millennium are the sustainable development, low carbon emission, skilled human resource development and automation utilizing cutting edge technology.

The Department is currently equipped with thermal evaporator, rapid thermal annealing furnace, centrifuge, pressurized reactor vessel, ultrasonic dispersion probes, high temperature furnaces, field emission scanning electron microscope, X-ray diffractometer, X-ray fluorescence spectrometer, thermal analyzers, UV-Vis-NIR spectrometer, P-E loop tracer, and optical microscopes etc. Our competent faculty members and researchers are utilizing these equipment for the last several years and gained sufficient experience to exploit and maintain these equipment to carry out high-end research activities. During this period, the department has successfully solved some industrial and research problems. This is again reflected in the research publications in international peer-reviewed journals by our faculties and students. It is noteworthy that these facilities are being fruitfully utilized by other departments in BUET and also public universities and national research organizations. But still the facilities currently available at GCE is inadequateto address in-depth and multifaceted research activities. To attain the research capabilities, we have proposedspecific cutting edge equipment and machineries in order to strengthen the research potential for the targeted socio-economic development of Bangladesh focusing 8th Fifth Year Plan and SDG 2030. The equipment are categorized into three sections (Figure 1), i.e. materials synthesis lab, characterization lab and nanofabrication lab covering 22 percent, 47 percent and 31 percent of the total proposed budget for GCE, respectively.

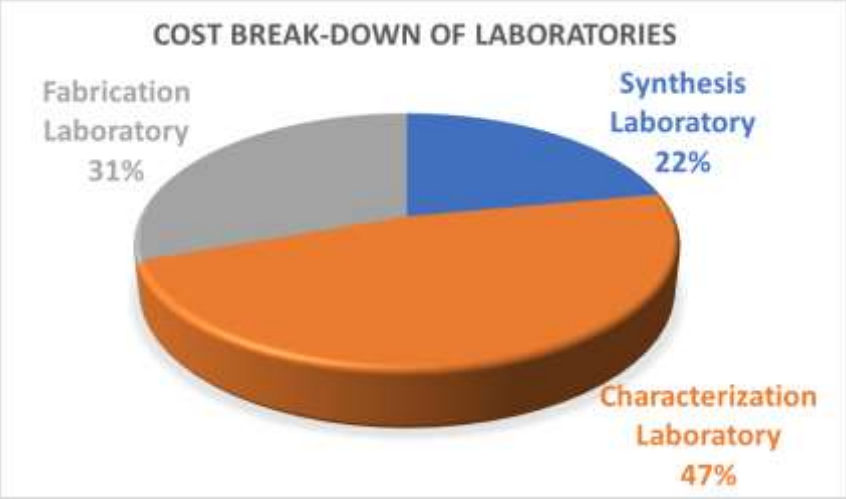

Figure 1: Cost break-down of proposed laboratories

Materials Synthesis Lab

Since the establishment of the Department of Glass and Ceramic Engineering, we have endeavored to develop our labs focusing on the recent trend and future prospects. In this effort, a materials synthesis lab, which lies at the core of any research work, is developed emphasizing with the deployment of synthesis enabled equipment. However, there still lacks a number of equipment; being able to acquire those may fill the gaps for full scale research work and put us on par with high-end research work. Therefore, we have proposed to procure a number of equipment in order to bridge the existing and future research prospect. The proposed equipment list for the development of materials synthesis lab can be divided into five sections, viz., Raw material preparation/ processing, Synthesis/ sintering (bulk, nano- and bio-ceramic), synthesized material preparation, Spares and consumables, and Utility facilities. The allocation of number of equipment and their cost (in percentage) is depicted in Figure 2 and Figure 3, respectively.

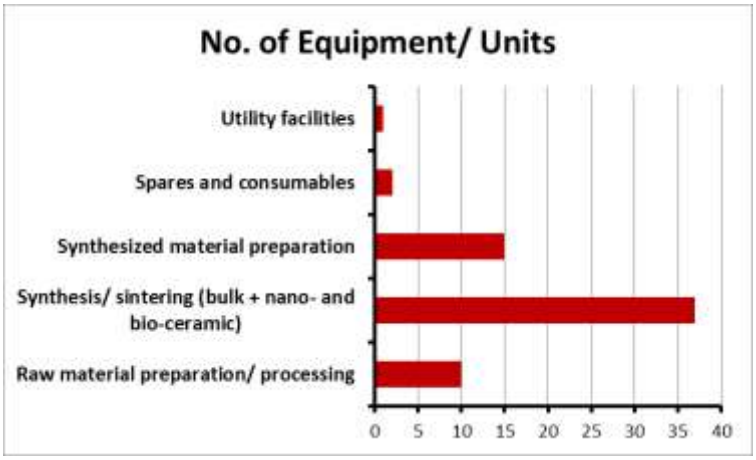

Figure 2: Number of equipment classified by division.

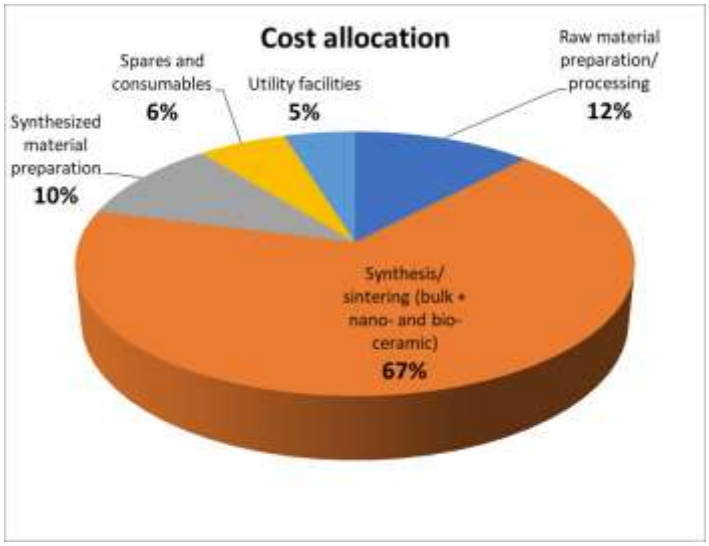

Figure 3: Pie chart of cost allocation.

The traditional raw materials of ceramics and glasses are clay, quartz, feldspar, limestone, bauxite and other various oxides, carbides, nitrides, etc. In order to expand and modernize our sample preparation and clay beneficiation facilities, necessary equipment are included that comprises 12 percent of the total budget allocated for materials synthesis lab. The installation of proposed equipment will enable us to process all types of glass and ceramic materials. Moreover, this full scale set up can address the R&D requirement of the local industries and build a strong academia-industry relationship.

For the last couple of years our department has acquired experience in various functional materials synthesis including spinels (AB_2O_4), perovskite (ABO_3), garnet type microwave materials ($A_3B_5O_{12}$), Bismuth Ferrite ($BiFeO_3$), Barium Titanate ($BaTiO_3$), etc. Recently, several rapid sintering techniques have gained popularity due to their unique advantage of reducing time and temperature for sintering, and thus new state-of-the-art equipment has been developed to implement the techniques. To be in line with current research trend, we have proposed 37 equipment that comprises lion share (67 percent) of the total budget allocated for materials synthesis lab.

Materials surface preparation needs to be carried out prior to the advanced characterization. GCE department already have some sophisticated tools for surface preparation. However, we are experiencing challenges to meet the surface finishing requirement for further analysis. The lack of complete set of necessary equipment is a barrier for required surface preparation. Therefore, we have proposed 10 percent of the budget allocated for materials synthesis lab for improvement and development of this synthesis lab which will bridge the current and future requirements to adopt new technologies and conduct up-to-date research.

For the smooth operation of the materials synthesis lab, a consistent supply of utility, spares and consumables is a perquisite. Therefore, 5 percent and 6 percent of the allocated budget of the materials synthesis lab is earmarked for spares and consumables, respectively.

Characterization Lab

To better understand and characterize advanced nanostructured materials is always a challenge to material scientists due to their complex structure. Therefore, we need some specific high-end characterization tools for advanced materials and devices. Characterization tools have been subdivided into 8 categories covering 42 number of equipment/tools as shown in Figure 4. An ultra-high resolution transmission electron microscope (HRTEM), scanning probe microscope (SPM), raman spectrometer coupled with atomic force microscopy (AFM) and BET surface analyzer will be used for in-depth characterization of microstructural finer details which includes particle size, morphology, distribution function, surface area, porosity. X-Ray photoelectron spectroscopy (XPS), raman spectrometer, photoluminescence (PL) and drop shape analyzer are state-of-the-art equipment for surface-interface characterization including their concentration gradient of depth profiles and surface cohesion-adhesion, surface energy and surface wetting capability and optical properties of the surface.

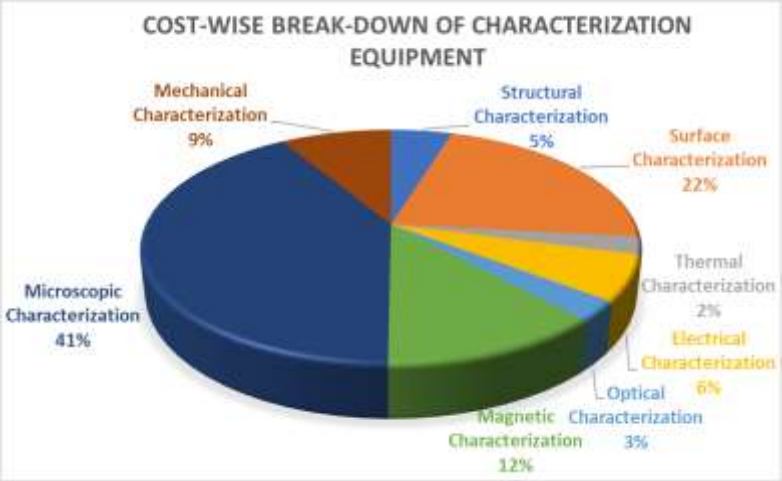

Figure 4: Cost-wise break down of characterization equipment

Electrical, transport and piezoelectric properties with the variation of temperature and external applied effects such as magnetic and electric field, AC/DC, play a vital role in the functioning of appliances and/or devices. Hence, we have proposed to procure an integrated impedance spectroscopy system, high frequency impedance analyzer, hall-effect measurement system, four pointtransport property measurement system, bulk and thin film piezoelectric measurement systems. These equipment are prerequisite for the development of sensors and actuators necessary for the automation technology development and also will give a deep understanding of the fundamental issues connected with the development of cutting-edge devices.

To fabricate devices of practical applications, thorough thermal analysis such as phase transition, reaction kinetics, thermal dissociation, thermal conductivity/ diffusivity, specific

heat etc. is required for further high temperature processing. This necessitates some sophisticated equipment for state-of-the-art thermal characterization systems like DSC/TGA down to sub-zero temperature, thermal conductivity and heat-capacity measurement set-up.

In coming days, applications of magnetism in diversified fields like hyperthermia etc. are posed a significant challenge of modulating the spin of electrons. To understand the fundamental properties of materials, magnetic state and magnetic properties need to be measured from absolute zero to high temperature with an applied magnetic field. In order to understand the magnetic nature of materials, we have proposed a physical property measurement system (PPMS) including a vibrating sample magnetometer (VSM) in this project. This sophisticated equipment is currently not available at any laboratory in Bangladesh. So, incorporation of this equipment will give not only a technological development but also will help the interested academics, researchers and faculties to study very fundamental and basic phenomena of materials science.

Tuning materials' optoelectronics performance will remain as an important aspects of future challenge. For a detailed optical characterization of synthesized materials, we have proposed a sophisticated FTIR, diffused reflectance FTIR and UV-Vis-NIR spectrometer. These equipment will be important tools not only to academicians but also to help reducing energy consumption in energy saving glass/ solar control coated glass windows which are recently being extensively used for high rising buildings/ commercial complexes. This effort by GCE will be in line with the Government's vision 2030 to reduce energy consumption for a sustainable development.

To ensure the sustainability and longevity of devices, the static and dynamic mechanical behavior are of significant importance. The manifestation of advanced industrial applications of materials, microhardness tester, universal nanoindentationsystem including universal testing machines for determining the compressive and tensile strength of materials and the system for Thermo-mechanical analysis are proposed here. Moreover, the fatigue and creep behavior of materials need to be accurately and preciously determined for the automation of devices prerequisite for IR 4.0.

Nano Fabrication Lab

The existing deposition facility at the department of GCE lacks processing, deposition and fabrication equipment necessary for high quality material deposition and sophisticated device fabrication. Material deposition is limited most of the time to chemical methods such as chemical bath deposition and simple physical methods such as spin coating. These methods cannot be adopted to deposit materials with low defect density required for optical, opto-electronic and thin film device applications. The current facility lacks lithography and etching tools which are necessary to create any small pattern or shape of a given material such as fabrication of quantum dots, nanowires, photonic structures, creating contacts, interconnects etc. In addition, fabrication of these advanced devices requires clean room facility, which is currently lacking at GCE. The total number of equipment including clean room facility is 51.

The Department of GCE has the expertise to work on advanced functional materials, exploratory materials for various applications such as energy conversion, energy storage, optical coatings, sensors, actuators etc. Proposed devices are decided to address these areas. Pulsed laser deposition (PLD) is used worldwide for various oxide based materials for thin film photovoltaics, thin film battery etc. Thermal evaporators are used for chalcogenides, e-beam evaporators for high temperature oxide based thin film, titanium oxide, aluminum oxide for working as insulating material, anti-bacterial coating etc. Sputtering tool is widely used to deposit the absorber layer of thin film photovoltaics and various other optical coatings on glass.

Thin film photovoltaics: This is a crucial area to address the energy crisis in the country. GCE has the experience to work on chalcopyrite, chalcogenide and perovskite based thin film photovoltaics. Deposition tools such as PLD, evaporators, sputtering are necessary to deposit various layers of a thin film solar cell. Glove box will allow fabrication of perovskite solar cells under inert condition.

Photonic devices: Various optical coatings on glass are one of the specialties of the department of GCE. These coatings are most of the time made of oxide based ceramic materials serving various purposes such as optical filters, anti-reflection coatings, low-energy coating, solar control coating etc.

Solid oxide fuel cells: Solid oxide fuel cells (SOFCs) have several advantages such as high combined heat and power efficiency, long term stability, fuel flexibility, low emissions and relatively low cost. SOFCs use solid oxide (ceramic) as electrolyte and have wide variety of applications such as auxiliary power units in vehicles, stationary power generation outputs up to 2 MW. In addition, the higher operating temperature makes SOFCs promising candidates for application with heat engine energy recovery devices or combined heat and power, which further increases overall fuel efficiency. However, limited research facilities are currently available for SOFCs at GCE and developing SOFC test station will open the door to explore this emerging device.

Battery: Among various existing battery technologies, Lithium-ion batteries are considered the most competitive due to its high energy density, power capability, design flexibility and longer lifespan. There exists ample scope to enhance the capacity of Lithium-Ion battery, and thus it has attracted significant attention among the researchers in the recent time. Recently, GCE has taken initiatives to put its imprint in this area. Limited synthesis facilities for the preparation of anode and cathode material are available here at GCE. However, lack of electrode slurry preparation, battery fabrication line, and testing facilities is hindering from achieving the final outcome from this research work. A complete set of material preparation, fabrication, and testing facilities is a requirement for this product-oriented research. Moreover, the time-span required to convert the research outcome into the final product is significantly small. We believe this research will contribute greatly to the energy sector of the country and therefore GCE has proposed a complete set of equipment necessary to perform the research.

Session (IIA): Theoretical and Computational Physics-I

IT-IIA: Signature of Segregation in the Transport Properties of Liquid Binary Alloys

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A complete understanding of the basic mechanisms, from the point of interionic interaction, about how and why segregation in some metallic alloys occurs at and under certain thermodynamic state specified by temperature and pressure is far from over although several attempts have been made from the point of experiments and empirical theoretical models. In this talk we intend to address this issue from the point of microscopic theory that includes theory of metals, perturbation approach and the statistical mechanics. The theory of metals we have engaged here deals with the electron-ion and ion-ion interaction through a local pseudopotential model. The perturbative approach handles the procedure how thermodynamic quantities can be calculated effectively. The essential ingredient for this study is the knowledge of liquid structure which is derived by using the statistical mechanics involving the interionic interactions. Thermodynamics of mixing namely the energy of mixing, enthalpy of mixing and entropy of mixing are calculated at different temperatures for Al1−xBix binary alloys to dig out the cause of segregation. Finally, a finishing touch is paid to the critical behaviors of segregation.

TCP-01: Wigner Rotation in Different Space-time

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We have introduced the Wigner rotation in two different ways. The formula of Wigner rotation has been derived in flat space in two different ways. The numerical values of Wigner rotation has been calculated for different cases. The graph of the Wigner rotation with respect to different velocities has been plotted. We have observed that the rapidity space provides a geometric approach to the Wigner rotation and the Thomas precession. We have also derived the formula of Wigner rotation in hyperbolic space. The numerical values of Wigner rotation in hyperbolic space have also been calculated. A graph of Wigner rotation versus boost angle for different boost velocities has been plotted. We have presented different types of Black holes such as Miniature Black hole, Stellar Black hole, Intermediate-mass Black hole, Supermassive Black hole, Schwarzschild Black hole, Kerr Black hole and Reissner-Nordstrom Black hole. We have derived the line element in Schwarzschild Black hole and the line elements of different Black holes have been represented. The formula of Wigner rotation in the outer space

of Schwarzschild Black hole has been derived. We have also calculated the numerical values of Wigner rotation in the outer space of Schwarzschild Black hole. The graph of the Wigner rotation with respect to different velocities of a moving object has been plotted.

TCP-02: Study of a Thunderstorm Event over Cox's Bazar, Bangladesh using WRF Model

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A thunderstorm event occurred over Cox's Bzazar, Kutubdia Island and Chittagong (21.3°N-22.3°N, 92°E) on 30 May 2017 has been simulated by using Weather Research and Forecasting (WRF-ARW version 4.3.0) model. The model was run on a single domain of 09 km horizontal resolution utilizing six hourly Global Forecast System (GFS) datasets for 72, 48 and 24 hours respectively from 0000 UTC of 28 May 2017, 0000 UTC of 29 May and 0000 UTC of 29 May to 0000 UTC of 31 May 2017 as initial and lateral boundary conditions. A sensitivity test has been done using Yonsei University (YSU) scheme as Planetary Boundary Layer (PBL) scheme and Kessler scheme for microphysics, Kain-Fritsch (KF) for cumulus physics option, Revised MM5 scheme for surface layer physics, Rapid Radiative Transfer Model (RRTM) for long wave radiation, Dudhia scheme for short wave radiation.Themodel performance has been evaluated by analyzing some thermodynamic parameters such as, Mean Sea Level Pressure (MSLP), Temperature, Relative Humidity (RH), Wind pattern at various pressure level, Vertical wind shear, Convective Available Potential Energy (CAPE), and Rainfall. Model generated outputs for every 30 munities interval are visualized by Grid Analysis and Display System (GrADS). Model-simulated values of MSLP, RH and rainfall were compared with observational data obtained from Bangladesh Meteorological Department (BMD) and it is found that the performance of WRF model is reasonably well to predict the thunderstorm overBangladesh.

TCP-03: Vortex Configurations of a Nano-sized Superconducting 3D Pyramidal Confinemen

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By using the state-of-the-art three-dimensional simulations within the two coupled nonlinear Ginzburg-Landau equations, I observe the effect of a superconducting pyramidal nano-sized

confinement on the vortex configurations. The stationary properties of the sample in the presence of a tilted field are studied. The Cooper pairs and screening current density are shown on the orthogonal plane to the applied field. Furthermore, in the presence of a tilted field, I analyse the magnetic behaviour of the sample, such as the stability range of the Meissner state, the magnetization, and the critical field. Square, triangle, and trapezoid arrangement of vortex configurations are observed for the field $\vec{H}_z$, $\vec{H}_x$, and $\vec{H}_t$, respectively. Obtained results are crucial to comprehend the characteristics of the superconducting pyramidal tip, which are currently being used in STM.

TCP-04: A Study of Volume Dependence Second and Third Order Grüneisen Parameter for Solid

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The Grüneisen parameter (γ) is used to measure the elastic and thermal properties of solids. The Grüneisen parameters and its higher orders logarithmic volume derivatives are known as second order (q) as well as the third order (λ) parameters. These parameters are determined by the some model calculations from the fitting of experimental data [1-2]. The calculated results of initial Grüneisen (γ_0) are in good agreement with the experimental data for the case of ε-*Fe, NaCl, K, Li,* and *Na* solids. The results of q_0 parameters for solids are compared with the other methods of calculation. A comparison result of the two parameters q_0 and λ based on the two models has been presented for the different solids [2]. It is noted that the entire volume dependence of the q and λ parameters cannot be explained by these models. In order to investigate of volume dependence of higher orders, we analyze the Grüneisen parameter of *MgO* in the different models [3]. We introduce the formula for the parameters q and λ in the different models. We also present the generalized formula from the fitting of experimental data for *MgO* solids in these models. Finally, we present the calculations of the volume dependence of q and λ parameters according to the different models. The calculated results show the volume dependence of the second order and third order Grüneisen parameters in this case.

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TCP-05: How H463R variant turns hKv1.5 into a loss of functional channel: A MD simulation study

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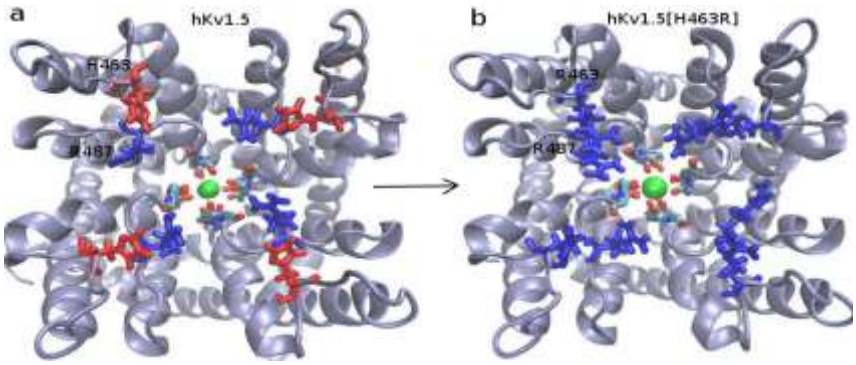
Genetic mutations studies are essential to explore the inactivation ways of a channel. The study will help design channel blockers or identify the side effect of a potent blocker as a new therapeutic. Kv1.5 is a voltage-gated potassium channel encoded as KCNA5. Genetic variant H463R on KCNA5 is associated with the loss of function in Japanese patients with atrial fibrillation (AF).



We performed a free energy simulation for H436R charge mutation and found that modification imposes an energy barrier on ion conduction without any pore structural changes. We also did similar Arginine mutation studies on hKv1.2 and hKv1.4 and found that the energy barrier is very small to convert the channels into a non-functional channel. From this study, we can say that any off-state toxin blocker (for example, HERG channel turret blocker) perturb ion conduction in Kv1.5 could lead to Atrial Fibrillation, a common heart disease.

TCP-06: Possible Inconsistencies of Schwarzschild Metric to Study Black Holes

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According to general relativity, black holes are objects whose gravitational attraction is so strong that not even light can escape from them. There are a lot of ambiguities about the interior of black holes. Schwarzschild's solution of general relativity for static black holes has been

studied to see its predictability about the interior of black holes. It has been argued that this metric is not realistic for probes below the event horizon, as we know it, of black holes. This is indeed an indication of a possible flaw in the foundation of general relativity, which states that gravity emerges from the curvature of space-time due to the presence of energy-momentum.

TCP-07: Consequences of Quantum Effects in Superconductor

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Flux quantization in superconducting ring in the persistent mode, the current voltage characteristics of Josephson junction etc. are the major remarkable macroscopic quantum phenomena associated with superconductivity. The wave like character of Cooper pair is responsible for interference and diffraction phenomena in superconductor. We have studied the above phenomena theoretically, giving interesting technological advantages when two or more superconducting devices are connected together. The resultant interference and diffraction phenomena are also comparable with the analogous classical optical phenomena in physics. The major consequences of the quantum interference and diffraction effects are analyzed and discussed with specific examples.

Session (IIB): Information and Communication Technology

IT-IIB: Active Integrated Array Antenna for Next Generation Wireless Communication Systems − Challenge to Advanced Antenna Utilizing Spatial Parameter of Radio Wave

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This talk presents the advanced active integrated array antennas (AIAAs) developed in our lab. In classical wireless communication systems, phase, amplitude, and frequency of the carrier waves are modulated by information signals. However, actual radio waves are vector quantity, and they have some other spatial parameters, i.e., polarization and beam direction. The massive MIMO and beam forming technique used in 5G mobile communication systems and wireless local area networks are good examples of the use of the spatial parameters. As

higher data rate and larger capacity are required in the next generation wireless communication systems like Beyond 5G and 6G, these spatial parameters have to be effectively used.

To overcome this issue, we have developed several types of AIAAs. In this talk, the concept of the AIAA is introduced, and two examples are demonstrated to highlight the features. The first AIAA integrates a 12-element array antenna, phase modulators, and 4-port Gunn oscillator to provide self-oscillation and polarization switching capability. By effectively using microstrip lines and slot lines located on both sides of the substrate, simple and compact structure has been achieved. The second one is an AIAA which integrates a 4-element array antenna, phase modulator, and Push-Push oscillator which provides the 2nd-harmonic signal. The phase modulator flips the phase of the signal, and as a result, two radiation patterns are switched.

As the active integrated array antennas integrate antennas and microwave signal processing circuits, they minimize the undesired connections between antennas and circuits. This feature is suitable for millimeter-wave and THz band where the connections severely degrade the performance.

EICT-01: A Secured Steganography Technique to Concealed Data within Image

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Steganography is a popular technique to hide data. In modern days, steganography is often used as data security purpose instead of cryptography. Various carrier formats like image, video, audio are used to conceal data. The digital image is the most popular used as a carrier file due its frequency on internet. There are many techniques variable for image steganography, each has own strong and weak points. In this research, we will overview several methods of image steganography for data hiding in digital images. In this study, we have compared the pixel selection, payload capacity and embedding Least Significant Bit (LSB) algorithm in terms of spatial domain sector. The outcome of this research will establish a secured data hiding technique and analyze the techniques with different security parameters in wireless data communication world.

EICT-02: Threat Minimization in Email using Data Mining in Banking Sector

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Machine learning in Artificial Intelligence is evolving constantly to introduce us the new era of the fourth industrial revolution. With the rapid increase in cloud computing, the enterprise sector always have to face a great challenge to protect the data from outside world. So, security is an important issue for organizational network design and development. The popularity of machine learning algorithms are increasing in the financial sectors nowadays due to its diverse use of detecting and filtering spam emails and protects the confidential data. In this paper, we are applying several machine learning algorithms to detect the threats from email. Initially, we will create a dataset containing emails (both span and non-spam emails). Then, using the dataset, we will evaluate and compare existing machine learning algorithms' performance. The overall process consists of preprocessing of the dataset, applying classification algorithms, and finally concluded with the findings of threat detection. This model can help the banking sector to evaluate the mail, classify them and act accordingly.

EICT-03: Implementation of E-Learning Using Moodle in Nuclear Education

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In this modern era, technological advancement and its implication impact all aspects of our life. Using technology in every sector has made our life more comfortable. We cannot deny the use of technology in the education and research sector. Many research and scientific organizations provide special domain-based training and academic short courses. Bangladesh Atomic Energy Commission (BAEC) is a multidisciplinary scientific organization that provides miscellaneous nuclear-related training and academic short courses to the academician, scientist, and students with the physical attendee. But covid-19 pandemic has made it harder to provide training courses physically. Using a Moodle-based e-learning program is the best alternative to this problem in this pandemic situation. E-learning is used to design online-based course development, assessment, and interaction. Moodle is an online-based software system that is easily accessible and it allows easier cooperation with the system administrator, students, and teacher. In this paper, we have designed a better framework of online training and a short course using Moodle for nuclear-oriented education from BAEC perspective. We also explore how the interactive, simulating and comfortable learning experience can be achieved through Moodle in providing nuclear-related training and short courses to the relevant participants.

EICT-04: A Private Cloud Configuration to Overcome the 'Big Data' Challenges of Bangladesh Atomic Energy Commission (BAEC)

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The current and upcoming era is the era of Big Data, where it comes along with challenges between Big Data management, processing and security that raises problems. On one side, the large amount of trust-related data must be highly available, flexible, and fast processing. On the other hand, the trust and security of Big Data are the challenges.

No doubt, the continuous data records such as Physical, Biological, Medical Record Data, Employee Record Data, etc., from Bangladesh Atomic Energy Commission **(**BAEC) and its establishments will introduce and strengthen the emerging 'Big Data' concept. On top of that, the enormous amounts of nuclear data records from its successful Rooppur Nuclear Power Plant (RNPP) project will also address the 'Big Data' concept in future. Cloud computing is a popular, dynamic trend across the IT landscape. A private cloud storage configuration means overcoming significant hurdles regarding capacity and performance scalability along with resource allocation and data management requirements. At present, private cloud storage is treated as an effective solution to the Big Data challenges. Among other reasons, BAEC users might prefer private clouds to public clouds for applications with high data-to-compute ratios, data privacy and security of the worthy and trust-related data.

This paper has the scope to present a private cloud architecture as the storage solution which will eliminate the 'Big Data' management and security challenges for the BAEC and its establishments. This proposal also describes and highlights the benefits and economic advantages of Big Data management in a private cloud architecture.

EICT-05: Apache Hadoop Platform: A 'Big Data' Storage and Management Solution of the Data Warehouses

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Datawarehouse is the central repository used for management for the strategic decision-making process. It usually keeps current and historical data and is queried for business intelligence or other analytical activities. The purpose of the decision support database is to meet reporting and analysis requirements of a business or enterprise and is maintained separately from the organization's operational database. Nowadays, data management is going to be very crucial

for Big Data and without the right management strategy, any investment can yield limited results. Apache Hadoop has emerged as a key architectural component that can help make sense of various types of data such as IoT, Data Warehouse data and can be a great solution for Big Data storage and management.

This paper describes the ETL process for populating a data warehouse from a traditional relational database using Microsoft SQL Server Management Studio. This proposal introduces the Apache Hadoop platform as the 'Big Data' storage and management solution for a big company and for their business advantages who possess the Data Warehouses. This paper has the scope to present a Data Warehouse with some test data and migrate it to the Apache Hadoop Platform. This paper highlights the migration, loading and manipulating of the warehouse data to an Apache Hadoop platform for further Big Data analysis using Hortonworks Data Platform (HDP).

EICT-06: Channel Estimation and Signal Detection in OFDM system using Deep Learning and its performance on Digital Modulation

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Due to the inter-channel interference (ICI) the performance of the orthogonal frequency division multiplexing (OFDM) system is degraded. This paper explores end to end handling of wireless OFDM channels by deep learning. By exploring the time and frequency correlation of wireless fading channels we trained our deep learning model for better channel estimation and signal detection using simulated data. It is different from the existing OFDM receivers as it estimates the channel state information (CSI) and then estimated CSI is used to recover the transmitted symbols, using our trained deep learning model. Finally, we take our system performance on different digital modulation (4-QAM, 16-QAM, 4-PSK, and 16-PSK). Our experimental results demonstrate that for 4-PSK and 4-QAM modulation the performance is almost approximately same but with increasing the order of modulation 16-QAM performance is better than 16-PSK modulation.

EICT-07: Problematic/Excessive Phone, Computer, and Online Use Among Bangladeshi Nationals Amid COVID-19: The Role of Psychological Well-Being and Pandemic Related Factors

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The COVID-19 has forced people to shift their routine activities into a remote environment with the help of technology which has generated a global health crisis among the people. The effect off the COVID-19 outbreak has caused many organizations to shut down or reduce employees and people were forced to initiate work from home using modern technology. Now it has become more than ever, important for people and institutions to understand the impact of excessive use of mobile phone technology and electronic gadgets on human health, cognition, and behavior. It is important to understand their perspective and how the individuals are coping with this challenge in the wake of the COVID-19 pandemic. This investigation is an effort to find out whether dependency on technology during pandemic has more physiologic and psychological effects on human health in comparison to normal times.

The study included participants who are Bangladesh nationals (n = 183). A questionnaire was formulated and the mode of conducting the survey chosen was online to maintain social distancing during the time of the Pandemic. Multiple regression was applied to the gathered data using RStudio to identify the impact of excessive use of electronic gadget

The statistical analysis confirms that lockdown scenarios have led to an increase in the usage of phone, computer, as well as internet usage which has been confirmed by over 96% of participants. Moreover, most of the participants perceive an increased risk of developing certain health problems due to excessive usage of mobile phones and technology.

There were 48.9 % female and 51.1 % males participated in this survey. There have been some noticeable changes found in all the participants which are physical & mental changes like anxiety-36.3 %, insomnia-32.4% depression-32.4%, concentration breaks-49.7%, headache-54.7%, shortness of temper-29.1%, sleep disorder- 57.5%, discomfort in face-to-face communicatiom-27.4%, decreased attention -43%, hearing loss-14%, eye side problem-46.9%, and 12.8% other problems.

The results show that dependency on phone, computer, internet technology during lockdown has more health effects as compared to normal non-pandemic times. Therefore, it is recommended that in case of more prediction of pandemic cycles, strategies should be planned to decrease the psychological and physiological effects of the overuse of these technologies during in confinement due to pandemics. As the COVID-19 pandemic lessens, people and organization functioning styles should be rolled back to the limited dependency on these electronic gadgets and communication technologies.

Session (IIIA): Health and Radiation Physics

IT-IIIA: The role of Nuclear Data for Production of Diagnostic and Theranostic Radionuclides

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Accurate knowledge of nuclear data is important for the production of a radionuclide via charged particle-induced reactions. This study outlined the availability and scarcity of standardized nuclear data for the production of promising medical radionuclides via the accelerator route. The data are considered for the radionuclides that have the potentials to be used in theranostic/therapeutic applications. The current trends in nuclear data production and evaluation activities via accelerator routes are discussed in detail. This work is expected to provide a direction for the accelerator-based production of promising radionuclides in no carrier added (NCA) form for various medical applications.

HRP-01: Experimental Research on Net Vapor Generation Point Under In-Vessel Retention Conditions

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During the severe nuclear reactor accident, a significant amount of molten core is accumulated at the lower plenum of the reactor pressure vessel (RPV), as happened in the Fukushima Daiichi and TMI accidents, and generates a considerable amount of decay heat that might be causing the thermal failure of RPV integrity. In-vessel retention (IVR) is an effective method for protecting the RPV integrity. In a light water reactor (LWR), it is achieved by the natural circulation of cooling water along cooling path on the outer surface of RPV, whose orientation angle varies gradually from downward-facing horizontal to vertical. The cooling water removes the decay heat by means of subcooled flow boiling, whose cooling ability is limited by the critical heat flux (CHF). The subcooled boiling CHF is significantly affected by the void fraction development along the heated channel, which starts from the net vapor generation point (NVG). Therefore, accurate knowledge of NVG for an inclined heating surface is vital for successfully implementing the IVR concept following the CHF. In this research, an experimental study was performed to measure the subcooling at NVG for a changing heating surface orientation from downward-facing horizontal to vertical under IVR conditions. An experimental facility has been fabricated and a series of experiments on NVG for different heating surface inclination was performed in subcooled flow boiling with a wide range of test conditions. The impact of mass flux, heat flux, inlet subcooling, and channel inclination on NVG was thoroughly investigated. The subcooling at the NVG point was found to reduce with increasing mass flux and decreasing heat flux for a given inlet subcooling. No significant

impact has been recorded on the subcooling at NVG for the inclination effect of the heating surface.

HRP-02: Characterization of LiF: Mg,Ti Crystal Dosimeters (MTS-100) for the Dosimetry of ^{60}Co Photon Beam

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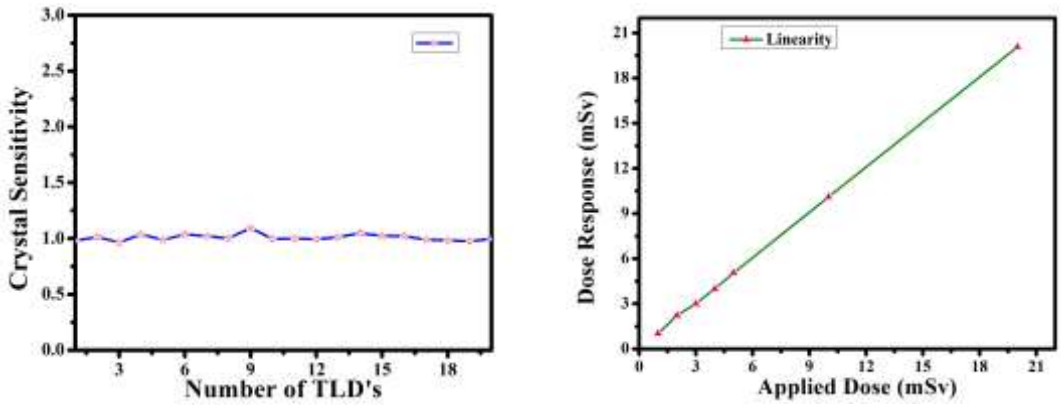

TLD is commonly used in individual control and monitoring devices to ensure quality assurance and quality control of the received radiation dose as well as radiotherapy level. The main goal of this study was to investigate the TLD crystal calibration procedure, specifically the crystal sensitivity and linearity of individual TLDs after irradiation at various dose levels for exact dosimetric purposes of radiotherapy in the SSDL, Bangladesh Atomic Energy Commission. Herein, a batch of ten (10) LiF:Mg,Ti dosimeters was used for calibration purposes of the RADOS RE-2000 TLD reader system. Firstly, dosimeters were annealed at 300°C using the reader for 15 sec and zero dose calibration was performed for dosimeters. Then these were placed on the flat surface of an Alderson Rando Phantom and irradiated at a dose of 2 mSv by a standard Cs-137 source (20 Ci) of GC-10 Gamma calibrator at SSDL. To obtain the desired dose, reference dosimetry was completed with the standard ionization chamber-NE 2575 (600 cc) at 100cm distance. Dosimeters were preheated at 150°C for 10 sec to remove the fading peaks and read out in the TLD reader. Results were assigned in the reader sensitivity. For the further steps the irradiation and preheating processes were repeated for three more times, and the results were assigned in the crystal sensitivity, local dose, and standard dose. On the other hand, for the radiotherapy dosimetry purpose, another twenty (20) LiF:Mg,Ti dosimeters were irradiated at 2 mSv by the Cs-137 source in the same manner as the calibration process. Crystal sensitivity of each crystal was found against the calibrated RADOS RE-2000 reader sensitivity. To check the linearity, the TLDs were exposed to 1, 2, 3, 4, 5, 10, and 20 mSv doses and showed a good linear outcome corresponding to the dose-

response (mSv). TLDs' individual crystal sensitivity was calculated, and the relative standard deviation was estimated at 0.0292 (about 3%), allowing a tolerance of ±5% to be used. This finding supports the use of TLDs to measurement accurate doses in radiotherapy for clinical practice.

HRP-03: Measurement of Natural Radioactivity Levels in Soil, Sediment, and Water Samples Collected from the Padma River around Rooppur, Bangladesh

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This paper presents the findings of a baseline study undertaken to evaluate the natural radioactivity levels in soil, sediment and water samples collected from the Padma River near the ongoing nuclear power project in Rooppur, Bangladesh using a High-Resolution Germanium detector (HPGe). Samples of three categories (soil, sediment, and water) are collected, processed and analyzed. The activity profile of radionuclides shows higher activity across the study area. The average activity concentrations of ^{226}Ra, ^{232}Th, and ^{40}K in soil samples are found to be 43.53±0.25 Bqkg^{-1}, 63.57±0.14 Bqkg^{-1}, and 690.14±1.60 Bqkg^{-1}, respectively, which higher than the worldwide average values. Sediment samples show the activity concentrations of ^{232}Th, and ^{40}K are 50.02±0.14 Bqkg^{-1}and 502.00±1.60 Bqkg^{-1}, respectively. The average absorbed dose rate for soil and sediment samples are found to be 87.49 nGyh^{-1} and 67.24 nGyh^{-1}, respectively. The estimated outdoor annual effective dose for soil and sediment samples are found to be 0.11 mSv y^{-1} and 0.08 mSv y^{-1}, respectively. The values of radium equivalent activity in almost all the samples were less than 370 BqKg^{-1}. The external hazard index for soil and sediment samples varied between 0.47 to 0.53 and 0.29 to 0.59, respectively. The calculated external hazard index (Hex) are found less than unity. The values of hazard indices confirmed that all the sampling areas are safe for the human to live and work.

HRP-04: Temporal Variation of Natural Radioactivity and Evaluation of Radiological Hazards in Sediment Cores of Sundarban, Bangladesh

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The temporal variation of naturally occurring radionuclides ^{226}Ra, ^{232}Th and ^{40}K in sediment cores (50 cm long) from different Ranges of the Sundarban mangrove forest, Bangladesh were determined using gamma-ray spectrometry to assess the radiological hazards in the forest. To obtain the temporal variation of the natural radioactivity, core samples were cut into a 2 cm slice and analyzed. The average activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K in first core were found to be 40.6 ± 24.5 Bq kg^{-1}, 59.4 ± 30.3 Bq kg^{-1}, and 2714 ± 1586 Bq kg^{-1}, in second core 64.8 ± 30.3 Bq kg^{-1}, 90.0 ± 33.6 Bq kg^{-1} and 2224 ± 1422 Bq kg^{-1} and in third core 82.0±24.3 Bq kg^{-1}, 83.1±15.1 Bq kg^{-1} and 9881±4032 Bq kg^{-1}, respectively. From the mean specific activities of the three radionuclides in sediment samples, the radium equivalent activity, the gamma absorbed dose rate, the annual effective dose rate and the external hazard index were calculated. The results of the radiological indices and dose rates obtained in this study were relatively higher than their worldwide mean values. The results of this study could serve as important radiometric baseline data and variation of radioactivity levels in the Sundarban with time.

HRP-05: GIS Predictive Mapping of Absorbed Dose Rate and Activity Concentrations of NORMs in Bangladesh

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This study deals with the variation of absorbed dose rate due to naturally occurring radioactive materials (NORMs) and the corresponding radiological predictive mapping along whole Bangladesh for the past two decades. All the measured data points for different types of environmental samples have been accumulated from 95 published and unpublished researches throughout the country since 1990. We divided the whole country into 2094 grids of 5'x5' area which is about 25 square miles by using geographical information system (GIS) and overlapped the measured data locations into it. From this, we found that some of the locations (grid) have been chosen many times (max 13) by the researchers and maximum regions have not been measured yet which are needed to consider for future researches. GIS is very useful technique to interpolate the scattered data by converting measured points into continuous surfaces. Using GIS, radiological prediction maps for activity concentrations of ^{238}U, ^{232}Th, ^{40}K and also a prediction map for absorbed dose were composed. The resulting maps could be used to understand the variation and to explain the trend of variation of absorbed dose and activity concentration of NORM. Therefore, it is concluded that from the maps the values of the absorbed dose rate and activity concentrations vary significantly at different locations in the study area. The detailed significance of these studies has been discussed from the future safety and radiation protection point of view. Also, this review suggests that in future environmental sampling, insignificant redundancy of sampling points should be avoided and samples should

be collected from significant distances. The following Fig 1 shows the absorbed dose rate (nGy/h) map made in this study by using secondary data for overall Bangladesh.

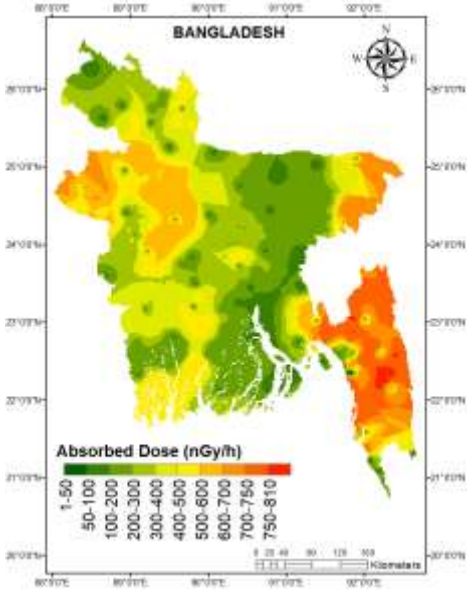

Fig.1 GIS prediction map of absorbed dose rate (nGy/h) for Bangladesh.

HRP-06: γ-radiation Induced Hydrogels in Removal of Dyes and Heavy Metals

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A hydrogel is a chemically responsive water-swellable three-dimensional crosslinked network of one or more hydrophilic polymers capable of trapping environmentally harmful dyes and heavy metals inside it through absorption and adsorption. Hydrogels prepared by ionizing radiations are convenient physical method as it offers the ease of sterilization, fabrication, and eco-friendliness of the production process. [1] The removal harmful heavy metal ions and dyes from water-bodies is a growing concern. The adsorption technique is simple to run on a large scale, making it appropriate for practical applications. Many adsorbent hydrogels have been developed and reported, comprising 4-Styrenesulfonic Acid (SSA)-based hydrogels as well as N,N-dimethylacrylamide (DMAA)-based hydrogels which have attracted a lot of interest due to their reusability, simplicity of synthesis, and processing. Being a cation exchanger, SSA-based hydrogels can remove cationic dyes and heavy metal cations from aqueous solutions.[2] On the other hand N,N-dimethylacrylamide (DMA)-based hydrogels promise to remove of anionic dyes and anions. In this study, we have used γ-radiation at doses varying within 3-30 kGy to prepare a series of eleven SSA-based hydrogels and four DMA-based hydrogels in combination with various acrylate monomers as well as with natural and synthetic polymers such as chitosan, cellulose, starch, polyvinyl alcohol, polyvinyl pyrrolidone, polyethylene

oxide etc. Their gel fractions vary from 70-98%, with swelling ratios varying from 32 to as high as 14,025. They have been characterized with Fourier-Transform infrared spectroscopy, scanning electron microscopy, X-ray diffraction, thermogravimetric analysis, and creep rheology analysis. These hydrogels are stable up to 250-300 ºC and can endure compressive stress within 85-565 kPa with elastic modulus varying within 40-541 kPa. The porosity of the swollen networks can be as high as 90%. In terms of methylene blue adsorption the PSSA-based hydrogels have shown maximum adsorption capacity varying from 108 mg/g to 441 mg/g following pseudo second order kinetics and Langmuir isotherm. In terms of heavy metal adsorption, these hydrogels have the maximum adsorption capacity of 69-180 mg/g Cu^{2+} salt, 530 mg/g Cu^{2+} complex, and 333 mg/g Cr^{3+} salt. On the other hand, our DMA-based hydrogels have shown promising results in removing the toxic Cr^{6+} ion by 16-74 mg/g and the anionic congo-red dye by 2-4 mg/g. These adsorption processes were determined as thermodynamically favorable and with further optimizations suitable eco-friendly heavy-metal and dye-remover hydrogels can be produced.

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HRP-07: Synthesis of Proton Exchange Membrane by Radiation Grafting

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Radiation grafted sulfonic acid membranes have been recently regarded as interesting alternative proton conducting materials for proton exchange membrane of fuel cells (PEMFCs). In this study, proton exchange polyethylene-tetrafluoro ethylene (ETFE) films were prepared by grafting pre irradiation of acrylic acid and sodium styrene sulfonate onto ETFE. After irradiation of the ETFE film with 50 kGy radiation dose the grafting reaction was carried out at 80º C with monomer solution consisted of sodium styrene sulfonate (SSS) and acrylic acid (AA) (1:2) and 4% NaCl in water. The prepared material was characterized by infrared spectroscopy (IR). The chemical and thermal stabilities of the grafted ETFE films were investigated in terms of its resistance to oxidation and decomposition by heating. Moreover, swelling behavior and ion exchange capacity were also calculated. The new method showed to be promising in improving the properties of the membranes and reducing their cost of fabrication. IEC varied 0.00 mmol/g to 1.57 mmol/g with grafting yield 8% to 487%. The higher the grafting yield (GY) of the membrane, the faster the response with respect to H_2O and H_2O_2. With the higher GY the membranes degrade quickly in H_2O in high temperature and in high concentrated H_2O_2 solution. So, the optimum GY of the membranes was selected 60% in which IEC was 0.011 mmol/g to avoid this problem.

HRP-08: Commissioning of Co-60 Teletherapy Machine at SSDL, Bangladesh: Verification and Measurements of Imperative Machine Parameters during Installation

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IAEA Technical Report Series (TRS)-398 is acode of practice that fulfils the need for a systematic and internationally unified approach to the calibration of ionization chambers in terms of absorbed dose to water. In ICRU Report 24 the need for an accuracy of ± 5% or even closer limits in the delivery of an absorbed dose to a target volume is mentioned for the eradication of a primary tumor. Secondary Standard Dosimetry Laboratory (SSDL) should facilitate with highest possible standard equipments to offer the reducing of uncertainty in the dosimetry of radiotherapy beams. The focus of this study was to investigate the limits of tolerance in mechanical and dose values and evaluation of beam check parameters of a newly installed Co-60 teletherapy machine (Theratron Equinox100#2149, Initial Activity: 12000 Ci) at SSDL, Bangladesh.In the commissioning process, accuracy of some particular mechanical parameters such as optical indicator, gantry indicator, collimator angle indicator, field sizes as well as some dosimetric parameters such as absorbed dose to water, Percentage Depth Dose (PDD), beam profile etc. were determined for different filed sizes. IAEA water phantom, CNMC 2D water phantom, IBA FC65-G Farmer chamber, IBA Dose 1 Electrometer etc. were used in thismeasurement. Checking of some functional parameters to ensure operational safetyand area radiation monitoring around the facility was also performed to ensure compliance with regulatory dose limits. The deviation of all mechanical parameters was found in good agreement with IAEA recommendations. The absorbed dose rate at reference field size (10×10 cm^2) was found 1.548 Gy/min with an uncertainty of ±0.020, the pattern of change in amount of output doseswith increasing field sizes (from 5×5 cm^2 to 15×15 cm^2)was achieved as per expectation.A deviation of 1.0 mm between measured and expected depth for maximum dose was found for different field sizes that might be occurred because of the uncertainty of effective volume of the ionization chamber.Beam profiles showed slight asymmetry in respect to the central axis. In radiation area monitoring around the facility, all values were measured within acceptable limits. On the basis of evaluation of all measured data it can be deduced that the installed Co-60 teletherapymachinecan ensure the Quality Assurance and Quality Control of radiotherapy machines in countrywide radiotherapy centers.

HRP-09: Determination of Gross Alpha Radioactivity in Surface Water Collected from Twenty-Three Major Geographical Regions from Central Point of Dhaka City

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Radioactivity found in surface water has turrn into a serious matter of health concern across the world in current days. Gross Alpha is a test that is performed to determine the overall radioactivity in water. Gross Alpha testing detects these alpha particles in the water and indicates the presence of radioactive substances, such as radium 224 and radium 226. These study gross alpha activities have been measured in 23 surface water samples collected in 2021 from different area of Shabag and Ramanathana which are situated at the central point of Dhaka city. The main objective of this study is to determine the Gross alpha radioactivity in environmental surface water sample. pH is an important parameter of water because there is a strong correlation between several water properties and this value. The pH value of collected surface water was found from 6.7 to 7.5 in standard pH scale. The gross alpha activity of our collected surface water sample was ranged from < 7 to 28 mBq L^{-1}, and the average value approximately 18 mBq L^{-1}There was not registered any exceeding of the maximum allowed limits for gross alpha activity stipulated in the national legislation. The values obtained in this study were compared with those presented in similar studies from Bangladesh and other regions of the world. This study aimed to provide an easier method to quantify the radioactive pollution in surface water and give a scientific basis for making policy decisions on radioactive pollution management. Moreover, this study will help to prepare national Survey data for gross alpha radioactivity in surface water samples which will be used as reference for the comparison of radioactivity level.

Session (IIIB): Materials Science-1

IT-IIIB: Designing the smallest bandgap proper ferroelectric material

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A low band gap ferroelectric material with a sizable polarization at ambient conditions would constitute an ideal photovoltaic material to harvest solar energy owing to their efficient polarization driven charge carrier separation as well as generation of high, above band gap,

photovoltage upon photoexcitation. Consequently, these materials in principle can overcome what is normally considered as the maximum theoretical limit of photoconversion efficiency. Unfortunately, all known ferroelectric materials tend to have very high bandgap with little overlap with the solar spectrum and the consequent inability to absorb most of the solar spectrum. Design and synthesis of reduced band gap ferroelectric transition metal oxides without compromising their polarization properties has been a longstanding challenge with little success. Based on our recent work, I shall discuss how one may achieve this elusive goal by co-doping a Jahn-Teller Mn^{3+} and Nb^{5+} pair for two Ti^{4+} ions, representing a charge-neutral dipole doping, in ferroelectric $BaTiO_3$, achieving for the first time a bulk ferroelectric oxide with the lowest bandgap of 1.66 eV with a sizable polarization of nearly 70% of $BaTiO_3$. More recently, we have found theoretical indications to expand this strategy with co-doping of Cu^{2+} and Te^{6+} at the Ti^{4+} sites of $BaTiO_3$.

Primarily based on

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MS-01: Study on the Effectiveness of Polyimide and Polyester Polymer for Radiation Shielding in A Spacecraft for Long Term Space Mission

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In the course of long-termed space missions, astronauts will be exposed to galactic cosmic rays (GCR) and solar particle events (SPE). Both immediate and delayed effects will be imposed on the crew members as the consequences of their exposure to space radiation. Passive shielding, that is, the use of shielding materials that attenuate High Charge and Energetic (HZE) particles, is one of the potential techniques to reduce space radiation dose. This paper presents the effectiveness of Polyimide (Kapton) and Polyester (Mylar) polymer for radiation shielding using Monte Carlo simulations. The shielding properties were studied using proton, alpha, and Fe ions with energies of 600MeV/n for a specific thickness of the polymers. In terms of particle flux and total ionizing dose, this study indicates that both polymers hold almost similar properties. The findings are compared with Polyethylene, which is considered an efficient shielding material that has been tested in the international space station (ISS) and ground-based experiments.

MS-02: Chemical Vapor Deposition Synthesis of Lead-Free All-Inorganic $Cs_3Sb_2I_9$ Perovskite Microplates for Ultra-Fast Photoconductive Response and Robust Thermal Stability

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Lead-based halide perovskites ($CsPbX_3$, X=Cl, Br, I) have received great attention for their excellentproperties which make them suitable materials for many optoelectronic devices. However, the poor stability as well as the toxicity of lead (Pb)greatlyhamperthe commercialization of these devices. Therefore, Pb-free, environmental friendly all-inorganic halide perovskites are now the subject of enormous interest to the scientific community. It has been suggested that antimony (Sb) can be a possible replacement of Pb ($Cs_3Sb_2X_9$) in these inorganic halide perovskites. Until now Sb-based all-inorganic perovskites have been synthesized by solution processes but properties are still inferior to Pb-based materials. However, due to the low melting point of Sb halides, synthesis of high quality $Cs_3Sb_2X_9$ using chemical vapor process is still a challenge. In this work,we present a report on the successful synthesis of Pb-free all-inorganic $Cs_3Sb_2I_9$ perovskite microplates by a two-step chemical vapor deposition (CVD) approach.XRD analysis of the microplates shows the pure phase crystalline nature of the $Cs_3Sb_2I_9$ perovskite structure.As compared with other typical lead-free perovskite materials, the $Cs_3Sb_2I_9$microplates demonstrate excellent optoelectronic properties, including substantial enhancements in the Stokes shift and exciton binding energy. Simple photoconductive devices fabricated using these microplates exhibit an ultra-fast response with the rise and decay time down to 96 μs and 58 μs, respectively. This respectable photoconductor performance can be regarded as a record among all the lead-free perovskite materials. The efficient response is benefited from the excellent crystal quality and enhanced exciton binding energy of the microplates. Importantly, these photodetectors have superior thermal stability with a wide temperature range, capable to function reversibly between 80 K and 380 K, indicating their robustness to operate under both low and high temperatures. All these results clearly suggest the technological potential of all-inorganic lead-free $Cs_3Sb_2I_9$ perovskite microplates forfuturehigh-performance photodetectors and other optoelectronic devices.

MS-03: The Influence of Magnesium Doping on $BaZr_{0.5}Y_{0.5-X}Mg_xO_3$ Perovskite Oxide for Applications in Solid Oxide Fuel Cell

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The influence of magnesium (Mg) doping on $BaZr_{0.5}Y_{0.5-x}Mg_xO_3$ perovskite oxide for increasing structural capacity and electronic properties were studied. The preparation and characterizations of $BaZr_{0.5}Y_{0.5-x}Mg_xO_3$ (where x = 0.0, 0.1, 0.2, 0.3, 0.4; named as BZYM0-BZYM4) materials were the main motif which will be used as possible electrolyte materials for intermediate temperature solid oxide fuel cell (SOFC). To get those materials, traditional solid state sintering method has been used. All the samples were sintered at 1200 ℃ for 8 hours in air atmosphere. The samples were characterized by X-ray diffraction, Scanning Electron Microscopy (SEM), thermogravimetric analysis (TGA), Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopic technique. The X-ray diffraction patterns showed that the samples were in single phase orthorhombic crystal structure with the Pbnm space group. From the TGA measurements in nitrogen gas environment, it found that the BZYM4 sample showed moderate stability at intermediate temperature range. The FTIR study confirmed that the functional groups appeared at 500, 850, 1410 and 1752 cm^{-1} in $BaZr_{0.5}Y_{0.5-x}Mg_xO_3$ were due to the Mg-O bending, Zr-O stretching, Ba-O stretching and C-O stretching modes. The SEM images of the samples showed that the average grain size of the samples has significantly changed with the doping of small amount of Mg content. From the Raman spectroscopy, elaborated inside view of the samples where the Y-O stretching mode was found perfectly. Experimental results of all the materials reveal that it can be suitable to use as electrolyte material in solid oxide fuel cells (SOFCs).

MS-04: Effect of Samarium on Electrical Properties of Lanthanum Ferrite Nanoparticles

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In recent years, a small word with giant potential has attracted attention to the scientists and researchers of all sectors of science and technology. The word is ‘nano’ which possesses a tiny scale range that is larger than the level of atoms and molecules but within the range of 1-100 nanometers.Multiferroics are materials in which at least two ferroic properties(ferromagnetism, ferroelectric and/ferroelastic) could be used simultaneously and are intrinsically coupled together.Multiferroic devices possess electric field controlled magnetic orderings which consumes significantly less power than magnetic field controlled, which requires electric currents to generate the magnetic field. Because of strong magneto-electric coupling, multiferroic materials have a vast area of application in spintronics devices, information storage devices, quantum electromagnets, microelectronics devices, and different types of sensors. Interestingly, it was found that LanthanumFerrite ($LaFeO_3$), a member of the centrosymmetric rare earth ortho-ferrite ($RFeO_3$) family (having a distorted orthorhombic perovskite structure), possesses magnetically tunable ferroelectricity due to the exchange striction mechanism.

XRD patterns, along with Rietveld refinement wereanalyzed to ensure the phase formation and crystallographic nature. Reduction of particle size and nanocrystallinity nature was studied in TEM analysis. Physics behind electronic states of different atoms was illustrated by XPS analysis.DC and AC conduction mechanism and charge transport mechanism are illustrated in association with Mott's variable range hopping (VRH) model and correlated barrier hopping (CBH) model respectively. The resistivity (DC & AC) is increased with a markable amount by virtue of Sm substitution. An improvement of dielectric properties is observed where dielectric loss is reduced due to the reduction of oxygen vacancies.Positive magneto-dielectric coupling is observed in the samples where coupling increases with doping which states that the Sm doped $LaFeO_3$ can be good candidate in in magneto-electric industries.

MS-05: Impact of Yttrium and Lanthanum on Structural, Optical, Electrical and Magnetic Properties of Cobalt Ferrites Nanoparticle

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Nanocrystalline $CoY_{0.5x}La_{0.5x}Fe_{2-x}O_4$ (x=0.00, 0.02, 0.04, 0.06, 0.08 and 0.10) ferrite was synthesized through sol-gel auto combustion method. The synthesized powders have been pressed into pellets and sintered at 900^0C for 4 hr. The final samples were characterized by X-ray Diffraction (XRD), Fourier Transform infrared (FTIR), Field-Emission Scanning Electron Microscopy (FE-SEM), UV-VIS-NIR spectroscopy, impedance analyzer and vibrating sample magnetometer (VSM). The XRD analysis confirmed the single-phase cubic spinel structure and the mean crystallite size varied from 36 nm to 46 nm. The presence of the functional group was determined by the FTIR spectrum which shows two strong bands within the range 600 to 350 cm^{-1}. FE-SEM micrographs of the samples revealed that the average grain size decreased with increasing doping concentration which ranges between 199 nm to 57nm. UV-VIS-NIR diffuse reflectance spectrum indicated the optical bandgap energy has decreased with increasing the La^{3+} and Y^{3+} doping concentration. Frequency-dependent (100Hz to 110MHz) dielectric properties of the samples such as dielectric constant, conductivity, quality factor, dielectric loss, and complex impedance were investigated by a precision impedance analyzer. The magnetic hysteresis curves measured at room temperature exhibited ferrimagnetic behavior with maximum saturation magnetization (Ms) of 78 emu/g and coercivity (Hc) of 1276 Oe for x=0.10. The ferrite nanoparticles with improved magnetic and dielectric properties are suggesting that these materials may be suitable for magneto-recording and high-frequency devices.

MS-06: Validate the Improvement of Footprint of the Female Connector on PCB Surface by Using HFSS

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Mode conversion occurs at the connector section that connects the shielded-twisted-pair (STP) cable with the printed circuit board (PCB), due to their structural difference. The inadequate shielding around the footprint of the female connector on the PCB surface causes mode conversion. Therefore, footprint of the female connector on the PCB structure is needed to be improved to make the shielding perfect around the connector section. A copper layer is placed on the PCB surface to improve the footprint of the female connector. Therefore, it will improve the shielding around the connector section and hence, suppressed mode conversion. The copper layer on the PCB surface connects with the PCB GND layer through vias. The footprint of the female connector is also shifted to make soldering entirely at the connector mounting point on the PCB surface that makes the shielding more improved around the connector. As a result, the improved PCB structure with the improved footprint of the female connector makes the connector shielding more improved to reduce mode conversion based on the idea of imbalance matching between the connector section and the cable section. In this paper, we validated the idea of shield improvement of RJ45 connector by improving footprint of female connector on PCB surface by using HFSS simulation. Furthermore, simulation result confirms the impact of improved footprint of the female connector on the PCB structure on mode conversion suppression.

MS-07: A Systematic Study of Structural, Electronic and Optical Properties of $MoTe_2$ in Bulk and 2D Monolayer Structures

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A typical two dimensional (2D) graphene like structural materials have attracted great interest because of their unusual physical and chemical properties. Among these, 2D monolayers of layered transition metal dichalcogenides (TMDs) exhibit intriguing physical and chemical properties. In contrast to graphene, they exhibit direct band gap nature with tunable band structures by controlling and/or layer numbers. To this point of view, the structural, electronic and optical properties of bulk and 2D structures of $MoTe_2$ have been studied systematically by first principles calculations based on the density functional theory (DFT). The first-principles studies of $MoTe_2$ show that the structural properties of bulk $MoTe_2$ are little bit changed when it transfer into 2D form. Importantly, the electronic indirect band gap of $MoTe_2$ is obtained to be 0.57 eV in the bulk form which in converted to direct band gap semiconductor in 2D monolayer form with a value of 1.20 eV. This new monolayer material extends the spectral range of atomically thin direct-gap materials from the visible to the near-infrared. The optical properties of the bulk $MoTe_2$ are significantly changed when it is transferred to 2D monolayer material. Therefore, these obtained properties would be helpful to promote its applications in

advanced spintronics, electronic, optoelectronic devices, photo sensors and photoelectrochemical cells, etc.

MS-08: Study on Hydrogen Isotopes Behavior in Proton-Conducting Oxides by TDS and TMAP4 Simulation

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It is crucial to understand hydrogen isotope behaviors, especially the solubility and diffusivity of hydrogen in oxide materials, to use them as functional materials in fusion reactors. However, hydrogen isotope behavior data in oxide materials are limited and scattered. Therefore, the motivation of this work is to carry out an in-depth study of hydrogen isotopes behaviors in oxide materials that could be suitable for the coating of metal piping in a fusion reactor's DT fuel circulation system to prevent tritium leakage or also to study oxide materials in which hydrogen isotopes selectively pass through and can purify unused tritium during fusion reactions.

In this study, thermal desorption spectroscopy (TDS) was used to investigate hydrogen dissolution and release behavior for $BaZr_{0.9}Y_{0.1}O_{3-\alpha}$ (BZY) in the temperature range of 673-1273 K using deuterium gas (D_2). From TDS, a similar trend of temperature-dependent hydrogen solubility was obtained, compared to the tritium imaging plate (TIP) method's literature data of HT- and DTO-exposed samples. To compare the experimental results of the D_2 desorption profile derived by TDS analysis, the simulation code of the tritium migration analysis program, version 4 (TMAP4) was employed.

The hydrogen diffusivity calculated by TMAP4 was higher than the experimental values because oxygen is not considered a diffusion species in TMAP4. From the Arrhenius plot of hydrogen solubility obtained from the TDS study, in the temperature range of 673 K to 1073 K for D_2-exposed BZY, a similar trend of temperature-dependent hydrogen solubility was obtained, similar to the HT- and DTO-exposure cases. Therefore, it could be said that the hydrogen solubility data obtained in this study from D_2-exposure are consistent with literature data.

MS-09: Study of the structural, electrical, and magnetic properties of $(Fe_{95}Ti_5)_{75}P_{15}C_{10}$ amorphous ribbon

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Ribbon of $(Fe_{95}Ti_5)_{75}P_{15}C_{10}$ amorphous alloy was made using melt-spinning technique. The samples were annealed at 430°C, 450°C, 470°C and 490°C for 30 minutes. The XRD and FESEM coupled with EDS revealed that the as made sample is amorphous with broaden XRD peaks and the become crystallized when annealed at 450°C. EDS spectrum confirms the presence of Fe, Ti, P, and C elements in the samples. The Crystallization temperature (T_x) of the sample obtained from Differential thermal analysis (DTA) is 452°C and thermo-gravimetric (TGA) analysis shows mass loss and/or gain of all the samples. Small increase of the electrical resistivity (ρ) is observed with the temperature increasing from 77 K to 298 K. The as made sample shows 6.95% magnetoresistance as a function of magnetic field and an abnormal change in MR percent is seen around 2.87 μT. Saturation magnetization is found to decrease with the annealing temperature. The different types of complex permeability as a function of frequency (real and imaginary parts, respectively) from 100 Hz to 120 MHz, shows effective permeability of 22.69.

20th May 2022 (Friday)

Session (IVA): Nanomaterials-I

IT-IVA: Innovations through Poor Man's Nanotechnology: From the Lab to the Market

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Nanotechnology — which has been considered by many as an "Industrial Revolution" — is maturing fast as increased number of products have moved from concept to commercialization. Nanotechnology is an emerging technology with potential applications in many sectors of global economy. These sectors include healthcare, cosmetics, energy, water purification, agriculture and food processing, amongst others. It is a horizontal technology revolutionizing every industry, while immensely attracting worldwide attention. Ample opportunities are there for industries to tap the fast growing market, which is capable of garnering enormous revenue on the back of commercialization of the technology. In a recent study, Global Nanotechnology Market Outlook 2024, a segmented research was conducted on the nanotechnology industry. The report interpreted the key market trends & developments that visibly point out the areas offering encouraging potentials for industries to enhance their growth. The global nanotechnology market is expected to grow at a Compound Annual Growth Rate of around 17% during the forecasted period of 2017-2024.

It is a misconception that nanomaterial synthesis and subsequent device fabrication and/or commercial product development involves huge amount of investments. Research in Nanotechnology calls for sophisticated instrumentation facilities for synthesis of nanomaterials as well as their characterization. This has been a deterring force for small laboratories to start research in this new technology. Characterization facilities are expensive but are available in centralized sophisticated analytical facilities set up by the Governments of almost all countries and can be accessed with an affordable fee. There are however simple techniques that can be adopted for basic nanotechnology research with nominal investments. We have come up with a concept which we have termed as PMNT or "Poor man's Nanotechnology". An advantage of developing basic instruments for synthesis of nanomaterials as well as making thin films for fabricating simple devices like sensors, solar cells, water purifiers, etc. is that the young students and researchers get a comprehension of the physics behind the operation of the instruments. Applied research ending up in innovative products that can improve the standard of living, especially of the people who form the base of the social pyramid, is the need of the time especially for developing nations where a major section live below the poverty line. Many scientific and technical problems await environmentally friendly solutions that could not be provided by established technologies. There is an urgent need for a disruptive technology and Nanotechnology is now being universally accepted as a technology with a potential to provide novel green solutions to existing technical problems. Research capacity building through interactions with and suggestions from global experts and scientists can boost up innovative and out-of-the-box thinking and impact applied research. Environmental impact assessment, detection and remediation of environmental pollution through novel techniques have become the need of the hour to preserve the sanctity of the natural wealth and beauty of this world.

NM-01: Synthesis and Characterizations of Nanohydroxyapatite (nHAp) from Eggshells Waste by Novel Hydrothermal Route for Biomedical Applications

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Plenty of bio-waste eggshells are being generated from food processing industries each day worldwide. These materials are directly discarded in the soil and those are creating odor and microbial growth in the environment. It is becoming a huge challenge for scientists to figure out an eco-friendly path to transform these wastes into wealth. Our main target in this study is to develop inexpensive and sustainable approaches to synthesize bioactive nanohydroxyapatatite (nHAp) from eggshells waste. Interestingly, nHAp has numerous biomedical applications especially as scaffold for tissue engineering and in orthopedic implants. To achieve these important goals, firstly, calcium precursor nanoparticles were synthesized from powdered eggshells (PES) by sol-gel method followed by calcination and chemical processes. Afterwards, nHAp was synthesized from calcium precursors by hydrothermal route at 280 ^{o}C. Moreover, nHAp was also prepared from commercially available chemicals by the similar method to compare the purity and phase of the produced nHAp from PES. To the best of our knowledge, nHAp prepared from eggshells waste via our novel hydrothermal technique is reported for the first time.

Initially, the produced calcium precursors, $CaCO_3$, $Ca(OH)_2$ and CaO were characterized by XRD, SEM, FTIR, EDS and TGA techniques to achieve desired nHAp. The X-ray diffraction patterns of nHAp, obtained from both eggshells waste and market available chemicals show the existence of the almost pure apatite phase with hexagonal structure (a = b = 9.423 Å; c = 6.915 Å) as presented in the paper. The exhibited XRD patterns also imply that although the nHAp was obtained from two different sources, but their purity and crystallinity were found dominantly analogous. FTIR spectra of nHAp confirm the presence of all relevant functional groups and boding of calcium (only inorganic element) to their corresponding wavenumbers. The morphological and particle size of our prepared HAp was investigated by SEM that reveals predominantly agglomerated spherical particle shapes with average particle size of ~200 nm. EDS analysis confirms the existence of all elements in nHAp with their percentage. From TGA data it is quite clear that nHAp suffers no decomposition and/or no mass change below 800 ^{o}C that confirm the superior stability of synthesized nHAp for future biomedical applications.

NM-02: Synthesis and Characterization of pH Controlled Biogenic Silver Nanoparticles Using Szygium Cymosum Leaf Extract and Investigation of their Potential Biomedical Applications

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Silver nanoparticles (AgNPs) have gained tremendous importance in the field of biomedical research owing to their excellent antimicrobial potentiality as well as less toxicity. The unique physical and chemical properties of AgNPs contribute to exerting bactericidal activity against a wide range of bacteria, even at minimal concentration. Hence, AgNPs could be one of the most promising and novel ways to overcome the odds of antibiotic resistance, one of the major menaces of global health. Green synthesis of AgNPs is an eco-friendly, less hazardous, and non-toxic approach. Therefore, in this study, we prepared AgNPs by using Szygium cymosum at four different pH levels (i.e., 5, 7, 8, and 10) and examined their antibacterial potency along with their toxicity. The as-prepared AgNPs were characterized through UV-Vis, Fourier transform infrared (FTIR) spectroscopies, scanning transmission electron microscopy (TEM), powder X-ray diffraction (XRD) analysis, dynamic light scattering (DLS), and ζ-potential analysis. A high-intensity surface plasmon resonance band was observed at ∼435, ∼410, ∼412, and ∼405 nm for AgNPs synthesized at pH 5, 7, 8, and 10, respectively, which are within the characteristic wavelength range of synthesized AgNPs. The average size and average hydrodynamic diameter of the synthesized AgNPs at different pH were 17.2-35.3 nm and 93-243 nm, and were negatively charged. Moreover, the polydispersity index (PDI) of synthesized AgNPs at different pH level were 0.296-0.629. Grain size, crystalline nature, and orientation of synthesized AgNPs were acquired by XRD spectra and the average particle sizes determined by using Scherer's equation were 29 nm, 27.7 nm, 23.5 nm, and 32.71 nm for the bAgNPs synthesized at pH 5, 7, 8, and 10, respectively. The antibacterial potentiality was determined against Bacillus subtilis, Escherichia coli DH5α, E. coli K12, enteropathogenic E. coli (EPEC), and Salmonella typhi. The antibacterial activity was investigated through disk diffusion, CellTox green dye, and trypan blue dye exclusion assay. The highest antibacterial activity was exhibited by AgNPs synthesized at pH 8 against all experimental bacterial strains which can be attributed to their smaller size and greater surface area to volume ratio. AgNPs displayed maximum zone of inhibition (ZOI) against Gram-positive bacteria B. subtilis (29.5 ± 0.8 mm in diameter). Exposure of bacteria to as-synthesized AgNPs oxidizes membrane fatty acids and leads to the formation of malondialdehyde-thiobarbituric acid (MDA-TBA) adduct. The Lipid peroxidation (LPO) assay showed the highest amount of MDA-TBA adduct was obtained with the treatment of AgNPs with B. subtilis. In addition, synthesized AgNPs demonstrated excellent hemocompatibility with rat (4.59 %) and human RBCs (4 %). Different dose (5, 10, and 50 mg/kg) and time (1, 7, and 28 days) dependent toxicity study in male albino Wistar rats assured admirable biocompatibility of AgNPs synthesized at pH 8. Data of both biochemical and histopathological analysis confirmed that single intravenous injection of AgNPs up to 50

mg/kg was well adjusted with brain, liver, heart, lung, kidney, and spleen functions till 28 days. The results of this study consolidate AgNPs as a promising antibacterial candidate to fight against antibiotic resistance.

NM-03: Investigation of Antimicrobial Activity and Biocompatibility of Biogenic Silver Nanoparticles Synthesized Using Syzygium Cymosum Extract

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Nanotherapeutics has emerged as the most sought-after approach to tackle the menace of drug resistant pathogenic bacteria. Among others, biogenic silver nanoparticles (bAgNPs) synthesized using various medicinal plant extracts demonstrate promising antibacterial propensity with excellent biocompatibility. Herein, bAgNPs were synthesized through green chemistry approach using Syzygium cymosum leaf extract as a reducing agent at different pH 5, 7, 8, and 10. The as-synthesized bAgNPs were characterized using UV-Visible, and Fourier transform infrared (FTIR) spectroscopy, powder X-ray diffraction (XRD) analysis, scanning transmission electron microscopy (TEM), dynamic light scattering (DLS), and ζ-potential analysis. The average size of as-synthesized bAgNPs were 23.3, 21.3, 17.2, 35.3 nm at pH 5, 7, 8, and 10 respectively, and were negatively charged. Their antibacterial potential was investigated against Bacillus subtilis, Escherichia coli DH5α, E. coli K12, enteropathoagenic E. coli (EPEC), and Salmonella typhi. The highest antibacterial activity was exhibited by bAgNPs synthesized at pH 8 against all the tested bacterial strains which can be attributed to their smaller size and greater surface area to volume ratio. The bAgNPs demonstrated the highest zone of inhibition (29.5 ± 0.8 mm in diameter) against B. subtilis through oxidation of membrane fatty acids that resulted in the formation of malondialdehyde-thiobarbituric acid (MDA-TBA) adduct. The highest amount of MDA-TBA adduct was formed when B. subtilis were treated with bAgNPs. On the other hand, bAgNPs demonstrated excellent

hemocompatibility with rat as well as human red blood cells (RBCs). Biogenic AgNPs synthesized at pH 8 also exhibited biocompatibility in terms of liver, and kidneys function biomarkers. Furthermore, hemotaxylin and eosin staining of the tissue sections of vital organs (i.e., liver, kidneys, lungs, heart, spleen, and brain) also confirmed the biocompatibility of bAgNPs.

NM-04: Study of the Influence of Annealing Temperatures on CdS Nanoparticles Synthesized by Chemical Precipitation Method

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CdS nanoparticles have been successfully prepared using a simple chemical precipitation method. Cadmium Chloride and Thiourea are used as the precursor materials. Ammonia water & distilled water are used as solvent. The samples are annealed at 100°C, 300°C and 500°C for 1 hour. Transmission electron microscopy (TEM), Energy–dispersive X-ray spectroscopy (EDAX), and X-ray diffraction pattern (XRD) are used to study the morphologies, distribution, and crystallinity of the CdS nanoparticles and to calculate the values of their sizes. The structural properties for the prepared samples are studied by X-Ray diffractions and it appeared that all the samples are polycrystalline and have hexagonal structures, with a preferred orientation along (002) (101) (103). CdS prepared using this method exhibits nano size regime with a predominantly hexagonal phase with sharp diffraction peaks. The particles are in high degree of crystallization. The XRD results reveal that the annealing effect has increased the crystalline size of the CdS nanoparticles. TEM demonstrates that the average sizes of spherical cadmium sulfide nanoparticles are 73.30 nm, 61.91 nm and 88.81 nm at annealing temperature of 100°C, 300°C and 500°C respectively. In this research CdS has been studied due to its potential technological applications and the present method is a simple and efficient for the preparation of nano-crystalline CdS nanoparticles at low temperature with excellent structural and elemental properties which could find their applications in optoelectronic devices, light emitting diodes, solar cell etc.

NM-05: Co_3O_4 Decorated Three Dimensional MoS_2 Nanoflower for Stable Supercapacitor Electrode with Improved Capacitive Performance

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In this study, a novel, Co_3O_4 nanoparticle decorated MoS_2 nanoflower (MoS_2/Co_3O_4) has been fabricated using a simple hydrothermal method by various concentrations of Co_3O_4 (0, 1, 2, 4,

and 6%). The FE-SEM images depict a three-dimensional flower-like structure for MoS_2 and MoS_2/Co_3O_4. The XRD analysis was used to estimate the various structural characteristics of the nanoflowers. According to TEM examination, the inter-planar spacing of the nanostructure changed with the quantity of Co_3O_4 nanoparticles. Raman spectroscopy of the MoS_2/Co_3O_4 nanoflower revealed a pronounced low-shift of the first-order Raman peaks, indicating n-type doping owing to the inclusion of Co_3O_4. The electrochemical investigation yielded a specific capacitance of 220.72 $mFcm^{-2}$ at 0.14 $mAcm^{-2}$, as well as a high energy density and excellent cycling stability (87% capacitance retention after 10,000 charge/discharge cycles) for the MoS_2/Co_3O_4 (4%) nanocomposite. This improved specific capacitance of MoS_2/Co_3O_4 can be attributed to the produced sample's greater surface area, defect-rich structure, and decreased charge transfer resistance. The MoS_2/Co_3O_4 nanostructure with better specific capacitance and greater stability produced by a simple, low-cost technique would pave the way for the development of efficient and cost-effective energy storage devices.

NM-06: Effects of Cr Doping on the Structural and Electromagnetic Properties of Cu Mg Nanoferrites Prepared by the Sol-gel Method

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Polycrystalline Cr substituted Cu-Mg ferrites having the chemical formula $Cu_{0.5}$ $Mg_{0.5}Cr_x$ $Fe_{2-x}O_4$ (x=0.0, 0.04, 0.08, 0.12, 0.16 and 0.20) were synthesized by sol-gel method and their structural, electrical and magnetical properties with Cr doping were examined. On this purpose, characterizations of the composites were performed by X-ray diffraction (XRD) techniques, fourier transform spectroscopy (FTIR), scanning electron microscopy (SEM), vibrating sample magnetometer (VSM) and impedance analysis. Single cubic spinel structure phase formation is confirmed by XRD and FTIR analysis. The lattice constants and particle size are estimated using XRD data and found to be strongly dependent on Cr concentration. SEM images suggest that the change in microstructure with Cr doping. Magnetic properties of Cu-Mg ferrites were measured using a vibrating sample magnetometer at room temperature. For impedance measurement, non-monotonic dependency with Cr doping on Cu-Mg ferrite is observed. The AC electrical resistivity (ρ_{ac}) and the dielectric constant (ε') as a function of compositional variation depicts an inverse trend of variation with Cr contents. The presence of all the existing elements as well as the purity of the samples were confirmed by energy dispersive X-ray spectroscopy (EDS) analysis. The grain and grain boundary contributions to the total resistance were described using the cole-cole plot.

NM-07: Sol-gel Synthesized Double Perovskite Nd_2FeCrO_6: Structure and Magnetic Properties

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A new double perovskite, Nd_2FeCrO_6 has been synthesized by citrate-based sol-gel technique. The crystal structure was studied from Rietveld refined powder X-ray diffraction data. Rietveld fits to the pattern showed that this compound has an orthorhombic symmetry defined in the space group Pnma, where the Fe and Cr cations are randomly distributed in the B-sublattice of the perovskite structure. Both bright field transmission electron microscopy (TEM) and high-resolution TEM imaging were carried out to determine the size and inter-planar spacing of the synthesized nanoparticles. The field-dependent magnetic hysteresis loops demonstrated the coexistence of weak ferromagnetic and antiferromagnetic domains in Nd_2FeCrO_6 nanoparticles. The temperature-dependent magnetization curves exhibited magnetization reversal (MR) behavior in this double perovskite at 6 K in the field cooled mode. In addition, at 10 K and 150 K positive and negative exchange bias (EB) effects were observed, respectively which were found to be tunable by applying magnetic field. The presence of both MR and EB in Nd_2FeCrO_6 double perovskite might be worthwhile for potential applications in the next generation spintronic devices.

NM-08: Effect of Sintering Temperature on Dielectric and Optical Properties of Na-montmorillonite Supported $NiFe_2O_4$ Nanocomposites

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Na-montmorillonite (Na-MMT) supported $NiFe_2O_4$ nanoparticles have been synthesized by sol-gel auto combustion method. $NiFe_2O_4$ was supported with 2 wt % of Na-MMT content. The effect of sintering temperature has been studied by sintered the sample at 600°C, 800°C, 1000°C and 1200°C. The structural characterizations of the prepared samples were made by X-ray diffraction (XRD) analysis and Raman spectroscopic analysis. The variation of dielectric constant, dielectric loss, Q factor, ac conductivity of the samples have been studied with the variation of frequency and sintering temperature. The optical band gap and their variation with temperature has been investigated using UV spectroscopic analysis. The XRD studies confirm the formation of spinel type cubic structure of pure $NiFe_2O_4$ showing the reflections from (111), (220), (311), (222), (400), (422), (511) and (440) crystallographic planes. Na-MMT supported Ni ferrite shows same reflections indicating the presence of Na-MMT in Ni ferrite as a supporting material. The values of crystallite size obtained in Williamson-Hall method are found to be 46.22 nm and 67.31 nm for pure Ni ferrite and Na-MMT supported Ni ferrite. Raman spectra shows the presence of five Raman active modes such as A_{1g}, E_g, $F_{2g}(1)$, $F_{2g}(2)$ and $F_{2g}(3)$ at the sintering temperature of 600°C, 800°C, 1000°C, 1200°C. The intensity of Raman active modes were found to be increased with increase of sintering temperature. The

value of dielectric constant decreases with the increase of frequency as usually observed. Investigation reveals the significant variation of dielectric constant with sintering temperature. The maximum value of dielectric constant is observed at 800°C and minimum value is observed at 1200°C. The value of dielectric constant is found to be 3.56 at 600°C and 1.56 at 1200°C at 100 kHz frequency. The variation of dielectric constant is expected to be explained by Maxwell–Wagner series capacitor model. The ac conductivity increases with increase of frequency in Na-MMT supported Ni ferrite. The ac conductivity shows an increasing trend with increase of temperature. The band gap energy calculated from UV spectroscopic analysis were found to be 1.84 eV, 1.82 eV, 1.81 eV, and 1.79 eV for the samples sintered at 600°C, 800°C, 1000°C and 1200°C, respectively.

NM-09: Microstructural Parameters Analysis of Hydrothermally Synthesized Mg-Doped SnO_2 Nanoparticles with Debye-Scherrer, Williamson-Hall and Halder-Weigner Methods

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In this research work, we have synthesized SnO_2 nanoparticles by hydrothermal synthesis with different doping concentrations of Mg (1, 3, and 5%M). The structural properties of the synthesized nanoparticles have been characterized by powder X-ray diffraction (XRD) analysis. The XRD pattern showed that the Mg-doped SnO_2 nanoparticles were tetragonal rutile type crystal structures with P42/mnm space group. The peaks are shown in the XRD pattern at the plane (110), (101), (200), (211), (220), (002), (310), (112), (301), (112), (301), (202) and (321) which are nicely matched with the JCPDS card no 41-1445. The nanoparticle shape was observed from a scanning electron microscope image and the presence of Mg contents was confirmed from the energy-dispersive spectroscopy analysis. The structural parameters such as crystallite size, lattice strain, dislocation density, lattice parameters, unit cell volume, stacking fault, and XRD peak broadening are calculated and compared with Debye-Scherrer, Williamson-Hall (W-H) and Halder-Weinger (H-W) methods respectively for pure and Mg-doped SnO_2. The most intense XRD peak in the plane (110) was observed at 26.6° degree for pure SnO_2 and the intensity decreases with increasing the percentage of Mg incorporation. Moreover, peak shifting towards the lower 2θ values after Mg incorporation was also observed. The average crystallite size was calculated 16.07 nm, 17.588 nm, and 11.62 nm from Debye-Scherrer, W-H and H-W respectively for undoped sample and this value decreases with increasing Mg concentration. However, the lattice strain and dislocation density increase after Mg incorporation.

NM-10: Natural Antioxidant Based Synthesis of Magnetic Silver Nanoparticles Using Some Medicinal Leaves and Their Applications Against Cancerous Cell and Multidrug-Resistant Strains

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Now-a-days, pharmaceutical and biomedical sectors are facing the challenges of continuous increase in the multidrug-resistant human pathogenic microbes. Re-emergence of multi drug resistant microbes is facilitated by drug and/or antibiotic resistance, which is acquired way of microbes for their survival and multiplication in uncomfortable environments. Multi drug resistant bacterial infections lead to significant increase in mortality, morbidity and cost of prolonged treatments. Therefore, development, modification or searching the antimicrobial compounds having bactericidal potential against multi drug resistant bacteria is a priority of research. In the present study, silver nanoparticles (Ag-NPs) have been synthesized using three different medicinal leaf aqueous extracts of Ocimum tenuiflorum, Cynodon dactylon and Azadirachta indica as a source of reducing and stabilizing agents. X-ray diffraction (XRD), transmission electron microscopy (TEM), selected area energy diffraction (SAED), Fourier transform infrared (FT-IR), thermo gravimetric (TG), and differential scanning calorimetry (DSC) analyses clearly demonstrates the successful synthesis of Ag-NPs with the variation of bio-molecules encapsulation. The vibrating sample magnetometer (VSM) study clearly revealed that the synthesized Ag-NPs have shown room temperature ferromagnetic property. The synthesized magnetic Ag-NPs were then exposed against different drug-resistant pathogens of clinical importance (erythromycin, ampicillin and tetracycline resistant E. coli, S. typhimurium and S. aureus) with a suspension of silver nanoparticles (Ag-NPs). Clear zone of inhibitions was obtained indicating the materials as an effective drug against multi-drug resistant strains. **Moreover, after exposing the synthesized Ag-NPs to cancerous HeLa cells no toxic effect was found up to a dose of 5 mg L^{-1}, indicating the safe use of the samples up to at least 5 mg L^{-1}. However,** the synthesized Ag-NPs are found to be toxic against the targeted carcinoma cell at the concentrations starting from 10 mg/L indicating their anti-cancerous property.

Session (IVB): Theoretical and Computational Physics-II

IT-IVB: Fluctuation diamagnetism in Y123: implications on the origin of the normal state pseudogap

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This investigation deals with the temperature and hole content dependent fluctuation diamagnetism of hole-doped $YBa_2Cu_3O_{7-\delta}$ (Y123) high-T_c superconductors. Two different compositions of Y123 have been selected with in-plane hole contents (p): 0.161 (optimally doped) and 0.143 (underdoped). The fluctuation induced excess diamagnetic susceptibility, $\Delta\chi(T)$, has been analyzed using the mean-field Gaussian-Ginzburg–Landau (MFGGL) formalism with and without a total energy cut-off in the fluctuating modes. It has been found that inclusion of total energy cut-off describes the $\Delta\chi(T)$ data better. Furthermore, the normal state pseudogap (PG) itself induces an anomalous decrease in the magnetic susceptibility above T_c. By means of the study of $\Delta\chi(T)/T$ at different hole concentrations, we have explored the possible role of the PG on diamagnetic fluctuations. We have found that the MFGGL formalism is not able to reproduce the $\Delta\chi(T)/T$ features for the underdoped compound over a broad range of reduced temperature, ε [= $\ln(T/T_c)$]. The discrepancy becomes more prominent in the temperature range where the PG dominates the normal state magnetic susceptibility. The agreement between the MFGGL prediction and experimental $\Delta\chi(T)/T$ is better for the optimally doped compound with p = 0.161, where the effect of the PG is small. This notable difference implies that the PG induced downturn in the magnetic susceptibility is not related directly to the superconducting fluctuations. Moreover, it indicates that the electronic correlations giving rise to the PG and the Cooper pairing are independent to each other.

TCP-08: Electronic, Magnetic, and Optical Properties of the Heusler Compounds $NbMn_2$(Si, Ge) Using TB-mBJ Potential

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The self-consistent full potential linearized augmented plane wave approach within the density functional theory (DFT) as implemented in the WIEN2K code was used to examine the electronic and magnetic properties of the $NbMn_2$(Si, Ge) Heusler compounds. These alloys in the minority spin channel have metallic property while in the majority spin channel, they have band gap that confirms their semiconductor properties, according to spin-polarized calculations using Tran-Blaha modified Becke-Johnson (TB-mBJ) approximation. Also, optical properties like dielectric function, reflectivity, energy loss function, absorption coefficient and optical conductivity were estimated for $NbMn_2$(Si, Ge).

TCP-09: Structural, Electronic and Optical Properties of Sn Doped Cubic ZnS Solid Solution: First-Principles Study

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Using the full potential linearized augmented plane wave approach within the density functional theory (DFT), the structural, electronic and optical properties of $Zn_{1-x}Sn_xS$ (x = 25,

12.5 and 6.25 %) solid solutions in most stable cubic phase of ZnS are computed in this study. The bandgap values are calculated by using Tran-Blaha approach of modified Becke and Johnson local spin density approximation (TB-mBJ). For Sn doped with ZnS, the compounds are non-magnetic semiconductors with narrow bandgaps. The obtained results demonstrate that ZnS has a direct bandgap in nature, but Sn doped ZnS has an indirect bandgap. The density of states of $Zn_{1-x}Sn_xS$ solid solutions are influenced by the Zn-3p,3d, 4s, S-3p, 3d and Sn-4d, 5s, 5p states. The optical characteristics are estimated using the dielectric function spectra as well as other associated optical properties such as absorption coefficient, reflectivity, refractive index, extinction coefficient and conductivity. The investigation shows that he doped compounds might be a good choice for optoelectronic devices.

TCP-10: Influence of M Atomic Species on Physical Properties of MAX Phases M_2TlC (M= Ti, Zr, Hf): a DFT Calculations

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The physical properties of M_2TlC (M = Ti, Zr, Hf) MAX phases ternary carbides have been performed using density functional theory (DFT). The charge density mapping, Vickers hardness, dynamical stability, thermodynamics and optical properties of the phases have been investigated along with revisited the structural, elastic and electronic properties to judge the reliability of our calculations. The mechanical and dynamical stability of all compounds affirm by the calculated single crystal elastic constants and phonon dispersion curves. The values of Pugh ratio and Poisson's ratio exhibit the brittleness of the compounds concomitant with strong directional covalent bond with a mixture of ionic contribution. The metallic nature of the phases endorses by overlapping of conduction band and valence band at the Fermi level. The Vickers hardness indicates the studied materials have moderated hardness with the highest value of 2.87 GPa for Hf_2TlC compound. The optical properties such as dielectric functions, refractive index, photoconductivity, absorption coefficient, loss function and reflectivity are calculated and discussed in detail. It is noteworthy that all studied compounds are exhibited reflectivity above 40% up to 12.0 eV energy that is covered IR and visible region as well. Therefore, the compounds are potential candidate for the practical use as a coating material to reduce solar heating.

TCP-11: Ternary Scandium Based Antiperovskites Sc_3GaX (X=B, N): DFT Study

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The structural, mechanical, electronic, optical, thermodynamic and vibrational properties of the cubic inverse-perovskites Sc_3GaX (X=B, N) have been investigated by using first-principles ultrasoft pseudopotential method in the frame work of density functional theory (DFT). The results are in good agreement with available theoretical results which ensure the reliability of the present first-principles calculations. The optical and thermodynamic properties of Sc_3GaX (X = B, N) are calculated for the first time.
In the pressure range of 0 to 50 GPa, Sc_3GaN is found to be less compressible than Sc_3GaB. The results of several mechanical properties indicate that both Sc_3GaB and Sc_3GaN are mechanically stable and anisotropic. Also the compounds are brittle in nature at ambient pressure and transform from brittle to ductile above 10 GPa and 40 GPa for Sc_3GaB and Sc_3GaN, respectively. The analysis of band structure and density of states suggests that Sc_3GaX (X = B, N) have finite values of DOS at Fermi level which ensures their metallic nature. The density of states of each of these compounds is mainly dominated by Sc 3d orbitals at the Fermi level. Fermi surfaces show that Sc_3GaB has more metallic conductivity than that of Sc_3GaN. Both covalent and ionic bonding is evident from charge density distribution maps for both compounds. The bond overlap population analysis depicts that the covalent bond between Sc-B is stronger than that of Sc-N.
The investigation of the optical properties indicate that Sc_3GaB and Sc_3GaN may be used as good coating materials to avoid solar heating in the IR-visible-UV regions. The maximum absorption occurs in the visible and UV regions for the both compounds which indicates that the compounds are promising materials for absorbing radiation in these regions. The thermodynamic properties of Sc_3GaB and Sc_3GaN are also analyzed as a function of temperature and pressure using quasi-harmonic Debye model.
The calculated phonon dispersion curves indicate that both the compounds are dynamically stable and capable of thermal transport.

TCP-12: Band Gap Engineering of Cubic Halide $RbSrCl_3$ Perovskite Under Pressure: Insights from DFT

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Metal halide perovskites are non-toxic which offer a wide range of uses in low-cost photovoltaic and optoelectronic systems. In this report, density functional theory (DFT) is used to explore the influence of pressure (0 - 150 GPa) on $RbSrCl_3$ perovskite metal halide to investigate structural, electronic and optical characteristics. At 0 GPa, $RbSrCl_3$ was found to be an indirect wide-bandgap semiconductor. In the pressure range [30 to 150 GPa], the indirect band gap transformed to direct band gap which is suitable for optoelectronic devices. At applied pressures 30 GPa, band gap value increases due to shifting of Sr-4p states towards fermi level and Sr-3d states towards higher energies of conduction band, and above 30 GPa the band gap value is decreases. Higher absorption for $RbSrCl_3$ was found in the ultraviolet region under the influence of different pressures. As the pressure on the halide perovskite increased, absorption peak is shifted to higher energy range. The reflectivity, optical conductivity, extinction coefficient and loss function were significantly changed due to induced pressures.

TCP-13: An ab Initio Approach to Understand the Structural, Thermophysical, Electronic, and Optical Properties of Binary Silicide $SrSi_2$: A Double Weyl Semimetal

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A large number of hitherto unexplored elastic, thermophysical, acoustic, and optoelectronic properties of a double Weyl semimetal $SrSi_2$ have been investigated in this study. Density functional theory (DFT) based methodology has been employed. Analyses of computed elastic parameters reveal that $SrSi_2$ is a mechanically stable, ductile, moderately machinable, and relatively soft material. The compound is predicted to be dynamically stable and possesses significant metallic bonding. Study of thermophysical properties, namely, Debye temperature, Grüneisen parameter, acoustic parameters, melting temperature, heat capacity, thermal expansion coefficient, and dominant phonon mode is also indicative of soft nature of $SrSi_2$. The electronic band structure calculations without and with spin-orbit coupling disclose semimetallic character with clear Weyl nodes close to the Fermi level. The electronic dispersion is anisotropic characterized by nearly flat and linear regions within the Brillouin zone. Optical parameters at different photon energies are investigated. $SrSi_2$ shows excellent nonselective reflection spectrum over a wide range of energy encompassing the visible range implying that the compound under study has significant potential to be used as an efficient solar energy reflector. $SrSi_2$ absorbs ultraviolet light quite efficiently. The compound also possesses high refractive index in the low energy. All these optical features can be useful in optoelectronic device applications.

TCP-14: DFT Insights into the New Hf-Based Chalcogenide MAX Phase Hf_2SeC

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The physical characteristics of the novel chalcogenide MAX phase Hf_2SeC have been investigated using the DFT method. The obtained lattice constant and elastic constants (C_{ij}) are compared with previous results to check the consistency of our setting parameters during calculations. Moreover, the elastic properties such as elastic constants, moduli, anisotropy, and hardness are also compared with preexisting MAX phases of its kind. The checking of the dynamical and mechanical stability has been done based on the phonon dispersions and elastic constants. The reason for the higher hardness of Hf_2SeC compared to Hf_2SC is explained using the density of states (DOS). The brittleness of Hf_2SeC has been revealed using the Pugh ratio, Poisson's ratio, and Cauchy pressure. The electronic properties (band structure and charge density mapping) of Hf_2SeC disclosed its metallic nature and bonding behavior. The anisotropy in both electronic conductivity and mechanical properties are investigated. The temperature

and pressure dependence of volume, Grüneisen parameter (γ), Debye temperature (Θ_D), thermal expansion coefficient (TEC), and specific heat at constant volume (C_v) are explored. In addition, minimum thermal conductivity (K_{min}) and melting point (T_m) are studied to investigate its suitability for high-temperature applications.

TCP-15: Potentials for α+^{50,52,53}Cr, α+^{63,65}Cu, α+^{64,66,70}Zn and α+^{70,72}Ge Elastic Scattering at 25.0 MeV

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The present work reports the analyses of the elastic scattering of α-particles from ^{50,52,53}Cr, ^{63,65}Cu, ^{64,66,70}Zn, and ^{70,72}Ge at 25 MeV in terms of the modified single-folded (MSF) and non-monotonic (NM) potentials within the framework of the optical model (OM). The MSF potential is semi-microscopic in nature and generated from the single folding model of Abdullah *et al.* [*M. N. A. Abdullah et al., Eur. Phys. J. A**18**, 65 (2003)*]. In this model, the nucleons in the target nucleus exist primarily in α-like clusters and the rest of the time, in an unclustered nucleonic configuration. The repulsive part of the α-α potential and the α-nucleon potential have been found to be essential in describing the experimental α+^{50,52,53}Cr, α+^{63,65}Cu, α+^{64,66,70}Zn and α+^{70,72}Ge elastic scattering data. The derived MSF potentials are deep with volume integrals for the real part around –350 MeV.fm^3. The empirically adjusted volume and surface imaginary potentials are used in conjunction with the real part of the NM potential to reproduce the experimental elastic scattering data. Both the MSF and NM potentials have been found satisfactory in reproducing the cross sections at 25 MeV for the targets studied in this study. However, the volume integral per nucleon pair for the real part of the NM potential for three isotopes namely, ^{52,53}Cr and ^{63}Cu has been found unexpectedly high for the NM potential. The variation of volume integrals with target mass number has also been studied.

TCP-16: Elastic, electronic, bonding, optoelectronic and thermophysical properties of $SnTaS_2$: comprehensive insights from ab-initio calculations

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$SnTaS_2$ is a recently discovered layered semimetal exhibiting type-II low transition temperature superconductivity. In this study, we report structural, elastic, bonding, optoelectronic and thermo-physical properties of this layered superconductor by using density functional theory (DFT) based CASTEP (CAmbridge Serial Total Energy Package) code. Elastic constants, bonding properties, optical properties, different thermophysical parameters and vibrational properties including phonon dispersion and phonon density of states are explored for the first time. Elastic anisotropy factors show that $SnTaS_2$ possesses strong anisotropy. The metallic behavior of $SnTaS_2$ is predicted by the electronic band structure and electronic energy density

of states diagram. Central force and metallic bonding dominate in the material under study. $SnTaS_2$ is fairly machinable and its theoretical hardness is low. This compound is ductile and soft. The Fermi surface consists of both electron-like and hole-like sheets with varying degree of dispersion. The phonon dispersion spectra confirm that the material is dynamically stable. The Debye temperature and thermal conductivity of $SnTaS_2$ are low. The electron-phonon coupling constant has been calculated. Both, absorption coefficient and optical conductivity also confirm the metallic nature of the compound. The real part of refractive index has high value from 0 to ~ 5 eV covering infrared to visible region. All the optical parameters of $SnTaS_2$ show moderate anisotropy with respect to the polarization direction of the electric field.

Session (VA): Reactor and Nuclear Physics

RNP-01: Sodium-cooled Long-life Fast Core Burnup Study with Serpent

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In this study, based on Breeder and Burn (B&B) core concept a long-life sodium-cooled fast core model has been developed using the universal Monte Carlo based computer code Serpent. The core concept is achieved by optimizing radial core zoning based on natural and enriched uranium. The long-life core has a capacity of 650 MW_{th} and a power density of 27 kW/kg. The developed core has the ability of maintaining criticality for more than 26 years without fuel reloading/shuffling. The initial excess reactivity of the core was found very low. Interestingly, the core presents two neutron balance points during cycle burnup. The long-life core concept is expected to provide a number of benefits, including reductions in capital and operational costs and low proliferation risk. In the future, it is expected that a safety analysis, advanced core cooling methods and a comparative cost analysis will be developed.

RNP-02: Particle Sedimentation and Bed Formation Behavior in Severe Accident of Nuclear Reactors

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Particle beds sedimentation behavior analysis is decisive in the assessment of severe nuclear accidents, in particular core-disruptive accidents (CDAs) that could occur in nuclear reactor, particularly sodium-cooled fast reactors (SFRs). After occurring a CDA, degraded core material may form debris beds on core-support structure or in the lower inlet plenum of the reactor vessel. Examination the characteristics of debris bed on a core catcher plate or a particle tray is significant concerning recriticality and cooling considerations to ensure the reactor main vessel safety in CDA. Several investigations were performed by particle mixtures as simulant debris from a nozzle into a quiescent water pool in isothermal condition at room temperature. Particles with different properties are employed to study the effect of key experimental

parameters on bed mound shape and height. Some crucial factors are identified as the key issues for particle bed formation that eventually essential in the design of efficient core catcher. In particular, particle shape is critical in the particle bed sedimentation process. Correlation model was developed for the properties of particle beds. This basic experimental database of particle sedimentation phenomena has a worth to be established as the baseline to validate and progress the pertinent models and approaches of reactor safety analysis codes. This study will have the potential contribution to the design of efficient core catcher for nuclear power reactors.

RNP -03: Internal Morphology Study of Madupur Clay Based Cox's Bazar Beach Sand and Minerals Incorporated Indigenous Radiation Shielding Composites by Thermal Neutron Imaging Using TRIGA Mark-II Research Reactor

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An attempt has been taken to study the internal morphology and radiation attenuation characterization of the fabricated indigenous shielding composites by the inverted Neutron Imaging (NI) using the high penetrating behavior thermal neutron at 3MW TRIGA Mark-II research reactor. In this perspective, several locally developed composites were fabricated using Madupur clay as base matrix which was reinforced with the filler of Cox's Bazar beach sand (RBS) and beach minerals such as magnetite, Ilmenite (M-I) and inland sand (IS) which were compares with ordinary concrete (OC). The neutron imaging of the fabricated composites was illustrated by implementing Image J software for the stipulated region of interests (ROIs). The MI & RBS composites show uniform and deep dark signals in neutron image (inverted) that indicates their homogeneity and high density along with the enhanced attenuation behavior. In contrast with that, the ordinary concrete has a mixture of deep dark and bright neutron image (inverted) with heterogeneous morphological structure. The chemical bonding of the cement ingredient makes the composite a moderate attenuation. The IS composite shows comparatively lower dark image than those of MI & RBS composites, which causes its lowest attenuation behavior among the studied composite materials. The ordinary concrete shows the fluctuating curves of gray values for various pixels (distance) at the stipulated ROIs which confirm the heterogeneous morphology of the ordinary concrete. The RBS and MI composites have shown the steady curves of gray values for the stipulated pixels at various ROIs which confirm the homogeneous morphology and fine grained structure of the prospective composites. The IS composite has shown the almost steady curves of gray values for the stipulated pixels at various ROIs which indicates the nearly homogeneous morphology. The morphology study reveals that the finely structured clay based MI & RBS composites have lower gray values than that of ordinary concretes, which indicates the lower transmission and higher attenuation of the ionizing radiation.

RNP -04: Radiological Dose Assessment Using RASCAL 4.3 Code for Postulated Severe Accidental Conditionsof VVER-1200 Type Reactor

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For normal operating conditions, nuclear reactors do not release an adequate amount of radioactivity to the environment. But, in case of a severe accident, a substantial amount of radioactive materials can be produced and released into the surrounding environment. It must be dealt with a regulatory prerequisite because of its threat to the human being. In the present study we studied the radiological safety and emergency response of the VVER-1200 type nuclear power plant using the RASCAL 4.3 code for INES levels 5, 6, and 7 reactor accidents due to Station Blackout (SBO) concomitant with Loss of Coolant Accident (LOCA) for both dry and rainy seasons. The simulation was performed using Gaussian Plume Model and Lagrangian Gaussian Plume Model, respectively. In the accident generation processes, technical parameters of the VVER-1200 type reactor and local meteorological data were used. The meteorological data for both dry and rainy seasons were considered for the Rooppur Nuclear Power Plant (RNPP) site of Bangladesh. It is found that radioactivity and doses were significantly higher in the accidental cases than in normal conditions. The amount of total radioactivities of radiological equivalence to I-131 that released to the atmosphere for INES levels 5, 6, and 7 nuclear reactor accidents were 4011.6 TBq, 25110 TBq, and 129650 TBq, respectively. Radiological doses such as TEDE, Thyroid CDE, Inhalation CEDE were evaluated for 40 km radial distance from the reactor site. The total effective dose for RASCAL code predicts the higher dose value during the rainy season compared to the dry season. In the rainy seasons, TEDE was very high about several ten times of permissible limit within 16 km radial distance. Therefore, immediate radiological protective measures are required to be implemented based on the emergency response plan of the local regulatory authority.

RNP -05: Coupled Neutronics and Thermal-Hydraulics Calculations for VVER-1000 Pin Cell Benchmark

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Multiphysics coupling is becoming a new paradigm to improve the accuracy of the calculations characterizing nuclear systems. The purpose of this work was to develop a coupled neutron transport and thermo-hydraulics external iterative calculation scheme and to perform preliminary verification of the calculations. The developed scheme obtains results of the coupled solutions with Serpent/COBRA-EN coupled codes. A verification study was done

against the benchmark based on the standard pin cell of VVER-1000 reactor with the modern generation TVS-2M type fuel assemblies.

RNP -06: Extension of the Length of Operation Cycle of the TRIGA MARK II by Compacting Reactor Core with Fuels

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Bangladesh Atomic Energy Commission has been operating the TRIGA research reactor since 1986, for training, research and isotope production. However, it has postponed the isotope production in 2008 due to some technical issues. Having operated for 800 MWD, BAEC has limited the utilization of the aged reactor due to scarcity of TRIGA fuel in international market. Hence, the possibility of extension of the operation cycle life of the TRIGA core by compacting the inner region with fuels replacing the graphite elements has been investigated in the present study. It is shown from the simulation that although the modification of core leads no significant changes in axial power peaking factor, the radial power peaking factor has been increased. Also the excess reactivity of the core has been found to be significantly higher, demonstrating the provision of the extension of reactor life. The performance of the core, i.e, the ratio of the thermal to high energy neutron flux has been reduced significantly. However, the safety has been quantified by the departure from nucleate boiling ratio still now by a large margin with its required value. The present study will be a good tool for future analysis with comprehensive thermal hydraulic safety calculation for the present core configuration as well as for the in-core fuel management of the present BAEC TRIGA core.

RNP -07: Numerical Studies of Plasma Pinch Properties in a Mega Joule Plasma Focus Device Using Lee Model Code

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X-ray emission (bremsstrahlung radiation, line radiation and radiative recombination) in mega-joule plasma focus (PF1000) device are studied using Lee model code (version: RADPFV5.15) for nitrogen (N_2), oxygen (O_2) and argon (Ar) gases with pressure in the range of 0.05 Torr to 4.5 Torr. Ion density, plasma velocity, pinch temperature and peak current are also calculated for these gases. In this study, the computed maximum discharge currents are: 2262.4 kA at 4.5 Torr N_2, 2264.8 kA at 4.00 Torr O_2 and 2255 kA at 3.00 Torr Ar. The optimum pressure point for each type of X-ray of the used gases are found separately where the line radiation is predominant. The optimum pressure of N_2, O_2 and Ar gases are found to be for bremsstrahlung radiation 0.827 Torr, 0.567 Torr and 0.127 Torr whilst for radiative recombination 0.866 Torr, 0.567 Torr and 0.127 Torr, respectively. At optimum pressure, the computed line radiations of N_2 at 1 Torr, O_2 at 0.575 Torr and Ar at 0.127 Torr are 3872 J (91.3 % of total N_2 XRs), 6232

J (84.48 % of total O_2 XRs) and 29576 J (97.27 % of total XRs), respectively. In this study, we obtain the ion densities for N_2 12.23×10^{23} m^{-3} whilst for O_2 12.21×10^{23} m^{-3} and 76.06×10^{23} m^{-3} for Ar at their corresponding optimum pressure.

RNP-08: On Fuel Loading Strategy of BAEC TRIGA Research Reactor (BTRR)

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The TRIGA Mark II research reactor of Bangladesh Atomic Energy Commission (BAEC) has been operating since 1986 without any reshuffling or reloading yet. Optimum fuel burnup strategy has been investigated for the present BTRR core, where three out-to-in loading schemes have been inspected in terms of core life extension, burnup economy and safety. In considering different schemes of fuel loading, optimization has been searched only varying the number of fuels discharged and loaded. Cost function has been defined and evaluated based on the calculated core life and fuel load and discharge. The optimum loading scheme has been identified for the TRIGA core, the outside-to-inside fuel loading with tens fuels for each cycle starting with five fuels for the first reload. The discharge burnup has been found ranging from 17% to 24% of U235 per fuel element for full power operation and optimum extension of core operating life is 100 MWD for each loading cycle. This study will contribute to the in-core fuel management of TRIGA reactor.

RNP-09: Supply Chain system for Sustainable Nuclear Power Plant in Bangladesh

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Bangladesh, a densely populated energy starving nation, and a member state of IAEA, has decided to go for its nuclear power programme, considering the forecasts on energy demand, to ensure energy reliability and security and build a sustainable energy future. Government of Bangladesh is implementing its first nuclear power plant project entitled, “Rooppur Nuclear Power Plant (Rooppur NPP) Project”. The introduction of nuclear power into a country is accompanied by the need to build appropriate nuclear infrastructure for construction and operation of NPP. Based on the experience gained from the preliminary activities on the Rooppur NPP project and lessons learnt from the implementation experiences of the first NPP by other developing nations, Bangladesh has recognized the form of cooperation of vendor country in the development of infrastructure and construction of Rooppur NPP and decided to build the first NPP of the country under a bilateral co-operation agreement. The Rooppur NPP

project is being implemented with the technical and financial assistance of Russian Federation under an Inter-Governmental Agreement (IGA) between the governments of Bangladesh and Russian Federation. JSC Atomstroyexport (ASE), the engineering division of ROSATOM State Corporation of the Russian Federation, has been entrusted with the responsibility of construction of Rooppur NPP as the General Contractor. Bangladesh Atomic Energy Commission (BAEC) is the owner of Rooppur NPP Project. The scope of the IGA included design, construction, installation, start up and commissioning and warranty operation of the Rooppur NPP, financing, fuel supply during the entire operational period of the power units, take-back of spent fuel to Russian Federation, education and training of Rooppur NPP personnel, cooperation for operation and maintenance of the plant, management of radioactive waste and decommissioning of the plant and other services. Comparing and referring to the general tiers for the nuclear supply chain management (NSCM), ROSATOM is performing the role of NPP technology provider and system integrator, while JSC ASE is responsible for managing the pre-construction works and main phase of construction for the NPP project, and also it is solely responsible for the supply of equipment (both Long Term Manufacturing Equipment-LTME and Non-LTME). Considering the global market trend, market analysis and based on supply capacity for NPP components, JSC ASE is one of the pioneer vendors. For Rooppur NPP Project, JSC ASE is ensuring three industrial challenges, economic, capability and quality challenges, for maintaining the international supply chain of the project. The project management team of JSC ASE, will ensure inspections and designer's supervision, and coordination of the quality control activities with sub-contractors, with participation of the project management team of BAEC. As the project is currently in its construction phase, with the associated project management activities underway in full swing, it can be said that as a newcomer country, Bangladesh, in cooperation with its vendor, is successfully overcoming the many challenges associated with the efficient nuclear supply chain management for the Rooppur NPP and learning important lessons in the process, which would be valuable to other newcomer countries in the near future.

RNP-10: Application of NAA for elemental analysis of sediments from the Padma river adjacent to Rooppur Nuclear Power Plant area

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Sediment samples from the Padma river adjacent to the Rooppur Nuclear Power Plant area were collected and investigated to determine and evaluate the elemental concentrations and contamination status of the river. A total of 20 surface sediment (0-5 cm) samples were collected and concentration of 25 major and trace elements (Ti, V, Al, Mn, Ca, Na, Dy, Sm, U, Lu, Yb, La, As, Sb, Eu, Hf, Ce, Ta, Tb, Th, Cr, Cs, Sc, Fe and Co) were determined using research reactor-based neutron activation analysis (NAA) technique. The activities of the product nuclides were counted using a high resolution (FWHM=1.92 at 1332 keV of the ^{60}Co source) gamma-ray spectrometry system at the neutron activation analysis (NAA) laboratory

of Bangladesh Atomic Energy Commission. The quality of the analyses was evaluated by analyzing certified reference materials IAEA-SL-1 (lake sediment), IAEA-Soil-7 and NIST-1633b. Determined concentration values of the studied elements were compared with the available international guideline values to determine their safe limits. Moreover, different pollution indices like enrichment factor (EF), geo-accumulation index (I_{geo}) and contamination severity index (CSI) were calculated to determine contamination levels of the elements. Multivariate statistical analyses were applied to reveal the origin of the elements. The present study recommended that proper monitoring of the attribution of the toxic elements should be done for the betterment of the aquatic life of the river.

Session (VB): Thin Film

IT-VB: Materials for Stable Perovskite Solar Cells: Advances, Challenges and Opportunities

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Organic-inorganic hybrid perovskite solar cells (PSCs) have recently gained a lot of attention as promising photovoltaic technology to the academic and industrial community due to their lightweight, flexible and low-cost manufacturing processes. The most advantages of using perovskite materials possess some interesting optoelectronic properties such as tunable bandgap, high absorption coefficient, long diffusion lengths (>1 μm), easy and low-cost solution processability together with cheap and available raw materials. Typically, a PSC is a sandwich structure having a perovskite absorber layer (e.g. $MAPbX_3$; MA= $CH_3NH_3^+$ and FA= $CH_3(NH_2)_2^+$, X= Cl^-, Br^-, I^-, BF_4^-, PF_6^-, SCN^-) sandwiched between the electron transport layer (ETL) (e.g. TiO_2, ZnO, C_{60}-derivatives) and the hole transport layer (HTL) (e.g.spiro-OMeTAD, PEDOT: PSS, NiOx) with front and back contact electrodes. Light passing through the transparent electrode of a PSC onto the photosensitive perovskite layer generates electron-hole (e^-/h^+) pairs. The charged particles separate and migrate through the ETLs and HTLs to their respective metal electrodes, thereby generating an electric current. Despite the current progress of PSCs, many issues remain to be resolved for further progress in this area of research, such as reproducibility, water and ambient moisture instability, carrier recombination process, interface defects, oxygen/moisture sensitivities of the electron/hole transport layer, low charge carrier mobility, poor crystallinity and solubility, efficient front contact, expensive counter-electrode (e.g. Au), cost-effectiveness etc., which restrict the commercial production opportunity. Therefore, new materials and strategies have been designed and screened to make the best heterojunction using suitable ETLs or stable inorganic HTL, with minimized interface recombination and bulk defects for enhancing PSCs stability and efficiency in large areas.[1-3]

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TF-01: Fabrication of Cu_2ZnSnS_4(CZTS) Thin Films by Ultrasonic Spray Pyrolysis at a Low Substrate Temperature and Effect of Tin Concentration on the Characteristics of the CZTS Thin Films

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In this paper, Cu_2ZnSnS_4 (CZTS) thin films fabricated on glass substrates using spray pyrolysis method with different concentration of Sn content were studied. To minimize the formation of secondary phases, all the CZTS thin films were prepared at substrate temperature 200°C. Here we show how the variation in Sn content concentration influence the optical and structural properties of the CZTS thin films. The XRD patterns reveal that the concentration of Sn content has to be optimized to minimize the formation of secondary phases at fixed substrate temperature. In turn, band gap of the CZTS this films are highly influenced by formation of secondary phases. We have found that the films prepared from the precursor solution with 1.8mM Sn content concentration have the best crystal structure and an optical band gap of 1.55eV. The CZTS thin films also have good carrier concentration ranging from $4.2x10^{19}$ cm^{-3} to $22.9x10^{20}$ cm^{-3}.

TF-02: Antimicrobial Effect of GO@CuO Nanostructured Thin Film Coated Leather with Enhanced Durability Against Abrasion

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Leather has been chosen as a flexible material for producing comfortable shoes because of its breathability and softness nature. But longtime intimate contact between leather and foot skin produces an environment favorable for bacterial growth which can lead to foot infection. This foot infection can be life threatening for patients with diabetic foot. In this study, a nanocomposite coating was developed and applied onto the leather surface via layer-by-layer assembly of chitosan and GO@CuO nanocomposite thin film. Then chemical crosslinking was used to immobilize the material on leather. Firstly, the chitosan layer then, GO@CuO nanocomposite film was applied on the leather. The characterization of these materials and treated leather was performed by FTIR, XRD, UV spectroscopy, SEM, TGA. Leather coated with cross linked CS/GO@CuO film showed efficient antimicrobial activities against Escherichia coli (E. coli) and Staphylococcus aureus (S. aureus). These results attributed to the synergistic effect of contact-killing of CS layer, Cu^{2+} ions release and bacterial killing of GO@CuO layer. So, Chitosan and GO@CuO can be an environment friendly biocide. Furthermore, the stability of the thin film coating on leather surface was investigated, and the results revealed that the cross-linking could enhance the durably antibacterial activities of leather against laundering and mechanical abrasion. The study suggested that CS/ GO@CuO thin film coated leather is a promising candidate for producing hygienic and durable footwear.

TF-03: Investigation of Structural, Optical and Electrical Properties of Calcium Substituted Barium Titanate Thin Films for Various Optoelectronic Applications

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Thin films of $Ba_{1-x}Ca_xTiO_3$ with various calcium (Ca) contents (x = 0, 2, 4, 6, and 8 at%) were successfully synthesized onto the glass substrate by a thermal spray pyrolysis technique. Field emission scanning electron microscopy images revealed that the average grain size varies from 1.38 to 4.95 μm. The presence of all the elements was confirmed by energy dispersive X-ray analysis. The X-ray diffraction analysis confirmed the formation of the hexagonal phase of as-deposited samples. The crystallite sizes were found to reduce from 189 to 116 nm as a result of Ca doping. Atomic force microscopy indicated surface roughness varies from 86 to 187 nm. The 2 at% Ca doped thin films exhibited transparency of about 47%. From the UV-visible spectra, an increment of optical conductivity is calculated from 2.9 to 7.3 s^{-1}. The optical band gap varies from 3.90 to 3.80 eV with the increase of Ca substitution. The electrical resistivity of the films decreased from 11.95×10^3 to 7.54×10^3 Ωm with increasing Ca content. Nanostructured thin films with uniform surfaces and well-distributed grains are grown in the present research. The results obtained from $Ba_{1-x}Ca_xTiO_3$ thin films could be useful for various optoelectronic applications.

TF-04: Synthesis and Characterization of $BaTiO_3$ Thin Films from Ball-Milled derived Nanopowder and Precursor Solution by Spin Coating

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Barium titanate ($BaTiO_3$) is a ferroelectric perovskite material with unique dielectric properties. It has been widely utilized in the fabrication of inorganic coatings or thin films, capacitors, sensors, or the production of devices for energy storage and conversion. In this study, two synthesis routes: One ball-milled derived $BaTiO_3$ nanopowder dispersed in Polyethylene Glycol and another from precursor solution by the sol-gel method were used separately to fabricate $BaTiO_3$ thin films on steel, quartz, and soda-lime glass (SLG) substrates by spin coating method. Barium acetate, Titanium Oxide, Acetic acid, Polyethylene Glycol (PEG), Potassium Hydroxide (KOH) were used in the sol-gel process. Some of the pristine thin films were also subjected to air-annealed at 250 ºC for one hour. Pristine and annealed thin films from both synthesis routes were characterized by UV-Vis-NIR Spectroscopy, Contact angle goniometer, Raman Spectroscopy, and Photo Luminescence (PL) spectroscopy - all carried out at room temperature. The optical band gap estimated from UV-Vis-NIR diffuse reflection data and PL was found to be in the range of 3.10 eV - 3.28 eV. Both approaches effectively produced high-quality thin films with homogeneous microstructure and thickness. The broad peaks in Raman spectra showed the polycrystalline character of the pristine $BaTiO_3$ thin films, and those peaks were seen to be narrowed when the annealing temperature was raised further. Our studies showed that even annealing at moderate temperatures increased the crystallinity and optical properties of $BaTiO_3$ thin films, making it a suitable, cost-effective, and environmentally friendly material for low-thermal budget energy storage devices. A parallel plate capacitive configuration of Graphene/$BaTiO_3$/Graphene based device is currently under investigation and the outcome will be presented at this conference.

TF-05: Copper Nano-particle Doped PEDOT: PSS Assisted to Enhance the Hole Transport in Thin Film Perovskite Solar Cells

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Inverted perovskite solar cells have involved a significant excessive contract of commitment due to its high power conversion efficiency and Poly (3,4-ethylenedioxythiophene):poly (styrene sulfonate) (PEDOT:PSS) acting an important role in the device performance as hole extraction layer (HTL) on thin film. In this study is to develop a polymer based thin film, which is being doped with copper nanoparticles (Cu NPs) in PEDOT:PSS. The The thin film is called Cu-PEDOT:PSS, which has already gained special attention because of its wonderful conductivity, sensitivity, accuracy and stability. The thin film deposited via spin coating method at ambient condition and subsequently it annealed at 60 ºC temperature for 2h. The

thin film structural characteristics study using XRD that reveal the presencyof pure Cu nanoparticle. Surface morphology carried out via SEM analysis and find that the Cu nanoparticles are homogeneously attributed and EDAX conform to the chemical composition of the element. UV-VIS spectroscopy is used for optical property measurement and finds the maximum absorption at 390 nm. FTIR spectra contain Cu and PEDOT bond estimation peaks for the hydroxy1 bonds, which ensure Cu-PEDOT bonding. Electrical measurement of Cu-doped PEDOT:PSS thin films indicates improved electrical conductivity without decreasing optical transmittance.

TF-06: Comparative Studies on the Properties of Nanoparticle and Precursor Solution Derived Wide Bandgap SnO_2 Thin Films Grown by Spin Coating

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Highly transparent and conductive oxide (TCO) thin films are extensively used materials, especially in solar cells, due to their conducive electro-optical properties. TCO with wide bandgap energy (E_g >3.4 eV) such as tin (IV) dioxide (SnO_2) thin films have prominent interest in transparent conducting electrodes for displays, n-type transport layer for high efficiency perovskite solar cells, photodiodes etc. In this study, we have synthesized SnO_2 thin films by spin coating both from SnO_2 nanoparticle sols (NP-sols) and precursor $SnCl_2.2H_2O$ sols (PC-sols) dispersed in butanol and ethanol respectively. The prepared sols were spin coated on UV-Ozone treated quartz substrates in two steps (500 rpm, 5 sec and 2000 rpm 25 sec). The prepared film was soft baked at about 100 ^oC for 10 min. This process was repeated five times to get a pristine thin film containing five layers. Then the pristine thin films were air-annealed at 250 ^oC for 2 h. The same processing conditions were employed for both NP-sols and PC-sols derived thin films. The room temperature Raman spectra analysis was carried out to identify the phonon modes and compare the synthesized samples. The electrical resistivities of annealed thin films were carried out by a four-point-collinear probe using current reversal technique and found in the range of ~200 - 1500 Ω.cm. UV-VIs-NIR Transmission data revealed that samples with the average thickness ~350 ± 35 nm showed maximum (86-92) % and (88-96) % transmission in the visible range for pristine and annealed films respectively. The optical bandgap of pristine and annealed films on quartz substrates was found in the range of 3.55-4.25 eV. Interestingly the bandgap value of the pristine NP-SnO_2 films were found to be increased whereas that for the PC-SnO_2 films were seen to be decreased some extent after annealing. The effect of bandgap matched UV-exposure on the thin films was also studied by measuring the contact angles with De-Ionized (DI) water to investigate the surface nature as well as the hydrophilicity of both groups of SnO_2 thin films.

TF-07: Dye Sensitized Solar Cells Based on Zno Thin Films Deposited by Ultrasonic Spray Pyrolysis

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Synthesis methods, substrate temperature, shape and size of the crystallite size, thickness of the photoanodes, etc. are very crucial parameters for the power conversion efficiency of dye sensitized solar cells (DSSCs). In this work, ZnO thin films having different thickness (10, 15, 20, 25 and 30 μm) have been synthesized by ultrasonic spray pyrolysis method on ITO coated glass substrate at substrate temperature 350°C. These films have been characterized by X-ray diffraction (XRD), energy dispersive X-ray (EDX), Fourier transform infrared (FTIR) and UV-visible spectroscopy. The prepared ZnO thin films have been used as the photoelectrodes in the DSSCs. To investigate the effects of the film thickness and dye adsorption time systematically, dye sensitization was achieved by immersing the films having different thickness in a 0.5 mM solution of N719 dissolved in Ethanol for different adsorption time (varied from 0.5 hour to 10 hours). Effects of the dye loading time on the photoelectrodes have been studied by measuring the absorbance using a UV-visible spectroscopy. Furthermore, the dye loaded ZnO photoelectrodes and Pt coated counter electrode were sealed together and the inner spaced was filled with a mixer of Iodine , ethylene glycol & potassium iodide (KI) solution which completed the fabrication of the DSSCs. Photovoltaic studies on these fabricated DSSCs revealed that different ZnO film thickness require different dye adsorption times for optimal cell performance. Therefore, this work suggests that these two fabrication factors: film thickness and dye adsorption times must be optimized simultaneously to obtain efficient ZnO based DSSCs.

TF-08: Coffee Ring Free CAAC ZnO Thin Film by Spray Pyrolysis for High Performance Thin Film Transistor

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Metal-Oxide-Thin-Film-Transistors (MOTFT) fabricated via spray pyrolysis (SP) are getting more interest due to its modest process and flexibility. A bottleneck problem of SP is to develop a highly dense uniform film without coffee ring. Coffee rings are formed due to the direct impingement of the droplet on preheated hot substrate and materials are segregated at the boundary of ring. As a result, there will be a lot of scattering on electron path by irregular structured film. Here we studied the influence of the addition of the ammonium acetate (AA) in solution of oxide precursor on the film and performance of spray-coated ZnO TFTs. AA in ZnO precursor solution act as a fuel to enhance the solubility of the solution and improves the quality of the film by reducing the defects. After addition of AA in ZnO solution, the ZnO film

deposited at 350 ^{o}C by spray pyrolysis showing coffee ring/bubbles free with higher mass density and uniform grain orientation. We also showed the mechanism to make coffee-ring free ZnO film formation by XRD, SEM, NMR, and XRR analysis. Additionally, the remarkable improvement of ZnO thin film transistor is found with the addition of AA and performance of device in terms of linear mobility (μ_{Lin}) increases to 41.53 from 5.12 $cm^2V^{-1}s^{-1}$, subthreshold swing (SS) decreases to 162 from 340 mV/dec and current on/off (I_{ON}/I_{OFF}) ratio increases from ~$1x10^5$ to $1x10^8$. Also, the excellent stability of ZnO TFTs with a negligible threshold voltage (V_{TH}) shift of ~ 0.1 V under positive or negative gate bias-stress. Based on our results, AA in ZnO solution can be a promising approach for any spray-pyrolyzed film and ZnO TFTs with high performance aimed for large area display having low manufacturing cost.

Session (VIA): Materials Science -II

IT-VIA: Emergence of Dirac Materials in Carbon Family

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The physics of two dimensional (2D) materials is always intriguing in their own right. Dirac materials are a class of complex and functional nanomaterials offering great potential in the development of new electronic components. In this talk, we would like to present some theoretical calculations of electronic properties of graphene, S-graphene phagraphene, and 8-16-4 Graphyne systems. A tight binding (TB) model along with density functional theory (DFT) will be used to unravel the characteristic features of Dirac points in these systems. Further, we will discuss an analytical scheme to address the emergence and robustness of Dirac fermions in phagraphene network. All these theoretical results in non-honeycomb structure may shed light on device fabrication in nano opto-electronic technology and materials characterization techniques in 2d carbon allotropes.

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MS-10: Investigation Through Structural, Electrical, and Magnetic Properties of the Al^{3+} Ions Doped Ni-Zn-Co Nano-Spinel Ferrites

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Aluminum (Al^{3+}) ions substituted nickel-zinc-cobalt (Ni-Zn-Co) nano ferrites investigation is still at the infancy stage, although the structural, electrical, and magnetic properties have been widely explored. Single-phase cubic nano-spinel ferrites of $Ni_{0.4}Zn_{0.35}Co_{0.25}Fe_{2-x}Al_xO_4$ ($0 \leq x \leq 0.12$) with space group Fd3m confirmed by the Rietveld refinement X-ray diffraction (XRD) data. Lattice constants exhibited a declining trend with compositions x. The average particle size was found to range from 29 nm to 25 nm. Selected area electron diffraction (SAED) patterns were indexed according to space group Fd3m, indicating nanoparticles are well-crystallized. Samples' modes of vibrations swung between red-shift and blue shifts detected in the Raman spectra. The saturation magnetizations (M_s) were in the range of 59.85- 86.39 emu/g. Frequency-dependent dielectric constants ($\varepsilon^{/}$) and ac resistivity (ρ) measurement recommended that samples were highly resistive. These resistive nano ferrites with high saturation magnetizations may function effectively for multifaceted electronic devices.

MS-11: Structural and Magnetic Properties of Dy Substituted Mg-Cu-Zn Ferrites

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The structural and magnetic properties of Dy substituted Mg-Cu-Zn ferrites having the formula $Mg_{0.40}Cu_{0.20}Zn_{0.4}Dy_xFe_{2-x}O_4$ (where x = 0.0, 0.01, 0.02, and 0.03) are reported in this study. The samples were synthesized using the standard double sintering method. The structural property of the prepared samples is observed with the X-ray diffraction (XRD) method. It confirmed that the samples were single phase cubic spinel structure for $x \leq 0.02$. However, the cubic spinel phase coexists with the amount of $DyFeO_3$ phase for $x \geq 0.03$, which could be attributed to the larger ionic radius of Dy^{3+} compared to Fe^{3+} . XRD patterns are used to find the lattice constant, crystal density and porosity of the prepared samples. The surface morphology was analyzed through field emission scanning electron microscopy (FESEM) and

the grain size was observed with the linear intercept method. The magnetic properties such as the saturation magnetization, coercive field, remanent magnetization and experimental magnetic moment have been observed for all the samples. The saturation magnetization was to found larger for x=0.02, which could be attributed the stronger super-exchange interaction between tetrahedral and octahedral sites in the spinel ferrites. The lower value of coercivity was to found for all the samples, which indicates the magnetic softness property of the materials.

MS-12: Ab Initio Study of Structural and Physical Properties of Cd-Based Chloroperovskite $XCdCl_3$ (X=Ag, K) Structures

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The quantum mechanical simulation tool CASTEP has been used to conduct an ab initio evaluation of the structural, elastic, mechanical, and thermal characteristics of $AgCdCl_3$ and $KCdCl_3$ cubic perovskite compounds. Distinct energy functionals have run for the different characteristics using the Density Functional Theory framework. The GGA-PBE and LDA-CAPZ functionals have been used to examine structural characteristics, while PBEsol has been used to explore elastic and thermal properties. Lattice parameters (a), ground state energy (E), bulk modulus (B) and formation energy (E_F) are among the structural attributes. All of the computational results are in good accord with the existing experimental data, indicating that our work is reliable. These cubic structures' computed elastic constants C_{ij} (C_{11}, C_{12}, C_{44}), meet mechanical stability requirements. Using these measured elastic stiffness constants (Cij), the bulk modulus (B), shear modulus (G), Young modulus (Y) and Poisons ratio (n) have been determined using the Voigt, Reuss, and Hill approximation. The Pug's ratio, Debye temperature, average sound speed through the crystal and melting temperature of the crystals are also tested. $AgCdCl_3$ and $KCdCl_3$ compounds have bulk moduli of 29.54 GPa and 25.46 GPa respectively, indicating that they are soft materials. $AgCdCl_3$ and $KCdCl_3$ have Pug's ratios (B/G) of 2.13 and 2.96, respectively, which cross the critical limit and show ductility in nature. The Poisson's ratio values ($AgCdCl_3$-0.35 and $KCdCl_3$-0.29) showed that they might be used within the steel design limit. Their high-temperature application was indicated by a higher-order melting temperature (T_m > 800K). At room temperature (298 K), the thermodynamical investigations have been carried out by calculating Gibbs free energy (G), Helmholtz free energy (F), Entropy (S), and Specific heat (C_v). Surprisingly, both $AgCdCl_3$ and $KCdCl_3$ have a positive G value, but only $AgCdCl_3$ has a positive F value. When compared to $AgCdCl_3$ (S=59.713 J/mol/K and C_v=43.55 J/mol/K), $KCdCl_3$ (S=184.019 J/mol/K and C_v=91.201 J/mol/K) has greater entropy and specific heat at ambient temperature. This computational investigation of the physical and thermodynamic features of $AgCdCl_3$ and $KCdCl_3$ perovskite structures might serve as a reference for their experimental characterization.

MS-13: Influence of Reaction Temperatures on the Particle Size of V_2O_5 Synthesized by Facile Hydrothermal Technique and Their Auspicious Photocatalytic Performance in Dye Degradation

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The vanadium pentoxide (V_2O_5) has been successfully synthesized at different reaction temperatures 100°C - 200°C (in the step of 20 °C) using an environment-friendly facile hydrothermal method. The stable orthorhombic crystal structure and surface morphology of V_2O_5 have also been confirmed by XRD analysis, SEM and TEM, respectively. It is revealed that the particle size increases with the increasing of reaction temperature. The functional groups and the single-crystal nature of V_2O_5 are established by the FTIR and SEAED images of TEM that are consistence with the measured XRD analysis. The optical bandgap of the samples has been estimated using UV-vis diffuse reflectance spectra (UV-DRS) and found in the range of 2.08 to 2.15 eV. The photocatalytic degradation activity of the V_2O_5 samples has been determined using methylene blue (MB) dye in aquatic medium (using deionized water) irradiated by visible light (LED) for up to 180 min. The lower reaction temperature V_2O_5 (100°C) exhibits higher photocatalysis efficiency (40%) than that of higher reaction temperature (180°C) synthesized V_2O_5 with 25%. It is elucidated that the lower reaction temperature yields smaller particle size results increasing the surface to volume ratio accordingly upsurges efficiency.

MS-14: X-ray Diffraction Analysis by Williamson-Hall, Size-Strain Plot and Halder-Wagner Methods of $Ni_{0.48}Cu_{0.12}Zn_{0.40}Gd_{0.06}Fe_{1.94}O_4$- a Comparative Study

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This work describes synthesis and structural properties of $Ni_{0.48}Cu_{0.12}Zn_{0.40}Gd_{0.06}Fe_{1.94}O_4$, prepared by solid state reaction using a planetary ball milling technique. The synthesized spinel ferrite was characterized by X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), Fourier Transform Infrared spectroscopy (FTIR), and Raman spectroscopy. Rietveld refinement of XRD pattern reveals cubic spinel structure with Fd-3m

space group, whereas FESEM image analysis indicates the spherical morphology of the prepared sample. FTIR and Raman spectra also confirmed the formation of a spinel ferrite crystal structure. Here, Williamson-Hall, Size-Strain Plot, and Halder-Wagner Method have been used to investigate the particle size and the intrinsic strain from the XRD peak broadening analysis. Further, in Williamson-Hall method, different models have been considered for the determination of mechanical properties and microstructural parameters such as strain, stress, and energy density. The average particle size that has been determined from Williamson-Hall, Size-Strain, Halder-Wagner Methods are compared with FESEM analysis.

MS-15: Influence of Gd^{3+} Substitution on Microstructural, Temperature Dependent Permeability and Electrical Properties of Mn-Ni-Zn Ferrites

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Microstructural, temperature dependent permeability, and electrical properties of various $Mn_{0.5}Ni_{0.1}Zn_{0.4}Gd_xFe_{2-x}O_4$ sintered at 1250ºC were investigated thoroughly. The samples were synthesized by standard double sintering ceramic technique. The synthesized samples were characterized using various techniques. Temperature dependent permeability, electrical resistivity, dielectric loss factorand magnetic loss factor were measured using impedance spectroscopy. Microstructural analysis and phase identification were analyzed using field emission scanning electron microscope (FESEM) and X-ray diffractometer (XRD), respectively. The XRD patterns for all the samples confirm the formation of single phase spinel ferrite structure. FESEM micrographs show that the average grain size decreases with increasing Gd content. The bulk density and initial permeability show similar trend as average grain size with the variation of Gd content. The value of magnetic loss and dielectric loss are found to decrease with the substitution of Gd^{3+} for the frequencies greater than 0.54MHz and 10KHz, respectively. For Gd substituted compositions, the value of Néel temperature is observed to increase significantly, about 200ºC greater than that of the parent composition. It is found that the AC resistivity (ρ_{ac}) increases with the substitution of Gd^{3+} and the maximum value of ρ_{ac} is observed for the composition with x = 0.03, about 600 times higher than that of parent composition. Considering above facts these ferrites can be suitable for the applications in high-frequency microwave devices.

MS-16: Synthesis and compositional analysis of ZnO powder using different chemical precursors

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Being a wide band gap semiconductor, ZnO is mainly attractive for its potential applications as a window and conducting material or transparent conducting oxide (TCO) in photovoltaic devices. In this study, Zinc Oxide (ZnO) nanoparticles have been synthesized by simple chemical precipitation method. The effect of annealing temperature on the composition and structural properties of ZnO nanoparticles have been investigated. The nanoparticles are synthesized under the most favorable conditions (deposition time, t_d=120 min, temperature = 60°C) using stabilizer (7.5ml MEA). ZnO nanoparticles have been characterized by X-ray diffraction (XRD), Fourier transform infrared (FT-IR), UV–Vis spectroscopy and scanning electron microscopy (SEM) before and after annealing. XRD data confirmed the hexagonal wurtzite crystal structure of ZnO nanoparticles. Different models have been used to derive the microstructural parameters from XRD data. The average size of the ZnO particles are found to be in the range of 50 to 60 nm. The results of FTIR and Raman observations of ZnO nanoparticles are not only mutually correlated but also supportive. The average size of the ZnO nanoparticles are highly correlated with the structural properties determined through SEM and XRD observations.

MS-17: Improvement in structural stability and electronic properties of Perovskite oxide $SrZr_{0.5}Y_{0.5-x}Ca_xO_3$ by doping Calcium for Solid oxide fuel cell application

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Having enormous opportunities of doping, Perovskite oxides have allocated itself as an attractive contestant as electrolyte material for solid oxide fuel cell. A series of Calcium doped $SrZr_{0.5}Y_{0.5-x}Ca_xO_3$ (where x= 0, 0.1, 0.2, 0.3, 0.4) powders are synthesized by conventional solid-state method. All the samples are sintered at 1200 °C for 8 hours in air atmosphere. The doping influence on the structural properties has been explored by X-ray diffraction (XRD), Thermo-Gravimetric analyzer (TGA), Fourier transform infrared spectroscopy (FT-IR), Raman spectroscopy. XRD data show that the material crystallized in orthorhombic symmetry with Pbnm space group. The effect of Ca doping on the microstructure has been analyzed by Scanning Electron Microscope (SEM) which exhibits that the average grain sizes of the samples have been significantly changed with doping of a small amount of Ca content. TGA

revealed that the samples (x=0.2, 0.4) exhibited high thermal stability up to almost 800 °C, after that mass changed drastically. FTIR Analysis confirms the presence of Zirconium-Oxygen (Zr-O), Calcium- Oxygen (Ca-O), Strontium- Oxygen- Strontium (Sr-O-Sr) bonds. Raman Spectroscopy confirmed the presence of Yttrium- Oxygen bond with all other bonds.

MS-18: Semiconducting to Metallic Phase Transition in $AgCdCl_3$ Perovskite under Hydrostatic Pressure

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The phase transition under external stress gives up several of the new opportunities for a diverse range of applications. The physical properties of $AgCdCl_3$ metal halide perovskite at various hydrostatic pressures were explored using first-principles density functional theory calculations (DFT). To perform all of the computational calculations in this work, we used the CASTEP program with GGA and GGA+U approximation. Physical qualities evaluated include the material's structural, mechanical, and electrical behavior in response to applied stress in the range of 0-32 GPa. As the external force squeezed the lattice parameter, it decreased linearly. The elastic stiffness constants C_{ij} uses the essential circumstances to show that the $AgCdCl_3$ perovskite structure is mechanically stable and ductile. At 0 GPa, the initial value of Pugh's ratio and Poisson's ratio passes the brittle-ductile transition limit. As a result, the $AgCdCl_3$ compound's ductility improves as pressure is applied. The electronic band structure and density of states are used to investigate electronic nature. The energy bands altered with pressure in such a way that at 32 GPa, the $AgCdCl_3$ perovskite changes from a semiconducting to a conducting phase. This sort of semiconductor to metal phase shift might lead to a slew of new possibilities.

Session (VIB): Medical Physics

IT-VIB: Scope of Neuroimaging for the Diagnosis of Schizophrenia: Machine Learning-based study as the future of clinical Study

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Medical Physics gave us a revolutionary opportunity in the imaging domain. The invention of MRI, fMRI, CT, PET, etc changed the way of looking inside a human body to diagnose complex disorders. Neuroimaging is the future of clinical diagnosis. This talk will present the state-of-the-art neuroimaging techniques available for medical diagnosis. Schizophrenia is a very complicated psychological disorder where it is pretty difficult to diagnose with standard MRI or CT. fMRI is a savior for the same. Here, we will explore the neuroscience of schizophrenia as well as the computational approaches being used with the help of fMRI.

Alongside, we will also explore the possibility of using fMRI for other ailments. Finally, we will conclude with the future scope for the medical physics students to join the field of neuroscience for a better understanding of the most complex organ of the human body, the brain.

MP-01: Early Detection of Breast Cancer using Rectangular Patch Microstrip Antenna

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Breast cancer is a serious global concern, however, it can be detected using traditional techniques such as X-ray mammography, ultrasound, and magnetic resonance imaging (MRI), which have some drawbacks. Microwave Breast Imaging (MBI) is a good alternative method for obtaining accurate information about breast tissues that promises to be more precise and safer than conventional breast scanning. In this article, we design a rectangular patch microstrip antenna with a triangular-rectangular slot based patch and a partial ground plane with a single rectangular slot that can identify an early breast cancer tumor. The antenna is designed for UWB band applications at 6.85 GHz. The simulation of antenna structure is carried out using high-frequency simulator (HFSSv15) finite element method (FEM) based electromagnetic software. A breast phantom with a specific dielectric value and conductivity has been modeled. Antenna parameters like radiation patterns, return loss and VSWR are analyzed and investigated on both with and without tumor. It is found that a significant difference has found between with and without breast tumor data which can help to identify the breast cancer. As a result, the proposed antenna is a good candidate for designing and developing a microwave imaging system for early detection of breast cancer.

MP-02: An Overview on ^{211}At for Targeting Alpha Therapy

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Despite of therapeutic progress in recent years with the introduction and development of targeted therapies, multiple myeloma remains an incurable cancer. For destroying the residual cells, Astatine-211 has become a valuable option for TAT. ^{211}At offers the exciting prospect of combining cell-specific molecular targets with radiation having a range in tissue of only a few cell diameters. For being a promising solution for the treatment of cancer, increasing number of ^{211}At-labeled compounds are currently under development for clinical trials. This paper provides a brief overview on the current status of the clinical development of compounds labeled with ^{211}At, also discusses the pre-clinical and the ongoing clinical trials.

MP-03: Synthesis and Characterizations of Nanohydroxyapatite (nHAp) from Eggshells Waste by Novel Hydrothermal Route for Biomedical Applications

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Plenty of bio-waste eggshells are being generated from food processing industries each day worldwide. These materials are directly discarded in the soil and those are creating odor and microbial growth in the environment. It is becoming a huge challenge for scientists to figure out an eco-friendly path to transform these wastes into wealth. Our main target in this study is to develop inexpensive and sustainable approaches to synthesize bioactive nanohydroxyapatatite (nHAp) from eggshells waste. Interestingly, nHAp has numerous biomedical applications especially as scaffold for tissue engineering and in orthopedic implants. To achieve these important goals, firstly, calcium precursor nanoparticles were synthesized from powdered eggshells (PES) by sol-gel method followed by calcination and chemical processes. Afterwards, nHAp was synthesized from calcium precursors by hydrothermal route at 280 ^{o}C. Moreover, nHAp was also prepared from commercially available chemicals by the similar method to compare the purity and phase of the produced nHAp from PES. To the best of our knowledge, nHAp prepared from eggshells waste via our novel hydrothermal technique is reported for the first time.

Initially, the produced calcium precursors, $CaCO_3$, $Ca(OH)_2$ and CaO were characterized by XRD, SEM, FTIR, EDS and TGA techniques to achieve desired nHAp. The X-ray diffraction patterns of nHAp, obtained from both eggshells waste and market available chemicals show the existence of the almost pure apatite phase with hexagonal structure (a = b = 9.423 Å; c = 6.915 Å) as presented in the paper. The exhibited XRD patterns also imply that although the nHAp was obtained from two different sources, but their purity and crystallinity were found dominantly analogous. FTIR spectra of nHAp confirm the presence of all relevant functional groups and boding of calcium (only inorganic element) to their corresponding wavenumbers. The morphological and particle size of our prepared HAp was investigated by SEM that reveals predominantly agglomerated spherical particle shapes with average particle size of ~200 nm. EDS analysis confirms the existence of all elements in nHAp with their percentage. From TGA data it is quite clear that nHAp suffers no decomposition and/or no mass change below 800 ^{o}C that confirm the superior stability of synthesized nHAp for future biomedical applications.

MP-04: Dosimetry of High Energy Electron Beam Delivered from Medical LINAC: A Study of Small Fields

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Dosimetry in small field is frequently used now-a-days in radiotherapy (intensity modulated radiotherapy, stereotactic radiosurgery, Volumetric Arc Radiotherapy) purposes. In this work, we focus on the study of high energy electron beam in small fields and hence to measure the quality correction factors for accelerated electron delivered from medical linear accelerator (LINAC). In this recent work, a comparative study between the protocols (TRS 398, DIN 6800-2 and TG 51) for electron beams in reference field (10 cm × 10 cm) was performed. By taking the TRS 398 protocol the standard one Varian Clinac IX SN6298 was used for both 6 and 12 MeV electron beams in 1 to 5 squard cm small field sizes. Eventually, Percentage of depth dose (PDD), beam profile was determined in water phantom. From the PDD curves range of fifty percent dose (R50) and Zref was measured experimentally. Using R50 in different field size(s) beam quality correction factors for electron beam was measured. For the measurement of the maximum absorbed dose depth to water using three protocols, the maximum deviations were observed between TRS 398 and TG-51 as well as TG51 and DIN 6800-2. In case of medical accelerator, for both 6 and 12 MeV electron beam R50 was increased with the increase of field size (s) in case of small field using CC13 chamber. On the other hand, beam quality correction factors were found to be decreased when the field sizes and beam energies were increased. Beam profiles showed dose scattered more in the small field rather than intermediate sizes. Combined uncertainty of this current work was kept under 1.44%. In case of electron beams, PDD and profile measurement in small field, field size up to (2 cm × 2 cm) experimental values and theoretical values were matched closely. At same time when field sizes narrower than (2 cm × 2 cm) both Razor nano chambers and CC13 chambers were showing discrepancies.

MP-05: Measurement of Dosimetric Errors of TPS Calculations for Radiotherapy Using CIRS Thorax Phantom

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Introduction: ICRU recommends that the dose variation within the planning target volume to kept within 7% to -5% as well as dose to the target should have an accuracy of 5% and in order to follow that recommendation all step in treatment planning including dose calculation, patient alignment and output calibration should have inaccuracy less than 5%.For this reason calculation should have an accuracy in the range of 2-3% .Thus this study shows the discrepancies of lung doses of TPS calculated dose & measured dose in 3D-CRT & IMRT radiotherapy modalities using anthropomorphic CIRS thorax phantom Model 002 LFC.
Materials and Methods: CIRS Thorax phantom Model 002LFC has been taken for this study during the dosimetry of measured dose of 6MV photon beam by Varian Clinac DHX-4526

linear accelerator. Eclipse TPS version 13.7 with Analytical Anisotropic Algorithm (AAA) Calculation algorithm has been used for this study. Treatment planning of 3D-CRT with Anterior Posterior (AP), Posterior Anterior (PA) fields (gantry angle 0º,180º) and AP,PA & Lateral fields (gantry angle 0º,180º,270º) as well as IMRT of 5 fields (gantry angle 25º,345º,305º,260º,180º) was executed during the dosimetry using CIRS Thorax phantom as well as measured the lung doses using ionization chamber IBA FC65-P inserting at plug 6 in the phantom.

Results: The discrepancy of 3D-CRT was .027%, 2.66% respectively in the AP, PA fields. For AP, PA & Lateral fields in 3D-CRT the discrepancy were 0.02%, 3.94%, 1.74% respectively. Finally for 5 fields IMRT deviations were 3.199%, 1.195%, 0.259%, 0.354%, 4.652%respectively. Biggest discrepancy was observed at the gantry angle 180º among the three plan were 4.652% in IMRT Plan.

Conclusion: This experiment with anthropomorphic phantom shows that TPS calculation for lung doses is not accurate and maximum deviation was 4.652%.Thus discrepancy in between calculated dose & measured dose should not exceed ICRU recommendation in order to execute an accurate dose within the volume in treatment plan otherwise it shows inaccuracy of the algorithm of TPS.

MP-06: Development a Dose Escalation of IMRT Protocol of HN Cancer Patient Based on SBRT Treatment Procedure

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The number of metastatic cancer patients is increasing day by day in the developing countries where modern radiotherapy treatment facilities are very limited. Appropriate treatment protocol with less fraction is, therefore, urgently needed to provide an effective and economic treatment to this huge number of metastatic cancer patients with limited treatment setup. The objective of the present study is to design such hypofractionated scheme capable to provide an efficient and economic palliative treatment. This is a theoretical based dosimetric calculation in which the number of fractions and corresponding optimal fractional doses have been thoroughly evaluated for different tumor doses typically prescribed in conventional IMRT technique. This study has been carried out using Linear Quadratic (LQ) model at the Ahsania Mission Cancer and General Hospitals, Dhaka.

In the study, we have designed two hypofractionated schemes, namely Modified Fraction with Low Dose (MFLD) and Less Fraction with High Dose (LFHD), for the palliation of the metastatic patients. In our proposed protocols number of fraction has been reduced by about 30% to 70% as compared to the conventional IMRT technique keeping same the biologically equivalent dose (BED) and acute effects for the tumor tissue. Assuming α/β=10 Gy, our proposed hypofractionated protocols will allow one to deliver the equivalent of 20 - 70 Gy with acute effects equivalent to 18.4 - 63.7 Gy and 15.7 - 55.7 Gy, respectively, by MFLD and LFHD. Because of the least number of treatment fraction, these protocols will reduce the treatment cost by several fold that was the primary objective of the present study.

As the biological effects on late responding normal tissues are usually not come during the patient's survival time the late effects in the present study have been ignored. However, both of the proposed schemes produce comparable late effects slightly higher in LFHD compared

to MFLD. In this context, the present study suggests MFLD for patients having a probability of larger survival period and the LFHD for the patients having a probability of very poor survival period. This is a first-time study to develop hypofractionated treatment course and, therefore, our proposed MFLD and LFHD schemes may lead in designing standards hypofractionated treatment protocols to provide effective and economic treatment facilities for the metastatic cancer patients.

MP-07: Observing Tumor Ablation of Numerous Soft TissuesUsing High Intensity Focused Ultrasound Setup

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Medical science is presented with the aim of finding cures and techniques that reduce patient intervention and hospital visit. Thermal ablation methods are invasive cancer treatment option that is rapidly gaining clinical acceptance.High-intensity Focused Ultrasound (HIFU) is much more efficient, painless, cost-effective and time-consuming than conventional cancer treatments such as chemotherapy, radiation therapy, bone marrow transplantation, invasive surgery, and so on. Mutation in DNA cause cancer. A DNA alteration can lead genes involved in normal cell growth to become tumorigenic. HIFU requires that the detectable and curable tumor/cancer would have been at least 1 cm in diameter; otherwise, it will not be diagnosed. Three basic types of tumors (Benign, Premalignant and Malignant) can be ablated with the HIFU therapy technique, however if the tumor becomes too enormous, surgical therapies can be done in combination with this therapy to ensure a complete cure. The primary processes of HIFU ablation discussed in this research include mechanical and thermal consequences.In this study, investigations and simulations on tumor ablation with HIFU were performed to determine how multiple soft tissue ablation operated and how to optimize tumor ablation while minimizing disruption to surrounding healthy tissue by setting the optimal temperature, power, intensity, frequency spectrum, field depth and transducer lens radius of curvature. All computations were performed by selecting several focal lengths ranging from 55 mm to 65 mm.A piezoelectric transducer was employed as a pressure probein the instance of tumor ablation. In conclusion, we tried to find the beneficial aspects of HIFU that are expected to play a major part in future everyday clinical practice in this research.

MP-08: Effects of Physiological Parameter Evolution on the Dynamics of Tonic-Clonic Seizures

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The temporal and spectral characteristics of tonic-clonic seizures are investigated using a neural _eld model of the corticothalamic system in the presence of a temporally varying connection strength between the cerebral cortex and thalamus. Increasing connection strength drives the system into _ 10 Hz seizure oscillations once a threshold is passed and a subcritical Hopf bifurcation occurs. In this study, the spectral and temporal characteristics of tonic-clonic seizures are explored as func- tions of the relevant properties of physiological connection strengths, such as maximum strength, time above threshold, and the ramp rate at which the strength increases or decreases. Analysis shows that the seizure onset time decreases with the maximum connection strength and time above threshold, but increases with the ramp rate. Seizure duration and o_set time increase with maxi- mum connection strength, time above threshold, and rate of change. Spectral analysis reveals that the power of nonlinear harmonics and the duration of the oscillations increase as the maximum connection strength and the time above threshold increase. A secondary limit cycle at _ 18 Hz, termed a saddle-cycle, is also seen during seizure onset and becomes more prominent and robust with increasing ramp rate. If the time above the threshold is too small, the system does not reach the 10 Hz limit cycle, and only exhibits 18 Hz saddle-cycle oscillations. It is also seen that the times to reach the saturated large amplitude limit-cycle seizure oscillation from both the instability threshold and from the end of the saddle-cycle oscillations are inversely proportional to the square root of the ramp rate.

MP-09: Effects of sugar concentration on the electroporation in giant lipid vesicles

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Irreversible electroporation (IRE) is a nonthermal tumor/cell ablation technique in which a series of high-voltage micro to millisecond electric pulses are used. Sugar in aqueous solution plays an important role in the functioning of cell membranes at various environmental states. Here, the electroporation of giant unilamellar vesicles (GUVs), comprised of a mixture of negatively charged dioleoylphosphatidylglycerol (DOPG) and neutral dioleoylphosphatidylcholine (DOPC) lipids in a physiological buffer with different concentrations of sugar (sucrose/glucose) has been investigated. The constant electric tension (σ_c)-induced probability of rupture (P_{pore}) and the rate constant of rupture (k_p) of GUVs for the sugar concentration c = 40, 100 and 300 mM were determined. Higher σ_c was required to generate nearly the same values of P_{pore} and k_p with increasing c. These results indicate that both the P_{pore} and k_p decrease with increasing c in physiological buffer. To verify this investigation, the average sizes (D_{ave}) and the bending modulus (K_{ben}) of DOPG/DOPC-GUVs were determined from the size distribution of GUVs with various c. With the increase of c, the D_{ave} and K_{ben} of GUVs decrease. It was also determined the D_{ave} and K_{ben} of DOPC-GUVs with different c which show a similar trend as that observed for DOPG/DOPC-GUVs. Based on these results, we conclude that the decrease in bending modulus is one of reasons of the

decrease in the probability of rupture and rate constant of rupture of GUVs with increasing sugar concentration.

Session (VIIA): Composite and Polymer Physics

IT-VIIA: Smart materials for future technology: Magnetoelectric coupling and Multiferroic composites

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For technological development and to meet new demands for the 4th IR, there is a constant need for smart materials with versatile properties. The perovskite and spinel structures have continued to attract interest of Scientists and Engineers because of their fascinating properties which are suitable for many applications such as memory devices, IR detectors, electrodes, magnetic read/write head, bolometer, and in optoelectronics. Therefore, perovskite and spinel type of materials can be considered as a treasure box of smart materials. The chemistry of perovskite in the ideal case can be described as ABO_3. The A cation and the O anion form together a close packed array. The B cations are located in the octahedral voids created by the O anions of subsequent layers. On the other hand, AB_2O_4 spinel type materials can be treated as natural superlattices as they have tetrahedral A-site and Octahedral B-sites.

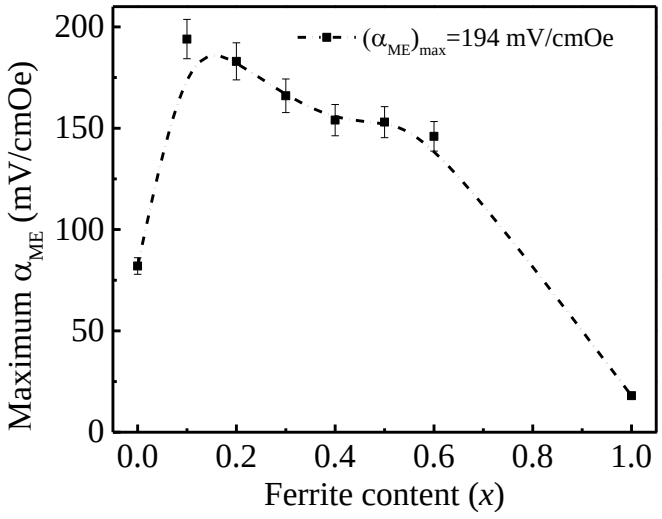

Fig. 1 Variation of maximum ME coefficient ($\boldsymbol{\alpha_{ME}}$) as a function of ferrite content for for (1-**x**)$Ba_{0.985}Ca_{0.015}Zr_{0.10}Ti_{0.90}O_3$+**x**$Ni_{0.48}Cu_{0.12}Zn_{0.40}Gd_{0.04}Fe_{1.96}O_4$ composites.

Various cations can be placed on A-site and B-sites to tune the properties of perovskite and spinel type materials. Depending on A-site and B-site cations, the perovskite type of materials can be colossal magnetoresistive, dielectric, conductive, magnetic, superconductive

and optical materials, and spinel type materials can be ferromagnetic, antiferromagnetic, spin glass and even paramagnetic materials. Experimental results of various properties of some of the perovskite and spinel materials will be described thoroughly. Spinel-perovskite composites show magnetoelectric coupling. There is a scope of designing smart multiferroic materials from the spinel-perovskite composites for the upcoming technology.

CPP-01: Extraction, Optical Properties and Ageing Effect of Natural Dyes and Its Impact on The Power Conversion Efficiency of Dye-Sensitized Solar Cells

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The improvement of efficiency of dye-sensitized solar cells (DSSCs) mostly depends on absorption peak in the visible region including the band gaps of dyes. This work is focused on the extraction, ageing effect and optical properties of natural dyes extracted from some selective flowers and leaves which are available in Savar, Dhaka, Bangladesh. The FTIR spectra were recorded to evaluate the presence of functional groups present in these natural dyes. The UV-Vis spectrophotometric studies of these dyes have indicated broad absorption peaks in the visible region including clear bandgaps. Scanning Electron microscopy was done to evaluate the surface morphology of the studied electrode before and after the absorption of natural dyes onto its surface. Among the studied dyes, Celosia cristata showed the lowest direct bandgap of 1.96 eV and indirect bandgap of 1.79eV. These natural dyes were used as sensitizers for the semiconductor TiO_2 as an electron conductor in order to improve the efficiency. The ageing effects of natural dyes were conducted to understand how these dyes perform after a certain time that stored under different conditions e.g. sunlight, temperature, pressure, etc.

CPP-02: Enhancing the Power Conversation Efficiency of Dye Sensitized Solar Cells by Using an Alternative Electrolyte to Conventional Electrolyte

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Dye-sensitized solar cells are attractive as an alternative to conventional photovoltaic technology due to their low cost and eco-friendliness. The electrolyte is an important parameter of DSSCs and plays a significant role in the recombination of electrons inTiO_2 with I_3^-. In this study, (Br_3^-/I^-) and (I_3^-/I^-) have been used as electrolytes. As a sensitizer, dye extracted from pomegranate (Punica granatum) and teak leaves (Tectona grandis) have been used which was collected from local markets and gardens. To prepare photo anode, metal-oxide-semiconductor as TiO_2 nano paste (energy band gap with 3.2-3.35 eV) was coated on FTO glass substrate by using the doctor blade technique. The cells are fabricated as FTO/TiO_2/Dyes/electrolyte/Carbon/FTO. The synthesis of the TiO_2 paste was characterized by using XRD, SEM, UV–visible and FTIR analysis. The power conversion efficiency of the Dye-sensitized solar cells was determined by using a calibrated solar simulator with a 500W Xenon arc lamp and the light intensity was 100 mW/cm^2 in AM 1.5G. As a result of using (Br_3^-/I^-) with pomegranate (Punica granatum) and teak leaves (Tectona grandis) shows the power conversion efficiency 0.788% and 0.373%. On the other hand, using (I_3^-/I^-) with the same dye shows conversion efficiency of 0.255% and 0.108%. Comparatively, (Br_3^-/I^-) electrolyte improves the efficiency of power conversion by 209% and 245% more than the conventional electrolyte of (I_3^-/I^-) for the pomegranate (Punica Granatum) and teak leaf (Tectona grandis) dyes, respectively.

CPP-03: Preparation of Cellulose Nanofiber-Leather Waste Biocomposites for Footwear Components

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In tanneries, approximately 20% of the total mass of raw hides and skins is converted to finished leather, while 80% become waste either in liquid or solid state. Moreover, during shoe manufacturing finished leather is skived to prepare for stitching and attaching which also produce significant amount of solid waste. In this paper, we reported utilization of solid leather waste to prepare a biocomposite. The leather waste is crushed into fibers, which are mixed with cellulose nanofiber produced from water hyacinth by using unsaturated polyester resin (UPR). Cellulose fibres are isolated from the lignin and hemicellulose by chemical treatment of the water hyacinth. Isolated fibers are micronized by centrifugal ball mill and then ultra-sonicated to obtain nanofibers. From leather-nanofiber mixture biocomposite is prepared by hand lay-up method. The composites can be used to prepare insole material of footwear and hard board.

CPP-04: Comparing the Structural, Magnetic and Transport properties of $Ba_{0.8}Ca_{0.2}Ti_{1-x}Nb_xO_3$ and $Ba_{0.8}Ca_{0.2}Ti_{1-x}Y_xO_3$ based on frequency

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Variation of material properties with respect to various parameters such as frequency, electric field, temperature, and so on is currently a technological requirement for improving the efficiency of devices and instruments in the spintronics, microelectronics, and communication worlds. Materials performance analysis with frequency variation is one of them. With the advent of modern technology, to meet the need for electronic communication among a large population, it is critical to enhance device frequency efficiency. Because of the polarization effect, materials' performance in the higher frequency range is poor. BaTiO3 emerges as a promising candidate with high dielectric constant and low loss characteristics. Because the dielectric characteristics of BaTiO3 samples are affected by a variety of parameters such as frequency, unit cell, crystalline phase, crystallinity, and particle size, the goal of this research is to discover the efficiency of $Ba_{0.8}Ca_{0.2}Ti_{1-x}Nb_xO_3$ and $Ba_{0.8}Ca_{0.2}Ti_{1-x}Y_xO_3$ based on frequency. Ca doped BaTiO3 (Nb and Y doping at Ti site) were synthesized by Solid State Reaction technique. The samples were characterized by XRD, SEM for structural & surface analyses. Magnetic properties were calculated by VSM. XRD experiment confirms the tetragonality although the peaks are slightly shifted due to doping. The crystal size is also decreasing with doping concentration as the intensity is decreasing. The grain size and surface morphology are observed from SEM image of the sample. The result reveals that the maximum dielectric constant is observed for x = 0.02 for Y content. The dielectric constant tends to decrease as Nb content increases because of grain size effect on the properties. Considering equipment in the realm of electronics and communication must deal with both electronic and magnetic properties, this property can be used to fabricate various electronic and communication devices.

CPP-05: Preparation of Amine Functionized Gma-G-Non Woven Pe Fabric and Its Application in Anionic Dye Removal

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In this research work, γ-ray induced grafting of Glycidyl methacrylate (GMA) on non-woven Polyethylene fabrics was investigated and amine functionalized GMA-g-non woven PE fabrics were tested for the adsorption of methyl orange (MO) from aqueous solution. Adsorption capacity was studied under different conditions: contact time, temperature, pH and initial metal ion concentration. The optimum condition for maximum adsorption was found to be contact time 48 h and initial metal concentration 500 ppm and pH 1.759 and temperature 80 ºC.

Langmuir isotherm model was applied for the system to completely understand the adsorption isotherm processes. The equilibrium experimental data of metal adsorption matched Langmuir isotherm model. Langmuir isotherm model suggested the monolayer saturation adsorption and the highest adsorption capacity of the adsorbent was found to be 60.60 mg/g. The adsorption kinetics was tested with pseudo-first-order and pseudo-second-order models. The adsorption of MO was successfully interpreted with pseudo-second-order model. The adsorbent was identified by Fourier Transform Infrared (FTIR), Scanning Electron Microscopy (SEM) and Thermo-gravimetric Analysis (TGA). Desorption and reuse of the adsorbent fabric were also studied which indicated that the film can be used repeatedly.

CPP-06: Removal of Toxic Cr (VI) Ions Using Amidoximated Acrylonitrile Grafted Non-Woven Polypropylene Fabric

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In this study, a new amidoximated adsorbent based on waste polypropylene (PP) fabric was prepared for the adsorption of aqueous Cr (VI) ions. A pre-irradiation technique was employed for the grafting of acrylonitrile (AN) onto PP fabric. The grafting reaction was carried out at 80 ^{o}C utilizing sulfuric acid as an additive, and the graft yield was 150% using 60% AN and a 30 kGy radiation dose. The amidoximated adsorbent was produced by treating AN grafted PP (AN-g-PP) with $NH_2OH.HCl$ and characterized by FTIR, SEM, TGA, and DMA. The removal of Cr (VI) was examined under various experimental conditions. Both the Langmuir and Freundlich isotherm models were used to fit the equilibrium adsorption data.The maximum adsorption capacity was found to be 232.56 mg/g. Kinetic studies have exhibited that the highest removal was 126.82 mg/g after 40 hours at pH 1.5 and the Cr (VI) concentration was 120 ppm. The kinetic data follows the pseudo-first order model. According to the thermodynamic data, the sorption process was endothermic and spontaneous, taking place by increasing the randomness of the system. Furthermore, studies of the desorption of Cr (VI) and reuse of the adsorbent indicate that the adsorbent can be applied effectively for the efficient removal of Cr (VI) ions from aqueous solutions.

CPP-07: rGO-CuO Nanocomposite Incorporated Chitosan/PVA Electrospun Nanofiber Mat for pH Sensitive Adsorption of Organic Dyes

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Water pollution causing waste effluents of the leather and textile industry is seriously causing various problems in human's health and environment. pH-responsive adsorbents are promising

tools in water remediation as they possess selective adsorption towards cationic and anionic dyes, which can be controlled by varying the pH of the medium. Here we report the green synthesis of a new bio-adsorbent based on electrospun nanofibrous mats composed of chitosan and polyvinyl alcohol (CS/PVA). A synergistic effect on the removal of heavy metals and dye was achieved by the incorporation of rGO/CuO nanocomposite into the CS/PVA electrospun fibrous mat. Furthermore, the stability of the as prepared fibrous mat was achieved by crosslinking with glutaraldehyde. rGO was synthesized from graphite and copper oxide nanoparticles were synthesized from Aloe Vera leaf extract. The chitosan/PVA/CuO–rGO nanofibrous mat was characterized by X-ray Diffraction, Fourier Transformed Infrared Spectroscopy, and Thermo Gravimetric Analysis. The CS/PVA/CuO–rGO nanofibrous mat showed better removal efficiency to cationic metal ions and anionic dye from waste water compared to pristine CS/PVA mat. The rGO-CuO incorporated CS/PVA mat showed 86% removal efficiency for lead, whereas only the CS/PVA nanofibrous mat showed 44% removal efficiency. And in the case of methylene blue, the CS/PVA electrospun mat showed 35% removal efficiency, but the improved efficiency was achieved by the CS/PVA/rGO-CuO electrospun nanofiberous composite and it was 50.18%. This novel approach to electrospinning of CS/PVA nanofiber mat with rGO-CuO indicates that current research should provide potential studies on the right modeling and construction of treatment plants for waste management.

CPP-08: Exploring the Coupling Effect of Ferromagnetic, $Co_{0.8}Zn_{0.2}Fe_2O_4$ with the Ferroelectric, $La_{0.5}Ba_{0.5}TiO_3$ at Different Concentrations in Composite Multiferroics

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Multiferroic particulate composites with the formula $(1-x)Ba_{0.5}La_{0.5}TiO_3+xCo_{0.8}Zn_{0.2}Fe_2O_4$ (x=0.0, 0.1, 0.3, 0.5, 0.7, 0.9, 1.0) are fabricated by the solid state reaction method at 1200℃ temperature for 4 hours. X-ray diffraction patterns confirm the presence of the constituent phases in the composites. The lattice parameter enhances with the increasing ferrite content. Theoretical density and bulk density show opposite behavior with changing ferrite concentrations. The average grain size are obtained using scanning electron microscopy. It varied from 1.308 μm to 3.046 μm. The Fourier Transform Infrared (FTIR) spectra of the investigated samples show the characteristic vibration bands of Co-ferrite, Zn-ferrite, and Ti-O. Hysteresis loops demonstrate that all the composites exhibit good ferromagnetic properties. The real part of permeability (μ′) gradually increases with increasing ferrite content as per the sum rule of mixture. Negative value of the imaginary permeability (μ″) is observed for x=0.1, 0.5, 0.9, 1.0. This property denotes that energy may be radiated from the samples because of the motion of charges under the ac-electric field. In order to investigate the electric properties of the samples, dielectric constant (ε′) and loss tangent (tanδ) were measured in the frequency

range 100 Hz to 100 MHz. The dielectric constants (ε′) decreases at first and after x=0.3, it begins to increase with the addition of ferrite phase. The maximum dielectric constant (ε′) found for x=0.9 is 1092.08. The dielectric constant (ε′) and loss tangent (tanδ) have high values at low frequencies and start to decline at high frequencies displaying Maxwell-Wagner interfacial polarization. P-E hysteresis loops indicate para-electric to ferro-electric transition as the ferrite content is increased. All of the samples appear to exhibit highly resistive properties.

Session (VIIB): Meteorology and Atmospheric Physics

IT-VIIB: Statistical Analysis of Long-term Temperature Trends in Bangladesh

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The monthly, seasonal and annual decadal trends of maximum temperature **(**T_{max}), minimum temperature **(**T_{min}) and average temperature (T_{ave}) during 1961-1990 and 1991-2020 were evaluated for 23 and 34 meteorological stations respectively all over Bangladesh using the trend free Pre-whitened non-parametric Mann-Kendall (MK) test. The magnitude of the trends was estimated using the Thiel-Sen slope estimator. The spatial distribution of monthly, seasonal and annual decadal trends of T_{max}, T_{min} and T_{ave} were plotted over Bangladesh Map using Surfer software. This distribution identifies the regional increasing and decreasing patterns of T_{max}, T_{min} and T_{ave} all over Bangladesh. The trends of T_{min} were increased in every month of the year at Dhaka, Cox's Bazar, Srimangal and Mymensingh during 1961-1990 and Dhaka, Cox's Bazar, Cumilla, Chattogram, Bogura and Rangpur stations during 1991-2020 and decreased at Rajshahi and Rangamati stations during 1961-1990. The trends of T_{max} were increased in every month of the year at Cox's Bazar and Hatiya during 1961-1990; Chandpur, Hatiya, Khulna, Sandwip, Rangamati, Sylhet, Khepupara, Sitakunda and Teknaf stations during 1991-2020 and almost all the meteorological stations of Bangladesh during May to November. The trends of T_{ave} were increased in every month of the year and annual at Dhaka, Faridpur, Hatiya, Cox's Bazar and Bhola during 1961-1990; Dhaka, Faridpur, Hatiya, Cox's Bazar, Chattogram, Kutubdia, Patuakhali, Sitakunda, Rangamati, Cumilla, Chandpur and Sylhet station during 1991-2020.
The trends of T_{min} and T_{max} were increased in every season and annually at Dhaka, Chattogram, Cox's Bazar, Kutubdia, Chandpur, M. Court, Barishal, Srimangal, Saidpur and Sylhet during 1991-2020; T_{min} were increased at Cumilla, Mymensingh, Rajshahi, Rangpur, Dinajpur, Bogura, Satkhira and Ishwardi and T_{max} at Bhola, Khepupara, Patuakhali, Sitakunda, Rangamati, Teknaf, Hatiya, Sandwip, Feni, Khulna, Mongla, Faridpur, Tangail, stations during 1991-2020. The trends of T_{ave} were increased in winter, pre-monsoon, monsoon and post-monsoon season and annually at Dhaka, Faridpur, Bhola, Srimangal and Cox's Bazar stations during 1961-1990 and also 1991-2020. The highest increasing trends of T_{min} were 1.19°C/decade in November at Srimangal, 0.89°C/decade in December at Dhaka; highest increasing trends of T_{max} were 0.85, 0.75, 0.71 and 0.71°C/decade at Bogura, Bhola, Cox's Bazar and Dhaka in November respectively.

MAP-01: Sensitivity of Microphysics in WRF-ARW Model for the Simulation of Tropical Cyclones 'Amphan' and 'Bulbul' over the Bay of Bengal

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The sensitivity of Microphysics (MP) in Weather Research and Forecasting (WRF) model have been studied for the Tropical Cyclone (TC) 'Amphan' and 'Bulbul' which crossed Sundarban Coast during 1000-1200 UTC of 20 May 2020 and 1500-1800 UTC of 9 November 2019 respectively. Eleven MP schemes viz. Kessler, Lin et al., WRF single moment 3 class (WSM3), Eta, WRF single moment 6 class (WSM6), Thompson, Morrison 2-moment, Stony Brook University (SBU), WRF double moment 6-class (WDM6), National Severe Storm Laboratory 2- moment (NSSL-2) and NSSL 1-moment 6 class (NSSL-1_6) in combination with Kain Fritsch (KF) Cumulus Physics (CP) and Yonsei University (YSU) Planetary Boundary Layer (PBL) parameterization schemes have been investigated. The Model have run for four different initial conditions i.e., 0000 UTC of 16, 17, 18, and 19 May of 2020 for TC 'Amphan' and three different initial conditions i.e., 0000 UTC of 6, 7, and 8 November 2019 for TC 'Bulbul'. In total of 44 and 33 experiments has been conducted for TC 'Amphan' and 'Bulbul' respectively. Model simulated track and intensity of different MPs has been analysed and compared with IMD estimated track and intensity. Average track errors for TC 'Amphan' have found above 50 to 170 km for all MPs except WSM3 at 0000 UTC of 16 May initial condition. At 0000 UTC of 17 May initial condition, except WSM3 and WDM6 all other MPs have simulated average track errors above 40 to 167 km, on the other hand at 0000 UTC of 18 and 19 May initial condition all MPs except NSSL-2, NSSL-1_6, and Kessler schemes have simulated average track error under 50 km. For TC 'Bulbul' at the initial condition of 0000 UTC of 6 November 2019, except WSM6 and SBU schemes, all other MPs simulated average track error above 50 to 100 km. The lowest average track error has simulated by WDM6 at the initial condition of 0000 UTC of 7 November and at 0000 UTC of 8 November initial condition all MPs except NSSL-2, NSSL-1_6, and Kessler simulated average track error below 30 km. In case of intensity in terms of Minimum Sea Level Pressure (MSLP) and Maximum Sustained Wind Speed (MSWS) at 10m level, for the TCs WDM6, WSM6, and WSM3 schemes simulated intensity better agreement with the IMD estimated intensity for all simulations.

MAP-02: Heat Wave in Bangladesh- dynamics and Predictability

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Heat wave is a period of excessively hot weather accompanied by high humidity, which threaten human health. Heat wave (HW) mainly occurs during the pre-monsoon season in

Bangladesh. But in the recent times it is found to occur in monsoon season. To understand the underlying meteorological causes and its impact HW conditions are searched utilizing the recorded maximum temperature of Bangladesh Meteorological Department (BMD) for the period of 1981-2021. In this aspect, HW days are calculated at each of the BMD station locations. It is found that HW days have significant increasing trend at most parts. As HW is more prominent in pre-monsoon season, initiative has taken to calculate weighted mean of HW days at each BMD stations and found that the country average weighted mean of maximum temperature during HW days was the highest in 2014 (37.7°C) followed by 2021 (37.2°C). In a similar manner, annual number of Heat Wave Magnitude Index (HWMId) with the scale of ≥ 1.0 has been calculated and found increasing trends at most part of Bangladesh. The trends at Chittagong, Barishal and Khulna locations are significant at 95^{th} level but the trend at Sylhet is significant at 99^{th} level. Considering all of these parameters the HW condition of 2021 in pre-monsoon season can be treated as one of the most potential HW period. To understand the cause of HW in Bangladesh the parameters of sea level pressure, wind flow, relative humidity and lifted index (LI) associated with different synoptic process were supportive jointly for the events that occurred during 2014 and 2021.

MAP-03: Comparison of High Resolution Satellite-Derived Sea Surface Temperature with Observed SST from Buoy over Indian Ocean

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Sea surface temperature (SST) is one of the key parameters used in global numerical modeling of atmospheric processes including weather and climate. Different space agencies of the world have launched satellites that include infrared and microwave payloads designed to provide global or regional sea surface temperature observations. However, before using satellite derived SST, it is essential to compare it with observed SST to examine the accuracy of satellite-derived SST estimates. The paper demonstrates the comparison of Group for High Resolution Sea Surface Temperature (GHRSST) data with buoy observed SST from the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) over Indian Ocean. In this study, the comparison performed for 19 different buoy as data available for each buoy. Different statistical verification methods including Correlation Coefficient (R^2), Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Bias Error (MBE), Index of Agreement and Kling-Gupta efficiency are used for better understanding. The results of all statistical verification methods shows that the GHRSST are very close to Buoy observed SST.

MAP-04: Sensitivity of Cumulus Physics Schemes in WRF-ARW Model for Predicting Thunderstorm Events over Bangladesh

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A thunderstorm event was simulated with 6 physics combinations using the Weather Research and Forecasting model at 9 km horizontal grid. The cumulus physics option was alternated while the other physics options remained the same. The objective was to determine the best cumulus physics option for more accurate prediction of thunderstorm over Bangladesh. The model outputs were compared with the observed data collected from Bangladesh Meteorological Department. The study was done for the parameters temperature, relative humidity and sea level pressure and the stations Chandpur, Comilla, Hatiya, Jessore and Khepupara. The Kain-Fritsch Eta (cu-1), Betts-Miller-Janjic (cu-2), Grell-Devenyi (cu-3), Grell-3 (cu-5), Tiedtke (cu-6) and New SAS (cu-14) schemes were compared. The errors were taken as a percentage of the observed data and compared side by side to choose between the schemes. Of them, the Kain-Fritsch Eta scheme yielded the least error. This study can be used to select the best cumulus physics scheme for better prediction of thunderstorm events over Bangladesh using the WRF-ARW model. Further study should be done with more events, parameters and stations to validate this result.

MAP-05: Sensitivity of WRF microphysics schemes for predicting Severe Thunderstorm Event over Bangladesh-Through validation approach

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In this study, the Advanced Research WRF (ARW) model has been used to simulate a thunderstorm event of 4th April 2020 for the sensitivity test of different microphysical schemes. The model conducted a simulation in a domain of 9 km horizontal resolution with grid spacing 211×211 and 38 vertical levels, using 6 hourly NCAR-GFS datasets from 0000UTC of 4th April 2020 to 0000UTC of 5th April 2020 as initial and boundary conditions. Three hourly output was analyzed numerically and graphically by Grid Analysis and Display System (GrADS) to compare the model performance for 7 different microphysics (MP) schemes coupled with Kain-Fritsch (KF) cumulus parameterization scheme and Yonsei University (YSU) PBL scheme. The microphysics schemes are Kessler, Lin et al., WSM3, Ferrier, WSM6, Thomson graupel, MYDM-7 class schemes. Root Mean Square Errors (RMSE), Mean Absolute Error (MAE) and correlation of coefficient have been calculated for temperature, relative humidity (RH %) and mean sea levele pressure (MSLP). To validate model performance, simulated values of MSLP, temperature and relative humidity (RH) were compared with observational data of Bangladesh Meteorological Department. From the validations and comparisons, this study suggest that the combination of Milbrandt and Ferrier microphysics scheme with Yonsei University (YSU) PBL scheme and Kain-Fritsch (KF) CU scheme provides most suitable combination of physical parameterization schemes in simulation of the thunderstorm event.

MAP-06: Tropical Cyclone Structure Analysis using Satellite Observations

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The accurate estimation of wind structure of tropical cyclones is highly important as they are used as input in various cyclone prediction models. The satellite observations play an important

role in the estimation of these parameters. In the present study, wind products obtained from SCATSAT-1 and SMAP (Soil Moisture Active Passive Radiometer) satellites over tropical cyclones formed in the North Indian Ocean (40°-100°E and 0°-30°N) during the period 2017-2018have been analysed. The structural parameter of cyclones (Center, Rmax, Vmax and Critical wind radius) were computed and compared with the best track data obtained from India Meteorological Department (IMD) and Joint Typhoon warning Center (JTWC). The cyclone wind structural parameters from the 40 wind passes over six NIO (North Indian Ocean) cyclones (Maarutha, Mora, Ockhi, Titli, Gaja & Phetai) obtained from SCATSAT-1 and SMAP were analysed and compared with respect to best track data. The INSAT 3D TIR-1 data over the TCs have also been analyzed. The relationship between brightness temperature (BT) values estimated by INSAT 3D TIR-1 channel and wind speed measured by scatterometer was investigated.

MAP-07: Study of Vertical Structure of Tropical Cyclones using Numerical Weather Prediction Model over the Bay of Bengal

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Tropical cyclones are the most destructive natural threats over the globe. Countries bordering tropical oceans are vulnerable due to tropical cyclones. In the present study, an attempt has been made to study structure of two tropical cyclones Amphan and Bulbul using Weather Research and Forecasting (WRF) model. Two way nesting domain with horizontal resolution of 27 km and 9 km are considered to simulate cyclone Amphan and Bulbul. Both cases, outputs from inner domain (9 km) are examined. Vertical structure of various parameters is analyzed. No significant outward slope of the Radius of Maximum Wind (RMW) is found at lower level for cyclone Amphan but the slope of the RMW is outward with height for Bulbul. Though Bulbul is less intense compared to Amphan, it is found that maximum value of relative vorticity as well as vertical velocity for Bulbul is higher than that of Amphan. It is also seen that relative vorticity center is almost coincide with the minimum sea level pressure (MSLP) center for Amphan nevertheless for Bulbul, it is shifted eastwards from the MSLP center. Analyses of vertical structure of these tropical cyclones would increase the knowledge in understanding the role of size and vertical structure in tropical cyclones intensity as well as movement.

MAP-08: Predictability of Monsoon Depression over the Bay of Bengal using NWP Models

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An attempt has been made to simulate monsoon depressions over the Bay of Bengal during 2010-2020 using Weather Research and Forecasting Model. The model was run on a single domain of 10 km horizontal resolution using Morrison 2-moment microphysics with Kain-Fritsch cumulus parameterization scheme and Yonsei University planetary (YSU) boundary layer scheme, MM5 surface layer physics scheme, Rapid Radiative Transfer Model (RRTM) for long-wave and Dudhia scheme for short-wave scheme are used in version 3.9.1 for the simulations. The NCEP high resolution FNL 6-hourly data is used for initial and lateral boundary conditions. GrADS is used to visualize the different graphics. The model predicting capability is evaluated by analyzing Mean Sea Level Pressure (MSLP), wind pattern, vorticity, vertical wind shear, reflectivity, temperature and rainfall distribution. The model has successfully captured the system, its initial condition, propagation, landfall time and location reasonably well. The model has simulated rainfall, wind and rh sensibly well compared with the observed data by BMD and Tropical Rainfall Measuring Mission (TRMM). It can be concluded that the WRF model with the accurate arrangement of the domain, horizontal resolution and the appropriate parameterization schemes is proficient to simulate and forecast the monsoon depressions over the Bay of Bengal and its associated rainfall over Bangladesh.

Session (VIA): Environmental Science

IT-VIA: Sustainable Management of Water Resources Using Isotope Techniques: Opportunities and Active Research Areas in Bangladesh

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Sustainable human development is dependent on the availability of water. So, a key to sustainable management of water resources is having the knowledge needed to make the right decisions. Isotope hydrology is a nuclear technique that uses both stable and radioactive environmental isotopes to trace the movements of water in the hydrological cycle. The application of isotopic techniques in Bangladesh over the last few years in determining groundwater residence times, recharge mechanisms, recharge areas, inter-aquifers hydraulic interactions and connectivity between different water bodies have proved valuable to improve our understanding on the behaviour of groundwater systems. Bangladesh Atomic Energy Commission has been participating actively in IAEA's technical cooperation programs on isotope hydrology for the last couple of years. Maximum benefits are derived from the application of isotope techniques when they are complemented with conventional techniques in an integrated manner. Based on the determination of the stable and radioactive isotope composition, these isotope hydrology projects give important results and form the basis for the decision of the future protection and exploitation of the aquifers. The isotopic information is critical in guiding Bangladesh policy of deep aquifer exploitation and was used in the World Bank funded projects for arsenic-free rural water supply. Integration of isotope techniques in the hydro-geologic characterization work in Bangladesh has provided information rapidly and at much lower cost than is possible with non-isotopic techniques alone. Knowledge of the current regional isotopic composition of meteoric water can be particularly useful in providing evidence for recharge provenance and groundwater residence times as well as predicting the climatic changes. It is envisaged that this study would help in understanding the advanced knowledge on interpretation of environmental isotopes of precipitation and also in improving

the capability to better assess the impacts of climate change on water resources variability and sustainability. Stable isotope signatures in precipitation are useful indicators of climate variability and provide critical information regarding regional and global water processes.

ES-01: Appraisal of Environmental Pollution Indices and Subsequent Human Health Risks of Groundwater in an Industrial Zone of Southwest Part of Bangladesh

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As a vital component of the eco-environment and water resource systems, groundwater is important for both the global hydrological cycle and water supply. Rate of depletion of groundwater levels and deterioration of groundwater quality is of immediate concern in major cities and towns of the country. The objective of the research is to assess the heavy metal contents in groundwater as well as effluent and to identify the level of pollution and associated health risks in study region. In this research work, eleven (11) groundwater samples from 80 – 180 feet depth of different places of Mubarakganj Sugar Mills area and the wastewater of sugar mills were collected. Physical parameters like pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Salinity and Turbidity of the samples were measured on site. Ten heavy metals and trace elements were analyzed in these samples using Flame Atomic Absorption Spectrophotometer after successive acid digestion. The average concentration of Fe, Zn, Cu, Al, Cr, Cd, Ni, Co and Pb were 1.792±0.09, 0.071±0.014, 0.041±0.012, 0.010±0.002, 0.131±0.010, 0.015±0.003, 0.092±0.017, 0.024±0.002 and 0.022±0.003 respectively. In comparison with WHO and Bangladesh National Drinking Water Standards the concentration of Fe, Cd, Cr and Ni in most of the samples exceeded the acceptable limit. To assess the environmental pollution condition of water, several indices were calculated like Heavy Metal Evaluation Index (HEI), Degree of Contamination (C_d), Modified Degree of Contamination (mC_d), Pollution Load Index (PLI), Contamination Factor (CF), Ecological Risk Index (E_r) and Potential Ecological Risk Index (PERI) etc. The overall HEI and C_d for groundwater was 169.96 and 81.96 respectively and it was quite higher than the onset limit of each factor. Overall HEI was 16.05, which indicates medium level pollution. Other pollution indices like mC_d, PLI and CF were showed low level of contamination for water. In addition, carcinogenic and non-carcinogenic risks of heavy metals in groundwater were calculated for both oral and dermal exposure. Hazard Index (HI) of groundwater for oral ingestion was 48.55 and for dermal contact was 156.47, which was quite higher than the recommended value

(HI≤1.00). For effluent, HI was 12.13 and 8.11 respectively which was also inordinate. Furthermore, carcinogenic risk of Cd, Cr and Ni was found on an average of 2.77E-03, 2.04E-03 and 3.16E-03 correspondingly which is considerably higher than the acceptable range (1.0E-04 to 1.0E-06). This study may be helpful in developing an appropriate management plan and sustainable utilization of groundwater of that area.

ES-02: An Approach towards Human Health Risk Assessment and Source Apportionment of Potentially Toxic Elements (PTEs) in Some Contaminated Fish Species

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Present study enlightened on the accumulation, origin and associate health implications of eight PTEs Mn, Fe, Cu, Zn, As, Hg, Pb, Cr in ten varieties of fish species collected from a heavily polluted river system of Bangladesh. Level of PTEs in the studied fish species were found within the legislative value suggested by different agencies except Fe, Cu, Zn Hg and can be assembled as Zn>Fe>Cu>Mn>Cr>Hg>As>Pb. The origin of PTEs in fish species apportioned mostly anthropogenic coupled with natural sources. Among the anthropogenic sources industrial waste water, recycling of leaded and lithium ion batteries, metallurgical industries, shipyards, tannery, cosmetics and chemical industries are the major contributors. This study identified children are exposed to As and Zn as their estimated THQ value exceeded the threshold limit of safety, whereas adults are exposed to As only. Estimated, hazard index (HI) for children were found more than four times higher than adults, however, both the population groups are in vulnerable situation considering HI value (HI>1) and indicating possible non-carcinogenic health risk. Moreover, cumulative cancer risk TCR appraised that all the fish species exceeded the threshold limit of >1E-03 for children and >1E-04 for adults, which are level VII and level V contamination state for child and adult respectively and manifested consumption of the studied fishes arise a high probability for lifetime cancer risk.

ES-03: Sensitivity Study of PBL Schemes on the Simulation of Tropical Cyclone Titli Over the Bay of Bengal Using WRF Model

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In recent years, the Tropical Cyclone (TC) is one of the most hazardous weather phenomena in the Indian sub-continent. Better prediction is necessary to relieve the TC-produced destruction. So, it is very significant to investigate the sensitivity of various physical schemes of the WRF model as well as the intensification and track of TC. Medium-Range Forecast (MRF), Mellor-Yamada Nakanishi and Niino Level 3 (MYNN3), Mellor-Yamada Nakanishi and Niino Level

2.5 (MYNN2.5), Yonsei University (YSU), Bougeault-Lacarrere (Boulac), and Asymmetric Convective Model version 2 (ACM2) schemes were used as Planetary Boundary Layer (PBL) schemes of WRF model for 48, 72, and 96 hours of simulations. The WRF-Double Moment 6 class (WDM6) microphysics scheme and Kain-Fritsch (KF) cumulus physics scheme are also used to simulate the selected TC 'Titli' which made landfall at 0000 UTC on 11 October 2018 near Palasa in North Andhra Pradesh and South Odisha coasts. For initial and lateral boundary conditions of the model, the spatial resolution of 1° × 1° final analysis (FNL) data of National Centers for Environmental Prediction (NCEP) is used. With the 9 km horizontal resolution the model was run for only one domain. The model simulated track and intensity of TC which is related to the minimum sea level pressure (MSLP) and maximum wind speed (MWS) at 10m level is verified with the help of the India Meteorological Department (IMD) estimated data. The time deviation of heat flux (HF), latent heat flux (LHF), and moisture flux (MF) are also simulated for these schemes. The Boulac and MYNN2.5 scheme simulates the minimum value of average track error and landfall position error in 96-hour simulation where the landfall time is delayed only 3 to 6 hours. The time variation of MSLP and MWS are much similar to the IMD detected data but for every simulation, the cyclone intensity is overestimated by YSU and ACM2 schemes. The Root Mean Square Error (RMSE) of MSLP and MWS is found very low, which specifies that the model simulated value shows less deviation from the IMD observed value. The value of the Correlation Coefficient (CC) also specifies the decent prediction of the simulation of TC Titli for 48 and 96 hours. A significant amount of LHF, MF, and HF are found which are correlated with cyclone intensification. Overall, the MYNN2.5, Boulac, and MYNN3 schemes show a better simulation of the intensity and track pattern of the TC Titli.

ES-04: Effect on Oxidation on the Leaching Behavior of Cesium (Cs) and Strontium (Sr) from Nonmarine and Marine Sediment: An Approach of Sequential Extraction Method

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Sediment is the ultimate sink for metals as well as pollutants. Determining total concentration cannot give detailed information on the potential mobility of pollutantsin sediment to environment. Chemical speciation analysis is necessary to understand potential mobile and bioavailable fractions of metals in sediment. Understanding leaching behavior of Cs and Sr is necessary as these are common in immobilized decommissioning waste. There were 25 undisturbed sediment samples were collected from a boring core at 1 m interval from a lowland in the Kanto plain, Japan. Samples were preserved carefully to prevail undisturbed condition. On the other hand, there were another 20 sediment samples were collected at 1 m intervalfrom a nearby boring core and air dried (oxidized). In both locations, nonmarine and marine sediments are distributed with same type, age, and depositional environment. A sequential extraction (four steps) techniques were applied to determine potential mobile fractions of Cs and Srfor both types of sediments. Extracted leachates were analyzed by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) as water soluble, ion-exchangeable, carbonate bound,

and Fe-Mn oxide bound fractions. Potential mobility is high when the trend is water soluble > Ion exchangeable > carbonate bound > Fe-Mn oxide bound. The trend of potential mobility of Cs is Fe-Mn oxide bound > Ion exchangeable fraction for both marine and nonmarine sediment in undisturbed sample. After oxidation, the trend is Fe-Mn oxide bound > Ion exchangeable> carbonate bound in marine sediment but in fluvial sediment, the trend is Fe-Mn oxide bound>carbonate bound. The trend is Ion exchangeable > carbonate bound > Fe-Mn oxide bound for Sr in both marine and nonmarine undisturbed sediment. However, Sr become more mobile after oxidation as the trend is water soluble > ion exchangeable >> Fe-Mn oxide bound > carbonate bound in marine sediment. Fluvial sediment showed the trend as ion-exchangeable > Fe-Mn oxide bound >> carbonate bound for Sr. Mechanism of leaching of Cs and Sr were understood from sediment of marine and nonmarine environment with the effect of oxidation.

ES-05: Study of Bioaccumulation and Potential Risk from Food Crops Cultivated with Pesticides in Pre-Selected Sites of Bangladesh

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Bangladesh has taken the challenges of the 4th Industrial revolution. To fulfill these challenges, outstanding growth in industrial sectors are taking place even within the ongoing COVID*19 pandemic around the world. Due to this huge industrial and anthropogenic activities in different sectors, environmental pollution and its consequences including the risk of accumulation of toxic heavy metal in edible food crops through food chain has risen. Hence study of food crops, their site of cultivation and their manure and pesticides, for the presence of heavy metals is urgent. In this study, the level of common toxic heavy metals viz. Pb, Cd and Cr in food crops, soil of their cultivation field and their pesticide and fertilizer, and from two highly cultivated district e.g. Bogra (site A) and Norshindi (site B) of has been investigated. In total 22 crop, 12 soil, 26 fertilizer and pesticides were collected and processed according to standard developed method to analyze using GF-AAS and F-AAS. The range of concentration (mg/Kg) of heavy metals in site A for Pb, Cd and Cr were found <0.2-0.86, <0.06-1.18, <0.7-4.58 in fertilizer and pesticide, 5.09-7.32, <0.7, 15.05-19.53 in soil, and <0.5, <0.2, <0.5 in food crops respectively. Whereas in site B, the level of Pb, Cd and Cr were found <0.2-5.53, <0.06, <0.7-6.59 in pesticide, 19.84-22.86, <0.7-0.72, 18.16-23.74 in soil, and 0.11-1.35, 0.021-0.138, <0.05-0.28 in food crops respectively. The level of heavy metals was higher in site B in comparison to site A. But the concentration of heavy metals in all food crops were under the permissible limit according to SEPA and WHO. Bioaccumulation factors for food crops were obtained in the order of Cd>Pb>Cr. Hazard Quotient for adult and children was less than 1. This indicates the consumption of food crops grown in the selected soil sites are nearly free of risks.

ES-06: Design and Development of an Industrial Chiller for Heat Removal in Process Plant Operations

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Heat removal from many process plant operations is necessary to obtain proper product quality or for achieving required process conditions. In regular laboratory works often huge amount of valuable water is wasted for cooling where the water is not recycled. Heat removal and saving of resources during process operation holds considerable importance. According to the objective of a R&D project to design and calculate parameters for a cooling unit various cooling tower, industrial chiller models were studied. Amidst the Numerous options and custom design solutions to meet a wide range of process cooling needs an industrial chiller model was selected for the project. Industrial chillers are classified as a refrigeration system that cools a process fluid or dehumidifies air in commercial and industrial facilities. The refrigeration cycle contains four major components: the compressor, condenser, expansion device, and evaporator. Refrigerant remains piped between these four components and is contained in the refrigerant loop. After selection of the model the basic four components and their parts were collected, fabricated and assembled following design needs. For better performance and control a temperature controller on the unit was installed so that if a desired water temperature is set, then it will heat or cool as necessary to maintain that temperature.

ES-07: Assessment of Contamination Level, Pollution Risk and Source Apportionment of Heavy Metals in the Halda River Water, Bangladesh

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This study demonstrates the level of heavy metal pollution in the Halda River, the only natural breeding source of carps in Bangladesh. Water was collected from 12 different sampling points along the Halda River. Water at various locations was found satisfactory in terms of the assessed physicochemical parameters (pH, electrical conductivity, and total dissolved solids). The presence of various cations and anions was also studied using ion chromatography. Atomic absorption spectroscopy was used to identify and quantify various heavy metals in the collected water samples. Among the heavy metals, Cd, Cr, Fe, Pb, Cu, and As concentration exceeded the safe limit suggested by WHO. The calculated heavy metal pollution index and metal index were found higher than the critical index value. The single-factor assessment (P i) and Nemerow's multi-factor index (P N) of heavy metals was calculated to find out the degree of pollution in the Halda River. The maximum values of P i (Cd), P i (Pb), P i (As), P i (Cu), and P i (Cr) were determined to be 26.67, 260.00, 17.00, 208.76 and 2.80 respectively. The

maximum value of P N was found to be 289.04. The discharge of effluents from various large and small industries near the Halda River is considered to be the major source of the identified heavy metals. Multivariate statistical analysis such as principal component analysis, Pearson correlation matrix and cluster analysis revealed that most of the heavy metals originated from different anthropogenic sources. Multivariate analysis also showed that Co, Mn, Cu, Cr, Pb, Cd, NH4 þ, NO3 - mainly came from artificial sources whereas Fe, Ca, As mainly originated from natural sources. Arsenic (As) also came from artificial sources with Cu.

ES-08: Heavy Metal Contamination from Soil to Vegetables: Case Study at the Industrial Zones of Dhaka District, Bangladesh

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In recent times, vegetable fields are being reported to be significantly affected by heavy metal contamination from various sources including industrial waste, traffic, pesticides, herbicides and so on. The present study evaluates the concentration of heavy metals in three different vegetables species and the soil of their cultivation field from three industrial area around the capital of Bangladesh, Dhaka. The study aims to observe the role of soil in the suspected heavy metal contamination of vegetables along with the estimation of the associated risks. In this study, eight toxic metals (Pb, Cd, Cr, As, Cu, Ni, Mn and Zn) has been assessed in 18 vegetable samples and 18 soil samples of eighteen different sampling sites using atomic absorption spectrometer (AAS). The average value of Pb, Cd, Cr, As, Cu, Ni, Mn and Zn in different agricultural soil samples are 89.2±5.71, 0.35±0.01, 65.4±7.76, 3.46±0.19, 33.7±2.03, 317±11.4, 473±79.4 and 96.7±13.5 mg/Kg respectively. On the other hand, in different vegetables sample the average of Pb, Cd, Cr, As, Cu, Ni, Mn and Zn are 0.48±0.02, 0.04±0.001, 0.14±0.01, 0.01±0.0002, 0.62±0.03, 1.38±0.05, 2.27±0.18 and 5.11±0.47 mg/Kg (fw basis) respectively. The trend of concentration of metals in soil and vegetables are almost same indicating the role of soil in vegetable contamination. Potential ecological and human health risk has been assessed through enrichment factor (EF), contamination factor (Cf_i), geoaccumulation index (Igeo), pollution load index (PLI), toxic unit analysis, chronic daily intake through exposure pathway, hazard quotient, and hazard index. The indexes portray various perspectives of soil led vegetable contamination and the associated human health risks.

ES-09: Seasonal Variation and Chemical Characterization of Ambient Fine Particulate Matter at an Industrial Area in Dhaka City

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Respirable fractions of airborne ambient particulate matter (PM), specifically those fractions that are less than 2.5 μm ($PM_{2.5}$) in size, have been identified as potential health concerns for the general public. So, Air quality monitoring data is a key component to understand extent of problem and to develop strategies for reducing air pollution. In this research work, particulate matter (PM) sampling was done between march 2019 to February 2020 at an industrial site in Dhaka city .PM sampling was performed using a GENT sampler, which collects samples in two size fractions: $PM_{2.5}$ and $PM_{2.5\text{-}10}$. A total no of 89 fine samples were analyzed for mass, black carbon (BC) and elemental compositions by using a Thermo Scientific ARL QUANT'X energy dispersive X-ray fluorescence spectrometer (ED–XRF). From the chemical characterization a total no of 17 elements (Na, Mg, Al, Si, S, Cl, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Zn, Br, and Pb) were identified in $PM_{2.5.}$ Seasonal variations of $PM_{2.5,}$ BC and $PM_{2.5}$ bound trace elements were also studied. Source apportionment was done by using both the multivariate statistical techniques and positive matrix factorization (PMF) methods. This study revealed that the possible sources at the study area are brick kilns, soil dust, road dust, motor vehicle, fugitive Pb, biomass burning and sea salt sources. Trajectory based analysis was also performed for the source apportionment of fine particulate mass concentrations. The Potential Source Contribution Function (PSCF) model and Concentration-Weighted Trajectory (CWT) method were used to evaluate the transport pathways and Potential Source Areas (PSA) of $PM_{2.5}$ in Dhaka city.

Session (IVA): Nanomaterials-I

IT-IVA: Modulation of metal-insulator transition properties in the three-dimensionally controlled nano-micro space

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VO_2 (vanadium dioxide), which is one of the strongly correlated metal oxides, has the potential to befabricated as a thermal trigger because of the characteristics of metal insulator transition (MIT) aroundthe room temperaturewith a change in conductivity of several orders of magnitude. For thermal triggers, the tunable MIT properties expands deviceapplication scenarios. Despite this strong motivation, a phase-separation, i.e., the coexistence of metal domains and insulator domains through the MIT [1] hamper the understanding of phase transition mechanism. In the phase separation in the macro-size samples, such as VO_2 thin films, metallic and insulating domains with a huge difference in conductivity are randomly mixed; the domains have a fractal nature near the transition temperatures. To understand the exotic properties of the nanoscale electronic domain, the investigation on the spatially-confined VO_2 sample isindispensable to identify the properties of domains [2]. In this research, in order to clarify the MITbehavior affected by the planarly confinement effect, the MIT process of VO_2

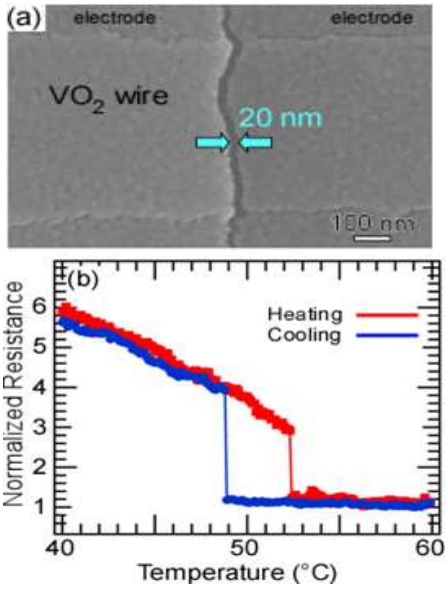

Fig. 1(a) Typical SEM image and (b) normalized *R-T* curve for the VO_2wire with *W* of 600 nm and *L* of 20 nm.

micron structures wassystematically studied, and the phenomenon of the phase transition properties change depending onthe confined VO_2 structures size was found.

The VO_2 wire structure with controlled width (*W*) and length (*L*) were produced from the epitaxially grown VO_2 thin films. The MIT behavior was investigated by two proberesistivity depending on the temperature change (*R-T*). Figures1 show typical *R-T* curve from the VO_2 wire sample with *W* of 600 nm and *L* of 20 nm. Interestingly, one-step rapid resistivity changes were observed in both the heating and cooling processes, in contrast to the continuous changes in a macroscopic VO_2 film sample. These one-step resistivity changes indicate the occurrence of the nano-confinement effect; the isolation of a single domain into a nano-space of 600 nm × 20 nm was realized [3]. The step numbers in the *R-T* curve, i.e., sharpness of MIT, and transition temperature changed with the sample size change. This result implies that the MIT properties weremodulated by virtues of the spatial confinement. We proposed a statistical transition model to describe the correlation between the domain behavior and the observable *R-T* curve. In the presentation, we will show thedetails and discuss the mechanism not only for VO_2 but also various strongly correlated oxides.

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[2]S.Tsubota*et al*.,*Appl. Phys. Express***10**, 115001 (2017).
[3] A. N.Hattori *et al.*,*Crystals***10**, 631 (2020).

NM-11: Colour-tunable Light-emitting Diodes Based on Ga-doped ZnO Nanorods

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Fabrication of nanorod-based devices is drawing attention for photonic devices because of immense light extraction efficiency; however, poor electrical injection into undoped ZnO nanowires hinder their practical applications in solid state lighting. Here, we demonstrate that ZnO nanorods doped with Ga dopant exhibit excellent optical and electrical properties and can be electrically integrated into Si-based photonic devices. Significantly the Ga doping was found to remarkably improve the nanorod crystallinity and reduce point defect densities of ZnO. The light emitting diodes (LEDs) fabricated from undoped ZnO nanorods/p-Si show yellow emission at 2.05 eV. The incorporation of Ga in ZnO nanorods quenches the yellow emission and exhibits a strong red emission at 1.78 eV. These Ga-doped ZnO nanorod based LEDs possess a remarkable enhanced light emission performance and an order of magnitude higher luminescence compared to the pristine LED devices. Our results point to a cost-effective route for large-area fabrication highly conductive and single-crystalline Ga-doped ZnO nanorods for chromaticity stable and colour-tunable LEDs.

NM-12: Titanium di Oxide (TiO_2) Based Nanostructure: Synthesis, Characterization and Photocatalytic Application

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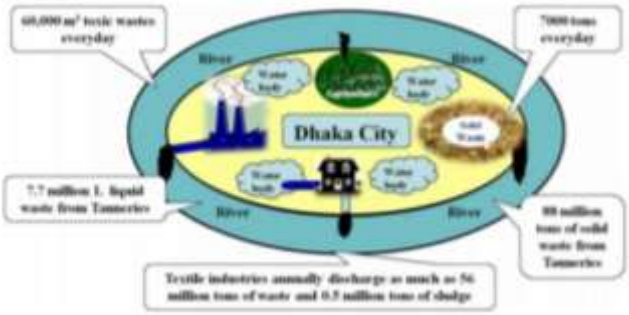
Bangladesh is one of the most populous countries in the world, facing challenges in its every aspect. Industrialization has accelerated in more recent years. Industrial sector now contributes more than 28% of the Gross Domestic Product (GDP), from around 11 per cent in the mid-1970s. According to the



Bangladesh Economic Review, manufacturing remained the largest sub-sector contributing to 17.78% of the GDP in 2009-10. Among them more than 58% are concentrated in and around Dhaka city. Textile industry uses large quantity of water in its production processes and highly polluted and toxic waste waters are discharged into sewers and drains without any kind of treatment. The textile dyeing industries of generate large amount of effluents, sewage sludge and solid waste materials everyday which are being directly discharged into the surrounding channel, agricultural fields, irrigation channels, surface water and these finally enter in to water bodies and ultimately goes to food change and living lifer various severe including carcinogenic disease.

Fig. 1 Solar hydrogen production from water using a powdered photocatalyst.

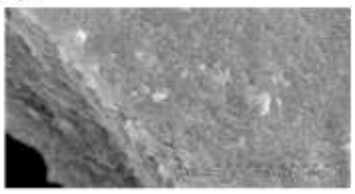


Fig. 3 SEM Images of as synthesis catalyst insets white sample are pure TiO2.

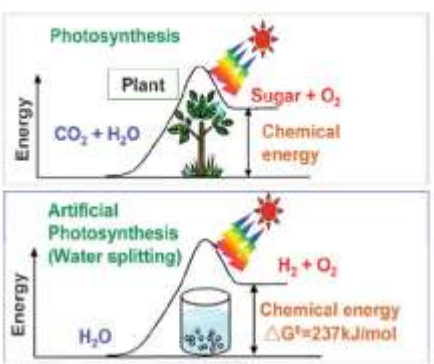


Fig. 2 Photosynthesis by green plants and photocatalytic water splitting as an artificial photosynthesis.

Fig.4 Results of waste water degradation/ and purification technique.

Extensive research is urgently need to treat this waste water for recycling and re storing and reusing this water for agricultural and fisheries sector as well as many other sector. Among the various treatment technique catalytic decomposition of industrial waste water is very important. Recently various polymorph of TiO_2 is play vital role for degradation of waste water as well as reduction CO_2 which is ultimately impact on climate change as well as global warming. In this experiment we chose methylene blue and 4CP as a model dye. As synthesis TiO_2 more than 70% highly efficient compare to commercial catalyst. XRD, TEM, SEM, GC, Solar simulator are used for detailed structural characterization and application.

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2. **Hossain, M. K**.; Akhtar, U. S.; Koirala, A. R.; Hwang, I. C.; Yoon, K. B. Steam-assisted synthesis of uniformly mesoporous anatase and its remarkably superior photocatalytic activities. Catal. Today **2015**, 243, 228.

NM-13: Enhanced Solar Light Driven Photocatalytic Activity of Gd^{3+} Doped Bismuth Ferrite Nanostructures

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In this investigation, 10% Gd doped $BiFeO_3$ (BGFO) nanoparticles were successfully synthesized by a facile hydrothermal technique at a lower reaction temperature of 160 °C. The physicochemical properties of the as-synthesized samples were evaluated following several characterization techniques. The Rietveld refinement of the X-ray diffractometry data revealed rhombohedral crystal structure with R3c space group, which was further validated by the Furrier transform infrared and Raman spectroscopy analyses. Both bright field transmission electron microscopy (TEM) and high-resolution TEM imaging were carried out to determine the size and inter-planar spacing of the synthesized nanoparticles. UV-visible diffuse reflectance spectroscopy result affirmed the reduction in the band gap from 1.95 to 1.18 eV due to Gd substitution. The photoluminescence spectra indicated lower intensity in the doped sample, signifying reduction in the recombination rate of the electron-hole pairs. The photocatalytic response of the nanostructures was examined for the degradation of industrial dyes; rhodamine B (RhB), methylene blue (MB) and pharmaceutical pollutants; antibiotic ciprofloxacin (CIP), levofloxacin (LFX) under solar irradiation. The enhanced photocatalytic activity of BGFO was attributed to the strong absorption of visible light, reduction in the optical band gap and the effective separation of photoinduced charge carriers. Moreover, the stability and long-time reusability of the sample was also examined by five recycles for the photodegradation testing of the pollutants. Based on the experimental findings a possible photocatalytic mechanism was critically discussed and the results suggested the potential application of the synthesized nanostructures as an efficient photocatalyst to remove various organic dyes and pollutants under solar irradiation.

NM-14: Annealing Effect on the Soft Magnetization and Structural Grain Growth and Nanocrystalline $(Fe_{0.9}Co_{0.1})_{73.5}Cu_1Nb_3Si_{13.5}B_4$ Metallic Glass

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The particular structure of a metallic glass with composition $(Fe_{0.9}Co_{0.1})_{73.5}Cu_1Nb_3Si_{13.5}B_4$ is essentially related to nanocrystalline formation in the amorphous and annealed state. The sample has been formed from the high purity gradients by melt spinning technique and their amorphous nature is confirmed by XRD. Metallic glass alloy has been annealed in a controlled way in the temperature range in between 400℃ to 650℃ for constant holding time one hour. The thermal analysis obtained from DTA scan reveals the primary crystallization α-FeCo(Si) phase of metallic glass and nanocrystalline state and is evaluated with XRD. The optimized evaluation of α-FeCo(Si) and their size, determined from line broadening amount is the crystallization temperature. Grain size has been obtained in the range between 12-15nm for annealed temperature range of 500℃ to 600℃. The saturation magnetization (M_s) initially decreases with increasing annealing temperature and again increases the M_s with further decreases that may be connected with the enrichment of the residual amorphous phase with Nb which causes weakening the coupling between ferromagnetic nanograin. Small applied field is sufficient to produce M_s that means nanocrystalline thermal state also magnetically soft.

NM-15: Synthesis and Structural Characterization of $R_{2-x}B_xMn_2O_6$ and $R_{1-x}B_xMnO_3$ (R= La, Sm and B= Ca, Sr) Nanoparticles

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$R_{2-x}B_xMn_2O_6$ and $R_{1-x}B_xMnO_3$ (R= La, Sr and B= Ca, Sr; x= 0.00, 0.025, 0.05, 0.075, 0.1) nanoparticles systems were prepared by the sol-gel and sol-gel combustion method respectively using citric acid as fuel and water as solvent. The samples after calcination at 800°C were characterized by X-ray diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) to examine the structural and vibrational/electronic properties. The XRD study demonstrates the single-phase crystalline high purity of the perovskite. The FTIR spectra showed two transmission band in the range of 352-608 cm^{-1}. The first band is probably due to the bending vibrational mode, at about 352.11-370.16 cm^{-1}, which is susceptible to the bonding angle M-O-M and the second band is due to the stretching vibrational mode, at about 570.58-608 cm^{-1} giving an evidence for the formation of M-O bond that are attributed to a characteristic vibration of the ABO_3 perovskite..

NM-16: Study of Magnetic Hyperthermia Effect and Verwey Transition of Iron Oxide (Fe_3O_4) Nanoparticles Synthesized via Thermal Decomposition and Chemical Co-precipitation Method

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Superparamagnetic Iron oxide nanoparticles (SPIONs) has versatile application in biomedical science which requires control over shape and size distribution. Thermal decomposition is one of the best methods for controlling the size distribution, and shape of produced NPs. The size distribution can be tuned ($5 - 30nm$) by varying the reaction environment such as precursor concentration, solvent amount, temperature ramp, and reflux time. Iron oleate was used as a precursor solution and heated up to reflux temperature (310 $^{\circ}$C) for different time lengths (2,10, and 30 minutes) within the oxygen-free environment. The XRD pattern confirmed the formation of nanoparticles ($17 \pm 2.45nm$). TEM image showed the particle size ($29 \pm 4nm$) and shape (moderately cubic) distribution. Magnetic properties such as saturation magnetization, coercivity, and remanence were calculated using the Physical Properties Measurement System (PPMS). Verwey transition was identified from magnetization vs temperature plot and FC-ZFC data analysis. The bonding and oleic acid surfactant were confirmed from FTIR data analysis. The hydrophobic phase was transferred to the hydrophilic phase using cetyltrimethylammonium bromide. The as-synthesized SPINOs were mixed with CTAB solution and alternatively vortexed and sonicated 10 times (each time 10 minutes) to transfer the phase. FTIR data exhibited the exchange of ligand. The hyperthermia heating of NPs was measured for different concentrations of NPs (0.25, 0.5, 1, 2, and 4 *mg/ml*) from which specific loss power (SLP) was calculated. From these SLP values, the optimized concentration was identified.

NM-17: Synthesis and Characterization of Nickel Oxide Decorated Molybdenum Disulfide Nanomaterials for Energy Storage Application

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We can synthesize nanomaterials to change their characteristics in such way that its advantages are maximized exponentially and their drawbacks can be minimized as well. Here, in a facile hydrothermal method we synthesized MoS_2 from Sodium Molybdate Dihydrate, Thiourea and NiO was fabricated from Nickel Nitrate Hexahydrate and Urea. To modify the characteristics

of the MoS_2 we synthesized MoS_2/NiO composites via same technique by varying the concentrations (2,5,8 and 12 weight percent) of NiO. After successful synthesis the different features of the as-synthesized nanocomposites such as structural, optical, chemical and electrochemical properties were identified by X-ray diffraction (XRD), Field Emission Scanning Electron Microscope (FESEM), UV-Vis spectroscopy, and Three electrode electrochemical workstation, respectively. The investigation of crystallinity, structure and micromorphology was carried out through XRD and FESEM. The high crystallinity traits with all major characteristic peaks are confirmed from XRD analysis. The taken images of FESEM confirms the flower like shape of the MoS_2 and it is also confirming that the flower like shape is quite stable with the varying concentrations of NiO. We can ensure the prominent presence of the NiO in the composites from EDS spectra. The measurement of optical bandgap is calculated by Kubelka-Munk function from the UV-vis spectroscopy data. The investigation of specific capacitance, current density, power density, electrochemical impedance spectroscopy and the variation in these traits with changing weight percentages was performed by the three-electrode electrochemical workstation. MoS_2/NiO nanocomposites with improved and tunable physical properties synthesized from a simple and economic route may pave a new horizon for electrochemical and photocatalytic materials.

NM-18: Dextran Coated Co-Mg Ferrite Nanoparticles: Investigation as temperature sensitive drug carriers

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Polymer coated magnetic nanoparticles have great potentials as prospective drug carriers in cancer treatment to minimize anti-cancer drug build-up in healthy tissue. In this study, we are working on Magnesium substituted Cobalt Ferrite $Mg_xCo_{1-x}Fe_2O_4$ ($0.0<x<1.0$; $\Delta x=0.1$) nanoparticles to use as drug carriers. The nanoparticles have been coated with dextran to increase biocompatibility and this coating is validated by Fourier Transform Infrared (FTIR) Spectroscopy. According to Dynamic Light Scattering (DLS) results, the coated particles have a hydrodynamic diameter of less than 250 nm on average and the polydispersity index value of each sample is less than 0.3 at room temperature. Doxorubicin, a chemotherapeutic drug, has been loaded on the coated sample which is confirmed by FTIR. Drug loading percentage has been observed using High Performance Liquid Chromatography (HPLC) and reconfirmed with UV spectroscopy. The samples with higher Magnesium content exhibit greater drug loading capacity. The drug release pattern over time has been observed at 37°C and 42°C separately. For each sample, higher temperature results in increased drug release. The high extent of drug release within hyperthermia temperature range implies that dextran coated Co-Mg ferrite nanoparticles are promising candidates as efficient drug carriers.

NM-18: Step Annealing Effect of crystallization Behavior and Transport Properties of $Fe_{30}Ni_{50}B_{20}$ Metallic Glass Ribbon

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Grain size formation with composition $Fe_{30}Ni_{50}B_{20}$ metallic glass alloy has been investigated in the amorphous and annealed states. The sample has been prepared from high purity in gradients by rapid solidification technique and their amorphous nature confirmed by XRD. The samples were annealed in a controlled way in temperature range of 200°C to 400°C for a constant annealing time at 1 hour and 30 minutes. When the samples were annealed at 350°C, it retains its amorphosity and displays a large peak at 400°C, which is a diffusion hallow, showing the temperature of the onset of crystallization. The structural properties such as grain size and Ni (%) in the amorphous matrix have been changed with increasing the annealing temperature. The XRD pattern at the intensity of a fundamental reflection becomes gradually stranger as the annealing time and temperature are increases. The increase in the sharpness of the intensity peaks with the different annealing time and temperatures indicates that crystalline volume fraction as well as grain size increased. The complex permeability of these samples is measured as a function of frequency in the range 1 KHz to 120 MHz using impedance analyzer. Step annealing effect on initial permeability loss factor and relative quality factor has been measured annealing temperature in the range 200^0C to 400^0C. The highest permeability of the optimum crystalline size of these samples has been observed due to effective anisotropy resulting from grain size effect due to strong magnetic couplings.

Session (IX): Physics Education

PE-01: Which is more elastic? Iron, or Rubber?

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Science education is preponderantly conceptual in nature and itaims to develop scientific concepts of natural phenomena in students. However, students' understandings of particular concepts are not always aligned to scientifically accepted notions in that area. This hinders their further science learning. This study explored undergraduate students' concepts of elasticity. Different types of concepts students hold on this topic, the relation of their concepts of elasticity and force, and sources of their alternative concepts of elasticity were explored.

An explanatory sequential mixed methods design was followed to conduct this study.

In the first phase, both quantitative and qualitative data on students' concepts were collected from 100 undergraduate students from five courses of studies with a semi structured questionnaire. In the second phase, based on questionnaire responses, 12 students were selected for two FGDs to further explore their concepts and sources of these concepts. Moreover, 4 higher secondary physics teachers and 3 subject experts were interviewed. Furthermore, 8 higher secondary physics textbooks were analyzed. Quantitative data were analyzed using descriptive analysis and thematic analysis was used for qualitative data.

The findings reveal that students from all courses of studies have the Iron-Rubber dilemma. Moreover, 23% students have Lack of Knowledge (LK) and 40% have Alternative Conceptions (AC). Only 37% students have Scientific Concepts (SC) of elasticity. There is no significant difference in the pattern of these concepts hold by students based on their gender, college location, HSC passing year, optional subject choice and preference of the chapter. Moreover, students'level of understanding of elasticity is weakly related to their understanding of force. This study also reveals that textbooks, teacher's concepts and language are major sources of student's alternative concepts. Most of the higher secondary Physics textbooks approved by NCTB provide scopes to develop misconceptions or reinforcethe concepts students develop from their daily life experiences. Moreover, Teachers lack sophisticated knowledge of the concept and the word 'Elasticity' have different meanings in physics and in daily life use of the word.

The findings of this study on students' concepts have implications for teachers, teacher educators, textbook writers, curriculum developers, and the textbook approval authority in terms of practice and policy development.

PE-02: A Research Proposal for Pedagogical Analysis and Development on Quantum Mechanics

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Quantum mechanics providing physical sciences with mathematical-physical model with extreme accuracy; its interpretation in terms of everyday experiences cannot be easily provided, and historically as well as present "physical" or "philosophical" Interpretations of quantum mechanics being not as solidly grounded as its theories, implies lack of common agreement among the scientists of past and future alike. Unfortunately, this counter-intuitivity is inadvertently implied as lack of rigor and logic in quantum mechanics by Fresh learners of the subject, discouraging them from conceptual learning of rigor, method and understanding of basic formulae of quantum mechanics that have direct and practical application. Students, being compelled to believe the subject cannot be conceptually learnt (not only the physical interpretation which is realm of philosophers, but also logical progression of formulae and equation), tend to cram the subject only for exam, not only hampers learning process but also

leaves no permanent understanding on the subject which hampers interpretation of formulae related to quantum mechanics at research article that have direct practical consequence.
In this research proposal, a collaborative conceptual framework and interdisciplinary approach towards teaching quantum mechanics, particularly aimed to university freshmen have been proposed that can potentially help students to conceptualize rigor and methodology of quantum mechanics applicable to their future research without falling prey to phobia of counter-intuitiveness, jargon and philosophical interpretation of aforementioned subject.

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INVITED & CONTRIBUTTORY ABSTRACTS FOR POSTER PRESENTATION

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PP-01: Relativistic Study on the Scattering of $e^{\pm}$ from Neutral Aluminum Targets

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The current study investigates the scattering of electron (e^-) and positron (e^+) from neutral aluminum atom using Dirac's relativistic partial wave analysis. For describing the scattering phenomena from neutral aluminum atoms, a short range complex optical potential is employed, which includes static, polarization and exchange (for electron projectile) potentials. Calculations are performed for the differential cross section (DCS), integrated elastic cross section (IECS), momentum-transfer cross section (MTCS), viscosity cross section (VCS), inelastic cross section (INCS), grand total (elastic + inelastic) cross section (TCS) and total ionization cross sections (TICS) over the energy range $1\ \text{eV} \leq E_i \leq 1\ \text{MeV}$. The Sherman function S and spin asymmetry parameters T and U are also predicted for the same scattering systems over the same energy range. In addition, we study the critical minima (CM) in the distribution of elastic differential cross sections as well as the associated maximum spin polarization (MSP) points in the Sherman function. We also compute the inelastic mean free path (IMFP), elastic mean free path (EMFP), momentum-transfer mean free path (MMFP), viscosity mean free path (VMFP), and total mean free path (TMFP) for the aforesaid scattering system across the specified energy range.

In total, we observed 3 deep minima positions for electron scattering and only 1 minimum for positron scattering. The DCS, in all of these deep minima positions, attains its smallest values. The present study also reveals 5 MSP points for electron scattering and 2 MSP points for positron scattering. And all these MSP points found to be correlated with the deep minima in terms of incident energy and scattering angles. However, at the observed deep minima, the direct amplitude always overrides the magnitude of their spin-flip counterpart. To the best of our knowledge, there is neither any experimental nor any theoretical study on critical minima of $e^{\pm} - \text{Al}$ scattering available in the literature. A comparison of our observations to previous theoretical and experimental studies reveals a decent consistency over the compared energy range. The present theoretical method is thus expected to be useful for the fast generation of accurate cross sections needed in the areas of science, technologies and industries.

PP-02: Half-metallic behavior with high magnetic moment of half-Heusler alloys MCrPb (M = Hf, Zr): insights from DFT

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Half-Heusler alloys MCrPb (M = Hf, Zr) are studied utilizing the Full Potential-Linear Augmented Plane Wave (FP-LAPW) method as implemented in the WIEN2k code in the context of density functional theory (DFT). Both the alloys exhibit band gap in the up-spin states, while the down-spin states are conducting, revealing half-metallic nature of the alloys. The total magnetic moment is found to be around 4 μ_B, indicating that the alloys are ferromagnetic. The alloys overall electronic and optical characteristics support their potential for spintronics applications.

PP-03: Structural, electronic, magnetic and optical properties of full-Heusler alloy Zr_2NiB

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The structural, electronic, magnetic and optical properties of Zr based full-Heusler alloy Zr_2NiB was studied using the pin-polarized full- potential linearized augmented plane wave (FP-LAPW) method based on Density Functional Theory (DFT). The optimized lattice parameter was estimated to be 6.266 Å. Our study revel that for the alloy, both the spin up and spin down states are conducting, demonstrating the alloy o be in metallic nature. The total magnetic moment of this alloy is 0.99 μ_B, indicating the alloy is ferromagnetic. Optical properties such as dielectric tensor, reflectivity, refractivity, absorption coefficient, optical conductivity was also calculated.

PP-04: Electronic and Optical properties of Nb doped rutile TiO_2: A DFT study

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In this work, we have studied the effects of doping of transition metal, Niobium (Nb), within rutile TiO_2 containing weight ratios 6.25%, 12.5%, and 25%. The changes, due to the doping, in electronic and optical properties were studied in the ultraviolet-visible range. Full Potential Linear Augmented Plane Wave (FP-LAPW) method based on Density Functional Theory (DFT) is implemented. We used both PBE-GGA and TB-mBJ exchange-correlation functional in solving Kohn-Sham equation as incorporated in the WIEN2K code. TiO_2 is mainly an UV light absorber but when Nb is doped in different ratios, its absorptivity increases in the visible

region. TiO_2 shows non-metallic behavior when it is pure. However, as a result of Nb doping the system turns to be metallic increasing the conductivity of the doped system.

PP-05: Comprehensive ab-initio insights into the mechanical, optoelectronic, thermo physical, and lattice dynamical properties of binary $BaGa_2$ compound

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In the present study we have explored the structural properties, electronic structures, elastic constants, acoustic behavior, phonon dispersion, optical properties lattice dynamics and thermophysical properties of binary $BaGa_2$ materialin detailsvia first-principles calculations using the density functional theory (DFT). The electronic band structure and density of states calculation reveal metallic nature. The minimum thermal conductivities and anisotropies of the compound are calculated. The elastic constants, phonon dispersion calculations show that the compound is both mechanically and dynamically stable. A comprehensive study of elastic constants and moduli shows that $BaGa_2$ possesses fairly isotropic mechanical properties, reasonably good machinability, brittle/ductile nature, low Debye temperature and melting temperature. The present investigations are expected to provide some valuable references for further exploring the properties of $BaGa_2$ compound. Moreover, the chemical bonding is interpreted by calculating the electronic energy density of states, electron density distribution, elastic properties and Mullikenbond population analysis. Which indicates the mixed bonding characteristics with ionic and covalent contributions. The reflectivity spectra show strong anisotropy behavior in the visible to mid-ultraviolet regions. High reflectivity over wide spectral range makes $BaGa_2$ suitable as reflecting coating. $BaGa_2$ is an efficient absorber of ultraviolet radiation. The compound is moderately optically anisotropic owing to the anisotropic nature of the electronic band structure. The refractive indices are very high in the infrared to visible range. All the energy dependent optical parametersshow metallic features and are in complete accord with the underlying bulk electronic density of statescalculations.

PP-06: The electronic, magnetic and optical property of Lanthanum Phosphide and Cerium Phosphide using first-principle calculation

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The full-potential linearized augmented plane wave approach (FP-LAPW) based on density functional theory is used to analyze XP's (X =La, Ce) electrical, magnetic, and optical

properties. The exchange correlation potential is approximated using PBE-GGA and TB-mBJ functional. There are two types of structures used in the calculations: rock salt (RS) and zinc-blende (ZB). In both magnetic states, the ferromagnetic phase is more stable than the non-ferromagnetic phase. In the ferromagnetic phase of ZB type structure, the direct band gap highlights XP's semiconducting capabilities. XP's semiconducting behavior is very intriguing as they are vital in current electronics. In addition, the predicted optical parameters like the dielectric function, refractive index, reflectivity, absorption coefficient and conductivity show XP's potential to fabricate optoelectronic devices.

PP-07: Quantum Gravitomagnetic Clock Effect for Spinning Particle Orbiting Kerr Black-Hole

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We present a quantum version of the gravitomagnetic clock effect for a spinning test particle orbiting in a circular equatorial orbit of Kerr black-hole in the presence of spin-curvature interaction, where spin of both test particle and black hole are parallel and small. We transfer gclock effect from classical mechanics to quantum mechanics with the help of Bohr's correspondence principle. We use quantum formalism in classical gravity, that is why the result holds for a semi-classical regime. Our finding matches with the classical one for spinning particles, and shows that the quantum gravitomagnetic clock effect reduces or even disappears completely with the presence of the spin of the test particle.

PP-08: Half-metallic behavior of SmP in the zinc-blende structure is revealed by first-principles study

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The full-potential linearized augmented plane wave approach based on density functional theory is used to estimate electronic and magnetic properties of SmP. The spin-polarized calculation shows that SmP is stabilized in the zinc-blende structure as a true half-metallic ferromagnet with a magnetic moment of 5 μB per formula unit. Also, optical properties like dielectric function, reflectivity, energy loss function, absorption coefficient and optical conductivity were estimated for SmP in the zinc-blende structure. According to the findings, SmP could be a promising candidate for spintronic and optoelectronic device applications.

PP-09: Relativistic Massless Simple Harmonic Oscillator in Dirac Equation

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In physics, the study of simple harmonic oscillator is of greatimportance, since in both macroscopic andmicroscopic world, any system in minimum potential behaves exactly like the one. Theinvestigation ofenergy spectrum of simple harmonic oscillator usingDirac equation has been done under manyconditions, but according toour knowledge, it has not been done for relativistic massless simpleharmonic oscillator in Dirac equation. This paper offers simple, analyticsolution of Dirac equation in threedifferent dimensional cases where theparticle is massless and act as relativistic simple harmonicoscillator, which give us a better understanding of its state and behavior.

PP-10: A DFT investigation of the effect of metals (Ag, Au, Cu) on the charge transport characteristics of BCP-metal complexes

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Bathocuproine (BCP) is a promising organic compound for use as a hole-blocking or electron-transporting layer in organic light-emitting diodes (OLEDs) or organic photovoltaic cells (OPVs). In this study, the effects of adding metal atoms (such as Ag, Au, and Cu) on BCP-metal complexes were investigated utilizing quantum chemical approach. We analyze a range of metrics for BCP and BCP-metal complexes, including frontier molecular orbitals, electronic structures, reorganization energies, and charge transfer rates. The molecular geometries of BCP-metal and their cationic and anionic states were optimized using the APFD\LanL2MB functional. Because of the material's unique properties, unoccupied electronic states play a crucial role in electron transport. The frontier molecular orbital shows the LUMO and LUMO+1 levels of the complex are almost degenerated and have little population on the metal atom. In contrast, the HOMO of the BCP-metal complex is localized on metal atoms. The presence of a metal atom on BCP results in a considerable reduction in the band gap, with the BCP-Cu complex having a band gap of 1.66 eV, compared to BCP's band gap of 5.13 eV. The ionization potential, electron affinity, and optical properties are all examined in detail. In terms of optical absorption, BCP-metal has the highest peak at around 4.4 eV, while BCP has the highest peak at about 6 eV. The Marcus formalism is used to calculate the charge transport properties. The hopping rate of BCP-Cu's is nearly identical to that of BCP, but the transfer rates of the other two complexes are significantly lower. The investigation of the overall molecular composition, reorganization energy, and charge transport features of frontier

molecular orbitals would be beneficial in determining their applicability as an electron injection, hole-blocking, and electron-transporting mechanism.

PP-11: Investigating the Origins of Quantum Indeterminism

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The indeterministic nature of quantum mechanics has puzzled scientists for decades. In this paper we investigate the boundary at which determinism begins to fade. We analyse the quantum Venn diagram paradox and the Elitzur-Vaidman approach on interaction free measurement to understand how quantum particles exhibit their probabilistic nature. We study the relationship between Bell's theorem and the possibility of realism in quantum mechanics. Finally, we invoke Bell's theorem to explain the arguments supporting "no-hidden-variables" theorems. Using this explanation, we assess the search for hidden variables which is pivotal in understanding the intrinsic indeterminism of quantum particles.

PP-12: Density functional theory based ab-initio insights into the pressure dependent physical properties of Mo_3P

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Tri-molybdenum phosphide (Mo_3P) is a tetragonal low-T_c superconducting compound. In this work, we have studied the structural, elastic, mechanical, thermal, electronic, and optical properties of Mo_3P at various pressures in details via first-principles method using the density functional theory (DFT). The unit cell of the compound is optimized at various pressures. The six independent elastic constants (C_{11}, C_{12}, C_{13}, C_{33}, C_{44}, and C_{66}) are calculated for each pressure value which satisfy all the elastic and mechanical stability criteria. Mo_3P possesses very low level of elastic anisotropy, reasonably good machinability, ductile nature and relatively high Vickers hardness with a low Debye temperature and high melting temperature. The electronic band structure shows that Mo_3P has no band gap and exhibits conventional metallic behavior. The chemical bonding is interpreted by calculating the electronic energy density of states, electron density distribution, elastic parameters and Mulliken bond population analysis. All the energy dependent optical parameters exhibit clear metallic behavior and are in complete accord with the underlying bulk electronic density of states calculations.

PP-13: Density functional theory based investigation of mechanical, electronic, optical and thermal properties of AC (A = Nb, Ta, Ti) binary metallic carbides

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Binary metallic carbides belong to technologically prominent class of materials. We have explored the mechanical, electronic, optical and some thermal properties of AC (A = Nb, Ta, Ti) binary metallic carbides in details employing density functional theory based first-principles method. Study of elastic constants and moduli shows that AC (A = Nb. Ta, Ti) possess low level of elastic anisotropy, reasonably good machinability, mixed bonding characteristics with ionic and covalent contributions, brittle nature and high Vickers hardness with high Debye temperature. The mechanical stability conditions are fulfilled. The bulk modulus and Young's modulus of TiC are lower than those of NbC and TaC. The hardness of compounds is estimated using a semi empirical hardness theory and it is found that AC (A = Nb, Ta, Ti) compounds are mostly hard compounds. The electronic band structures with high electronic density of states at the Fermi level reveal metallic character of AC (A = Nb, Ta, Ti) compounds. Unlike notable anisotropy in elastic and mechanical properties, the optical parameters are found to be almost isotropic. The optical absorption, reflectivity spectra, and the static index of refractive of AC (A = Nb, Ta, Ti) show that the compounds hold promise to be used in optoelectronic device sector. Debye temperature, melting temperature and minimum phonon thermal conductivity of the compounds under study are high and show excellent correspondence with the elastic and bonding characteristics. Calculated values of different thermal properties indicate that AC binary metallic carbides have the potential to be used as thermal barrier coating material.

PP-14: Structural, elastic and optoelectronic properties of $CaZn_2X_2$ (X = N, P, As) semiconductors: density functional theory based investigations

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We present herein a detailed first principles density functional theory (DFT) calculations to study the structural, elastic and optoelectronic properties of ternary semiconductors $CaZn_2X_2$ (X = N, P, As). The unit cell of all the compounds was optimized using generalized gradient approximation (GGA) and local density approximation (LDA). The obtained lattice parameters are in good agreement with the experimental data and other theoretical findings. With the optimized unit cell geometries of $CaZn_2X_2$ (X = N, P, As), the elastic constants were calculated using the GGA. From the computations we obtain six independent elastic constants,

i.e., c_{11}, c_{12}, c_{13}, c_{14}, c_{33} and c_{44}. These elastic constants satisfy the mechanical stability criteria. HSE06 (hybrid) functional was also used to estimate the band gaps accurately. The electronic band structures show that $CaZn_2N_2$ has a direct band gap while $CaZn_2P_2$ and $CaZn_2As_2$ compounds possess indirect band gaps.

PP-15: Effect of hydrostatic pressure on elastic, electronic, and optical properties of $CaCuO_3$ and $SrCuO_3$ in comparison with superconducting $BaCuO_3$

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We investigate the hydrostatic pressure dependent elastic, electronic, and optical properties of newly hypothesized perovskite compounds $CaCuO_3$ and $SrCuO_3$ using first-principles method. The structural and mechanical stabilities have been established theoretically. The good machinability, ductile nature, high Vickers hardness and metallic character of these transition metal oxides have been confirmed by the calculation of elastic constants. Relatively low value of Young modulus possesses high thermal shock resistance and proclaim the materials to be a promising thermal barrier coating material. The minimum value of thermal conductivity, low thermal expansion coefficient, and comparatively high value of Debye temperature substantiate to be used the compounds as thermal management material. Both the compounds are elastically anisotropic and the elastic constants, moduli and Debye temperature can be seen as the monotonic function of pressure. The metallic characteristics of these compounds have been pointed out from the electronic band structure. Partial density of state shows the dominant behavior of Cu-3d and O-2p orbitals at the Fermi-level and it implies the subsequent good electrical conductivity. Significant response of the optical properties such as reflectivity, dielectric constant, optical absorption, and loss function with the change in pressure have been noted. High refractive index and high reflectivity in the infrared-visible spectra range show the large absorption capacity in ultraviolet energy region and make the compounds to be a good choice for coating material and optoelectronic device applications. The exploration revels interesting correlation among the properties of $CaCuO_3$ and $SrCuO_3$.

PP-16: Screen the mechanical and optoelectronic properties of $NbFeTe_2$: A DFT study

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First principle calculations are performed to study the structural, mechanical, electronic, and optical properties of orthorhombic half-Heusler $NbFeTe_2$. The various properties are analyzed with LDA functional under CA-PZ treatments using CASTEP code. Metallic nature is confirmed from the electronic band structure calculations, which shows a very good agreement with previous experimental results. Density of states near the Fermi level show the predominant hybridization of p and d states of p-bloke element Te, and transition metal Fe and Nb, respectively. The independent elastic constants predict the high damage tolerance of $NbFeTe_2$ due to having appropriate mechanical stability. With a low hardness performance, the metallic luster is ductile in nature and the bond type is nearly ionic which are confirmed from the value of Poisson's and Pugh' ratio. Directional elastic anisotropy factor analysis disclose the possibilities of stress based application in different devices. The analysis of optical properties such as dielectric constants, conductivity, absorption coefficient, reflectivity, refractive index, and loss function give valuable information to use the material in optoelectronic devices. It shows a wide range of optical response such as a very high absorption obtained for ultraviolet (UV) spectral emissions. Appreciating reflectivity in UV region avoids solar thermal heating in outer space applications. A sharp static dielectric response decreases suddenly and vanishes below the energy of 10 eV. The present study can explore a new window for the applications of $NbFeTe_2$ in efficient superconductor and optoelectronic devices.

PP-17: Density functional study of pressure dependent structural and physical properties of SnS and Sb_2S_3

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In this study, we have performed density functional theory (DFT) based calculations to study structural, mechanical, elastic, electronic, optical and thermal properties of tin sulfide (SnS) and antimony sulfide (Sb_2S_3). The effect of pressure on the structural, mechanical, electronic properties have also been studied. The results obtained are seen to be in good agreement with the available experimental and theoretical results which ensures that the first principles calculations performed here are reliable. We have also studied the effect of pressure on the optical and thermodynamic properties for the first time.

In this investigation, the pressure is increased from 0 GPa to 20 GPa. A complete geometrical optimization for structural parameters are performed for both SnS and Sb_2S_3 reveal that with increasing pressure the lattice parameters as well as the cell volume are compressed. The elastic constants and anisotropic behavior of the compounds have been calculated under the specified pressures and the results were recorded. The investigation on the elastic constants and moduli shows that both SnS and Sb_2S_3 possessed significant anisotropy, relatively good machinability, and are brittle in nature at 0 GPa. Similarly, at 0 GPa, from the electronic band structure and

density of states calculations, it is seen that both the compounds are semiconductors. After increasing pressure Sb_2S_3 remained semiconductor but its band gap value decreased with increasing pressure. Whereas for SnS with increasing pressure, the band gap vanishes and its semimetallic behavior gets enhanced. From the study of energy dependent optical properties, a good correspondence is observed with the electronic energy density of states. The absorption spectra of both the compounds reveal that they are quiet efficient in absorbing ultraviolet radiations and the high value of refractive index indicated that they have the required characteristics to be used for light emitting and optoelectronic devices.

PP-18: Hydrostatic Pressure Dependent Structural, Elastic, and Optoelectronic Properties of $ScCuO_3$: A DFT study

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A comprehensive investigation of the structural, elastic, electronic, and optical properties of $ScCuO_3$ perovskite have been performed using density functional theory (DFT). The unit cell of $ScCuO_3$ is optimized using generalized approximation (GGA) which is implemented in CASTEP code. We estimated the mechanical behaviors under compression, including mechanical stability, Young's modulus, Poisson's ratio, ductility and anisotropy index. The metallic behavior of $ScCuO_3$ is confirmed from the electronic band structure where a few bands crosses the Fermi level. The Cu-3d and O-2p orbitals overlap near the Fermi level which is found from the density of states diagram. Under, the applied pressure, the transition from unfilled Cu-d orbital to filled Cu-d orbital is observed. Different optical properties such as absorption, refractive index, dielectric function, conductivity, loss function, and reflectivity are also calculated. Both the absorption spectra and optical conductivity reflects the metallic nature which is supported by electronic band structure calculations. The real part of refractive index has high value from 0 to ~ 5 eV covering infrared to visible region. Different optical parameters shown anomalous behavior when the pressure exceeds 30 GPa. The possible applications of $ScCuO_3$ in different devices have been mentioned from the calculated properties.

PP-219: Comprehensive study of thortveitite structure of Zinc Pyrovanadate $Zn_2V_2O_7$ under pressure

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We compute a pressure-driven study of zinc pyrovanadate $Zn_2V_2O_7$ using first-principles approach under the framework of density functional theory (DFT). In comparison with the ambient pressure phase, such pyrovanadate undergoes structural transitions at 0.7, 3.0 and 10.8 GPa. $Zn_2V_2O_7$ crystalizes in a monoclinic (α-phase) structure with the space group C2/c at ambient pressure. On the other hand, the high-pressure phases of β -form of monoclinic (C2/m), γ -form of triclinic ($P\bar{1}$) and post γ -form of triclinic ($P\bar{1}$) structures have been found at 0.7, 3.0 and 10.8 GPa, respectively. The detailed crystallographic data is consistent with the experimental results reported in the literature. The criteria of mechanical stability of this pyrovanadate are completely fulfilled under pressure. The energy dispersion of these studied phases reveals that the energy band gaps are successively reduced by the increase of pressure. The values of energy gaps obtained from the band structures are almost similar with the optical band gap, calculated by Wood-Tauc theory, found in the optical absorption spectra.

PP-20: Numerical Study on Double Diffusive Natural Convection in a Dome Shaped Cavity

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The present study investigates laminar fluid flow with heat and mass transfer in a dome-shaped partly square cavity for three different dome inclination angles. The cavity is filled with air. The obtained results are found by solving two-dimensional Navier-Stokes, energy, and species diffusion equations via Galerkin finite element method. The cavity is submitted to horizontal temperature and concentration gradients. Both aiding and opposing flow phenomena are examined here. For the aiding flow, high temperature and concentration are maintained in the left wall, whereas the same at low condition is kept on the right wall. Concentration boundary condition is altered for the opposing case. Other walls were kept adiabatic and impermeable. The impact of dome shape utilization is compared with the reference sqaure enclosure. To broaden the investigation, different solutal Rayleigh numbers ($10^3 \leq Ra_s \leq 10^5$) and Lewis numbers ($0.5 \leq Le \leq 5$) are considered in both aiding and opposing flow, by keeping constant thermal Rayleigh number. To present a qualitative analysis, streamline, isotherm and iso-concentration plots are depicted, while average Nusselt and Sherwood numbers are evaluated for quantitative analysis. The computed results reveal that both Nusselt and Sherwood number can be significantly enhanced by the utilization of dome shape. Furthermore, the solutal Rayleigh number and Lewis number show different but noticeable impact on heat and mass transfer performance during aiding flow and opposing flow.

PP-21: Computational Investigation of Small-Orgnanic Molecule Electron Acceptors

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The active layer in an organic solar cells (OSCs) comprises a light absorbing electron donor semiconductor and an electron accepting acceptor material. Because of this reason, organic electron acceptor materials are one of key factors for OSCs. In this work, a nitrile functional group containing small organic molecules TAc-X (X=F,Cl,Br,I) (3,3'-(thiophene-2,5-diyl)bis[2-(4-halo(gen)phenyl)acrylonitrile] is characterized by means of density functional theory (DFT). We have performed Natural Bond Orbital (NBO) analysis and Molecular Electrostatic Potential (MEP) study. The result of theoretical computation of NBO analysis of TAc-Cl show that the computed total stabilization energy E(2) / the computed total interaction energy, E(2) value for nitrile groups at the acceptor position is much more than the computed total interaction energy, E(2) value for that at the donor position. In MEP analysis of TAc-Cl, we have seen that the most negative electrostatic potential around nitrogen atoms that are portion of nitrile groups located at both sites of TAc-Cl gives a good electron withdrawing property to the nitrile group of TAc-Cl molecule. NBO and MEP studies through DFT calculation determine that TAc-Cl works effectively as an acceptor molecule. Further we extend our investigation study. We have calculated interaction energy and molecular electrostatic potential for TAc-X (X=F,Br,I). Then we discuss the comparison of theoretical results of TAc-X (X=F,Cl,Br,I).

PP-22: First principle study of elastic, electronic and optical properties of $MCuO_3$ (M = La and Y) under hydrostatic pressure

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The elastic, electronic and optical properties of perovskite $MCuO_3$ (M = La,Y) are calculated under hydrostatic pressure up to 100 GPa by the first principles calculations based on density functional theory. The mechanical and thermodynamical stabilities are confirmed from the calculated values of elastic constants and phonon spectra, respectively. Semiconducting nature of $LaCuO_3$ is assured from the electronic band structure calculations with the band gap about 0.56 eV. On the other hand, $YCuO_3$ shows metallic behavior where few bands crosses the Fermi level. The density of states near the Fermi level show the predominant overlapping of Cu-3d and O-2p orbitals. The analysis of pressure dependent optical properties such as dielectric constants, conductivity, absorption coefficient, reflectivity, refractive index, and loss function provide important information to use the material in optoelectronic devices. It is noticed that pressure has a significant effect on the optical properties as it changes with pressure. In $LaCuO_3$, the absorption as well as conductivity spectra changes its peak position at the pressure about 30 GPa. While, in $YCuO_3$, the change of peak position occurs at about 60

GPa. The real part of the refractive index of both compounds has high value from 0 - 5 eV covering infrared to visible region. The present work can disclose a new window for the application of Cu-base perovskite in different electronic devices.

PP-23: Relativistic treatment for scattering of $e^{\pm}$ by SO_2 molecule

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The differential, integrated elastic, total, momentum transfer, viscosity, total ionization cross sections and Sherman function for electron and positron elastic scattering of sulfur-di-oxide (SO_2) molecule are calculated for the energy range of 1 eV–1MeV. Present results are compared with the available experimental data and some other theoretical calculations. For scattering process, independent atomic model (IAM) and independent atomic model with screening correction (IAMS) with the same framework are used in our present calculations. Dirac's partial wave analysis is required to the calculation of phase-shifts for generating the scattering observables using a complex optical potential model (OPM). Energy dependent DCS and Sherman function are also analyzed for particular scattering angles 30^0, 60^0 , $90^0120^0150^0$ and 170^0. IAMS has given the better results rather than IAM in lower energy regim.

PP-24: Theoretical study $e^{\pm}$ from the NH_3 molecule

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The theoretical investigation of differential, integrated elastic, momentum transfer, viscosity, inelastic, grand total and total ionization cross sections along with the Sherman functions for the scattering of electrons and positrons by polar NH_3 molecule in the energy range 1 eV − 1

MeV are reported in the present work. We carry out the calculations using the independent atom model (IAM) and IAM with screening correction (IAMS). The scattering observables are calculated using a complex optical model potential in the framework of the Dirac partial wave analysis (DPWA). The application of screening correction to the IAM substantially improves the cross sections particularly at lower incident energies. The results obtained from the present study are compared with the available experimental and theoretical works found in the literature.

PP-25: Effect of Heat Conducting Rotating Cylinder on Conjugate MHD Mixed Convection inside a Cylindrical Domain

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This study investigates mixed convection heat transferinside a cylindrical domainhaving a concentric rotating hollow cylinder. The cylindrical domain is filled with heat conducting fluid (air) and the surrounding part of that domain is maintained at ambienttemperature. The inner boundary of the rotating cylinder is always kept at a constant and comparatively higher temperature. A constant magnetic field is active causing magnetohydrodynamic (MHD) effect on the system. The numerical results are obtained by solving two-dimensional Navier-Stokes and energy equations via Galerkin finite element method. To broaden the investigation, Richardson number ($0.01 \leq Ri \leq 1$) and Hartman number($0 \leq Ha \leq 100$) along with Reynolds number ($1 \leq Re \leq 200$)are varied.At first conduction takes place throughout the thickness of the rotating cylinder and then mixed convection occurs. It is observed that thermal performance decreases due to increase of Richardson number and Hartman number under certain condition. A quantitative analysis shows that average Nusselt number can be increased by increasing the speed of the rotating cylinder.

PP-26: A Study on Non-Linear Optical Property of SchiffBase Ligands and Its Metal Complexes

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The study of all the happenings when intense light interacts with materials is known as non-linear optics (NLO). Changes in the system's optical properties happen when it comes into

contact with a nonlinear optical material. The next photon that comes in sees a different substance than the one that came before. The word "nonlinear" refers to a system's response to an applied optical field because the intensity of the applied optical field has a nonlinear effect on the system's response instead of a linear effect. The mission is to establish materials that can regulate this interaction and alter or combine photons (wave mixing), fine-tuning the optical process' amplitude and reaction time. Recent years have seen a lot of new materials, like organometallics and coordination complexes. In contrast to organic molecules, they have a wider range of molecular and bulk configurations, as well as the ability to be very durable and have a wide range of electrical properties. This is because they have a coordinated metal center. Because of their strength, chemical and physical stability, and wide range of options, coordination metal complexes with Schiff base ligands are a good target for NLO. Our study will focus on the NLO property of Schiff base ligands and its metal complexes.

PP-27: CFD Study of MHD MixedConvection in a Quadrantal Enclosurewith Heat Conducting Rotating Cylinder

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The current numerical study aimsto investigate the magnetohydrodynamic mixed convection thermal energy transport inside a quadrantal enclosure with a heat conducting rotating cylinder. The horizontal wall of the enclosure is subjected to a constant hot temperature, whereas the vertical wall is kept at a cold temperature. The curved wall is maintained to be adiabatic. The heat conducting cylinder placed inside the enclosure is rotating and thus induces inertia flow within the enclosure. The mathematical modelsof the current problemin terms of Navier-Stokes and thermal energy equations are solvedusing finite element method. Governing parameters that have been varied here are: Re (Reynolds Number), Ha (Hartman Number) and Ri (Richardson Number). This simulation has been done for different values of Reynolds numbers and the ranges of other parameters are: $0 \leq Ha \leq 100$, $0.1 \leq Ri \leq 1.0$. From this study, a variation in average Nusselt number is observed. The Nusselt number, i.e., the convection heat transfer is decreasing with increasing both Hartmann and Richardson numbers. The heat transfer is increasing with increasing Reynolds number.

PP-28: First principles study of structural, electronic, and optical properties of $CsSnI_3$

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ABO_3 type perovskites exhibit interesting physical and chemical properties. A comprehensive investigation of the structural, elastic, electronic, and optical properties of $CsSnI_3$ perovskite have been performed using density functional theory (DFT) under different pressure. The unit cell of $CsSnI_3$ is optimized using generalized approximation (GGA) which is implemented in CASTEP code. The mechanical and thermodynamical stabilities are confirmed from the elastic constants and phonon spectra, respectively. The electronic property including the density of states and band structures reveals that $CsSnI_3$ are direct band gap semiconductor at zero pressure. However, with increasing pressure, the value of band gap decreases and a transition from semiconductor to metallic is observed at 10 GPa. The optical properties such as conductivity, dielectric function, refractive index, absorption coefficient, reflectivity and loss function are also studied under different hydrostatic pressure. With the hydrostatic pressure, the peak position and peak intensity of different optical properties are strongly influenced. The direct band gap nature and high absorption power predict that this perovskite can be used in optical and optoelectronic devices.

PP-29: Optimization of Pair of Heat Conducting Obstacles on Natural Convection in a Square Enclosure with Discrete Heating

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In the present study, we investigate the effect of pair of heat conducting obstacles (square block) on natural convection in a square enclosure with discrete heating. Inside the enclosure, two pairs of source-sink are placed at the vertical walls with constant (high and low) temperatures and the remaining parts of the enclosure are completely insulated. The mathematical model of this problem is governed by two-dimensional continuity, momentum and thermal energy equations. Finite element method is used to evaluate fluid flow behavior and heat transfer under different orientations of the obstacles inside the cavity. We have analyzed streamlines, isotherms and the average Nusselt number with the variation of different Rayleigh numbers ($10^3 \leq Ra \leq 10^6$). From this study, we have observed that the effect of placement of pair of heat conducting obstacles greatly influence fluid flow and heat transfer behavior inside the enclosure, and helps one to find out the suitable (optimum) orientation of the obstacles for maximum heat transfer.

PP-30: Overall Thermal Performance Due to MHD Conjugate Mixed Convection Flow in a Triangular Cavity with Heat Conducting Rotating Cylinder

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Mixed convection heat transfer in a triangular cavity with heat conducting rotating cylinder has been examined in the present study. The cavity is filled with air. A constant magnetic field is active from left to right in the positive x-direction causing magnetohydrodynamic (MHD) effect on the system. The heat conducting solid cylinder is rotating at a constant velocity and the thermal performance is investigated for both clockwise and anticlockwise rotation of the cylinder. The upper surface of the cavity is at a higher temperature, while the inclined sidewalls are at a lower temperature enforcing natural convection current. Flow and heat transfer phenomenon are governed by two-dimensional Navier-Stokes and energy equations with defined boundary conditions. Finite element method is implemented to find out the numerical solutions. The results are enumerated for the wide range of governing parameters namely Reynolds number ($50 \leq Re \leq 150$), Richardson number ($0.01 \leq Ri \leq 10$), and Hartmann number ($0 \leq Ha \leq 20$). The study shows that thermal performance decreases due to increasing of Richardson number and Hartmann numbers for both clockwise and anticlockwise rotation of the cylinder.

PP-31: Mixed Convection Analysis in a Lid-Driven Square Cavity in the Presence of Heat Conducting Cylinder with Roughness Component

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Mixed convection in a lid-driven differentially heated square cavity having a heat conducting cylinder with different number of roughness components has been numerically investigated in this study. The fluid flow and the heat transfer within the cavity are governed by two-dimensional Navier–Stokes and energy equations, and those are solved using the finite element method. The right wall of the enclosure is assumed to have higher temperature than the left wall, while the top and the bottom walls are insulated. In addition, the left wall is moving in its own plane with a constant speed while the other walls remain stationary. Numerical simulation

is carried out over a specific range of Reynolds number ($1 \leq Re \leq 10^3$) for laminar flow consideration with a fixed Richardson number (Ri = 1) and fixed Prandtl number (Pr = 0.71). The effect of the roughness of the solid cylinder on the heat transfer characteristics of the cavity is observed in terms of the average Nusselt number of the heated wall. It is found that the roughness components have less influence on the thermo-fluid behavior of the proposed system.

PP-32: Analysis of Aiding MHD Mixed Convection Heat Transfer within a Heat Absorbing Cavity

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The study of aiding MHD mixed convection heat transfer in a square cavity filled with water that absorbs heat is studied numerically. The left wall of the cavity is heated, while the right wall is maintained at cold temperature. The bottom and the top walls are adiabatic. In addition, the left-side and the right-side walls are sliding in such a way that aids the buoyancy-driven flow within the cavity. A magnetic field is applied in the horizontal direction normal to the moving walls of the cavity in order to introduce MHD effect. Finite element method is used to solve the governing (Navier-Stokes and energy) equations for both fluid flow and heat transfer. The Richardson number, Ri (0.01–10), Reynold number, Re (25-200), Hartmann number, Ha (0-50), heat absorption rate, Q (1-5) are considered as pertinent parameters in this parametric study. Aiding flow of thermal boundary layers are observed qualitatively in terms of streamlines and isotherms. Besides, the effects of these parameters on heat transfer inside the enclosure are observed by evaluating the average Nusselt number. It is found that Nusselt number increases with heat absorption as expected and Nusselt number decreases as Hartmann number increases.

PP-33: MHD Natural Convection of Nano Fluid in a Heated Square Enclosure with Multiple Heat Generating Elements

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MHD natural convective flow and heat transfer of Al_2O_3-water nano fluid confined in square enclosure with multiple heat conducting solid elements are investigated numerically in the present study. The magnetic field is applied to the enclosure to an angle with the horizontal axis. Two heat generating elements are placed in the bottom wall, while keeping the vertical walls at comparatively low temperature and insulating the top wall. The system of governing mass, momentum and energy equations comprising dimensionless variables and parameters which have been solved using finite element approach. Change in flow pattern is studied by varying the magnetic field parameter, angle of magnetic field, Rayleigh number, volume fraction of nano particles. Evaluation of average Nusselt number along the heated element is carried out to study the effect of the relevant parameters on heat transfer. The flow and heat transfer characteristics are also visualised in the form of streamlines and isotherms respectively.

PP-34: The first principles calculations of undoped and Ag doped $MoTe_2$ for catalytic and optoelectronic applications

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Two dimensional (2D) materials have been gained great interest as it possesses unique properties that distinguishes it from bulk materials. Among them transition metal dichalcogenides (TMDCs) are the most promising materials to reduce the limit of zero band gap of graphene and insulating nature of hBN $MoTe_2$ for catalytic and optoelectronic applications. To this point of view, undoped $MoTe_2$ has been attracted great interest because of its intriguing optical and electronic properties and it can easily be formed into two dimensional (2D) materials which can be an excellent candidate for future applications in electronic and optoelectronic devices to its high surface area and versatile electronic structure. In this research work, the different physical properties are calculated using first principles calculations based on density functional theory (DFT) in the framework of local density approximation (LDA). From the structural study, it is found that structural properties little bit change with doping. The indirect band gap is explicitly observed in the band structure calculation but the band gap of the doping system is reduced. The optical properties viz., absorption coefficient, dielectric constants, refractive index, loss function and reflectivity have been calculated. The outcome of the present work suggest that doped system can be used in advanced electronic and optoelectronic devices rather than undoped $MoTe_2$.

PP-35: A theoretical study of undoped and Nb doped $MoSe_2$ for solar cell and optoelectronic applications

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Two dimensional (2D) materials have been gained great interest as it possesses unique properties that distinguishes it from bulk materials. Among them transition metal dichalcogenides (TMDCs) are the most promising materials to reduce the limit of zero band gap of graphene and insulating nature of hBN $MoSe_2$ for electronic and optoelectronic applications. To this point of view, undoped $MoSe_2$ has been attracted great interest because of its intriguing optical and electronic properties and it can easily be formed into two dimensional (2D) materials which can be an excellent candidate for future applications in electronic and optoelectronic devices to its high surface area and versatile electronic structure. In this research work, the different physical properties are calculated using first principles calculations based on density functional theory (DFT) in the framework of local density approximation (LDA). From the structural study, it is found that structural properties little bit change with doping. The indirect band gap is explicitly observed in the band structure calculation but the band gap of the doping system is reduced. Dielectric constants, absorption coefficient, photoconductivity, refractive index and reflectivity properties have also been calculated for undoped and doped systems. These findings of the present work suggest that doped system may be more suitable for advanced electronic, optoelectronic and solar cell applications rather than that of undoped $MoSe_2$.

PP-36: Approximation of the Inverse of the Fine-Structure Constant (137.036) Using the Golden Ratio, Euler's number, and Pi

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Since the inception of the Fine-Structure Constant (α), for the last hundred years scientist have been trying to explain its origin using other mathematical constants, as it is considered as one of the fundamental constant of nature as well as it is dimensionless. The value is very nearly equal to 1/(137.036) and for reasons of convenience, the reciprocal value of the fine-structure constant is often specified. The 2018 CODATA recommended value is given by α^{-1} = 137.035999084 [1]. In this article a simpler way was devised to obtain the inverse of this cosmological constant, with no more care given to physical dimensional analysis by using the Golden Ratio (Φ = 1.618034), Euler's number (e = 2.718282), and Pi (π = 3.1416)

PP-37: Reanalysis of Proton's Electric and Magnetic Form Factors Using Rosenbluth Separation Data at $1 \leq Q^2 \leq 10$ GeV²

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Understanding the internal electric charge and magnetization distribution of proton relies heavily on the knowledge of proton's electric and magnetic form factors, G_E and G_M respectively. For nearly half a century, the Rosenbluth extraction method has been crucial in measuring the form factor values for different ranges of four momentum transfer squared Q^2. But in recent decades, a new experimental method called polarization transfer has produced a significantly different result in the form factor ratio. To theorize the discrepancy between these two different experimental methods, several reanalysis schemes have been organized. In this project, a similar recalculation of radiative corrected cross-section data has been reviewed and reproduced. The recalculated results were found to follow the world data trend of the Rosenbluth Separation method significantly. As the mystery remains unsolved, a look into the two photon exchange (TPE) correction for hard photon exchange might produce some answers, or this might be a gateway to extend our understanding of particle interaction beyond the boundary of the standard model.

PP-38: Half-metallic behavior with high magnetic moment of half-Heusler alloys MCrPb (M = Hf, Zr): insights from DFT

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Half-Heusler alloys MCrPb (M = Hf, Zr) are studied utilizing the Full Potential-Linear Augmented Plane Wave (FP-LAPW) method as implemented in the WIEN2k code in the context of density functional theory (DFT). Both the alloys exhibit band gap in the up-spin states, while the down-spin states are conducting, revealing half-metallic nature of the alloys. The total magnetic moment is found to be around 4 μ_B, indicating that the alloys are ferromagnetic. The alloys overall electronic and optical characteristics support their potential for spintronics applications.

PP-39: Theory of 3 Folds and 4 Dimensional Universe (Beyond Standard Model of Particle Physics)

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Abstract: Three Postulates are defined here, based upon current experimental limit on size of Fundamental particle i.e. upto 10^{-19} m and an Empirical formula is derived (h=Q*c*k) giving maximum mass of particle within experimental range of ≈ TeV. 3rd Postulate i.e. Equivalency between "Mass" and "Straight Imaginary Line" gives co-relation between massless and spin = 1 properties of Boson as proved in QED theory. Fundamental particles of Standard Model are

arranged in 3 Folds way in 4th Imaginary Dimension; Bottom Fold, Top Fold and Middle Upper and Lower Folds with decreased in energy from TeV to approx. 0 eV respectively. With this representation of the Universe at atomic and sub-atomic level, it solves lot of current problems of SM of Particle physics like Matter-Antimatter asymmetry, origin of 3 Generations or families of Fermions, Nature of gravitating dark matter and repulsive dark energy particles, cosmological coincidence, origin of mass of hadrons like protons, wave-particle duality of particles etc. giving true insight about nature of fundamental particles. This theory also demands existence of 4th Pair of Neutrino-AntiNeutrino.

PP-40: DFT insights into Nb-based 211 MAX phase Carbides: Nb_2AC (A = Ga, Ge, Zn, Tl)

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In this study, 211 MAX phase Carbides Nb_2AC (A= Ga, Ge, Tl, Zn) have been studied by using density functional theory (DFT) based first-principles calculations. The thermo-mechanical properties of Nb_2AC (A= Ga, Ge, Tl, Zn) have been focused. The structural properties agree well with the previous results. The value of stiffness constants, elastic moduli, and Vickers hardness has been calculated. The Nb_2GaC shows the best mechanical properties with highest hardness values whereas Nb_2GeC possesses the lowest values of mechanical properties. We have calculated different anisotropic indices and 2D and 3D plots of Young's modulus, compressibility, shear modulus, and Poisson's ratio to demonstrate the anisotropy of the elastic properties. We have calculated the important thermal properties characterizing parameters such as Debye temperature (Θ_D), minimum thermal conductivity (K_{min}), melting temperature(T_m), Grüneisen parameter (Υ). The values of these parameters suggest that the titled carbides can be used as thermal barrier coating (TBC) materials.

PP-41: A DFT+U Study on the Structural, Electronic, Magnetic and Optical Properties of Fe-doped, Ni-doped and Fe-Ni co-doped ZnO

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In this study, we investigated the structural, electronic, magnetic and optical properties of pure zinc oxide, 8.33% Fe-doped ZnO, 8.33% Ni-doped ZnO and 4.17% Fe and 4.17% Ni co-doped ZnO. The whole investigation was performed with computational work and we used here the DFT theory (DFT+U approach). Pure zinc oxide is non-magnetic in nature and the studied band gap is 3.12eV. Introducing iron and nickel as doping elements creates few magnetizations and

decreases its band gaps from the pure one. Doping 8.33% Fe, 8.33% Ni and 4.17% Fe and 4.17% Ni co-doping in 2×2×3 supper-cell and in 2×3×2 supper-cell results total magnetic moments of 3.929, 1.966, 1.959 and 1.953μ_B respectively. The band gaps after doping lies between 2.10 to 2.98eV. Which makes it more usable in water purification process. The electronic and optical properties were studied thoroughly and had a good agreement with experimental works. After doping, conduction band became narrower which indicates the process an overall optical red-shift transitions.

PP-42: Physical properties of M_2BC (M =Ti, Zr, Hf and W): A comprehensive theoretical study

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High-hardness materials with fracture toughness properties have recently been interested in their prospective applications, especially as hard coating materials. The structural, electronic, mechanical, optical, and thermal properties of metallic boro-carbides of M_2BC (M=Ti, Zr, Hf, and W) compounds are studied using density functional theory. The lattice parameters and volume are well consistent in the prior report. All the studied compounds are metallic in nature as there is no band gap between the valence and conduction bands. The compounds under investigation are both thermodynamically and mechanically stable. These compounds are also found as anisotropic in nature. The compound W_2BC exhibits fracture toughness behavior, whereas Ti_2BC, Zr_2BC, and Hf_2BC show brittle deformation behavior. W_2BC compounds have the greatest Vicker's hardness rating of all the studied compounds. The predicted Vicker's hardness value increases with metallic element in the following sequence: $Ti_2BC<Zr_2BC<Hf_2BC<W_2BC$. Different optical properties such as dielectric function, refractive index, absorption coefficient, photoconductivity, reflectivity and loss function are computed and discussed in detail. Reflectivities with greater than 50% for Ti_2BC and W_2BC suggest that these compounds have tremendous promise for usage as coating materials to reduce solar heating. Hf_2BC and W_2BC compounds can also be applied as promising thermal barrier coating materials due to their low Debye temperature and minimum lattice thermal conductivity.

PP-43: Synthesis and Characterization of Spray-pyrolized Ba-doped ZnO Thin Films

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In the current study, $Zn_{1-x}Ba_xO$ (x = 0.00, 0.05, 0.10, 0.15 and 0.20 at%) thin films have beendepositedonglasssubstrate bySprayPyrolysistechniqueat substrate temperature 340 ºC.The grown films are characterized by XRD, SEM, Optical and Electrical measurements. The X-ray diffraction (XRD)patternreveals thepolycrystalline nature of the films with hexagonal wurtzite structure,possessing no impurity or secondary phases.The unit cell lattice constants of $Zn_{1-x}Ba_xO$ determined from prominent peaks, are found to vary with Ba concentration.The crystallite size (ξ) in different crystallographic planevariesintherange (11 - 46) nm. The SEM micrographs demonstrate theformationof nano-flakes, nano-hexagonal slabs and nano-sprout like structures. $Zn_{1-x}Ba_xO$ thin films are direct band gap semiconductor and the band gap energiesvaryfrom3.15eVto 2.84 eV depending on Ba concentration.Moreover, the refractive index,extinction coefficient, dielectric constant, loss factor and loss angle have also been calculated. The Four-probe resistivity measurement shows an anomalous behavior; firstly, resistivity decreases upto a certain temperature, called Transition temperature (T_t), after which increases up to the measured temperature range. This result suggests that Ba doped ZnO thin film changes its phase from semiconducting topoor metallic nature.The measured Hall voltage is negative which reveals that the $Zn_{1-x}Ba_xO$ is n-type material.ThecarrierconcentrationatRTestimated from Hall study, found to increase with increasing Ba concentration and the orderofcarrier concentration is$\sim 10^{18} cm^{-3}$.

PP-44: Investigation of various physical properties of TiO_2 using spray pyrolysis and nsights from density functional theory method

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Titanium dioxide (TiO_2) thin films were deposited onto glass substrate using Pulse spray pyrolysis at a fixed substrate temperature 140 ℃. The deposited samples were then subjected to thermal treatment (annealing) at 450 ℃ in open air for 1 hour. The XRD patterns reveal amorphous in nature for as grown films while annealed films are polycrystalline having tetragonal structure. The crystallite size of the annealed TiO_2 films is of the nanometer scale and increases from 18.5 to 27.5 nm with increasing film thickness. FESEM image demonstrates blocks type morphology. FTIR analysis suggests that the anatase titania bonding are formed in the region 400-800 cm^{-1}. The optical analysis stated that the transmittance is high in the infrared (IR) region for both deposited and annealed TiO_2 thin films. The absorption co-efficient is found to be in the order of 10^6 cm^{-1}. The experimental band gap energy found in this study varies from 2.08 to 2.31 eV (as deposited) and 1.94 to 2.20 eV (annealed) depending in film thicknesses which are very close to our calculated theoretical band gap 1.189 eV (rutile) and 2.126 eV (anatase). This correspondence in band gap energy attributed to the appropriateness of the first principal method. The four-point probe resistivity of the films is in the range of

$\sim 10^2$ ohm-cm and the resistivity gradually decrease with increasing temperature (295-390) K indicating semiconducting behavior of the samples. The activation energies are found to be 0.061 to 0.086 eV and 0.077 to 0.091 eV for as deposited and annealed films respectively. Hall measurement confirms the n-type nature with carrier concentration of the order of 10^{20} cm^{-3}.

PP-45: Synthesis and Characterization of Strong Light Absorber $Cu_2AgS_{1-x}Se_x$ Thin Films for Solar Cell Applications

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Mixed Chalcogenide thin film materials have been attracted great interest due to their intriguing physical, chemical, and optical properties. These types of materials have been extensively studied for applications in solar cell, photoluminescence and optical devices due to suitable optical band gap, abundance on earth crust, nontoxic and friendly to environment. From these points of view, the mixed chalcogenide strong light absorber of $Cu_2Ag\ S_{1-x}Se_x$ (x=0.0 to 1.0, Ag=0.05) thin films fabricated by chemical spray pyrolysis technique and investigated their structural, surface morphology and optical properties by XRD, SEM, optical metallurgical microscope (OMM) and UV-vis spectrometer measurements. The XRD results show the formation of polycrystalline structure of cubic $Cu_2AgS_{1-x}Se_x$ phase and the stoichiometry causes a reduction in the content of secondary phase. OMM shows the grains of different sizes are oriented in polycrystalline film surface. The thin film exhibits low transmittance which indicates the photon absorption occurs predominantly. The absorption edge shifts toward lower wavelength region with Ag (Ag=0.05%) and Ag-Se (Se= 0 to 1%) doping, which indicates the widening of band gap due to Burstein-Moss effect. The absorption coefficient of the film is very high on the order of 10^5 cm^{-1}. The obtained band gap energy is to be in between 1.30 and 1.83eV which is so closed to the optimum value required for solar cell applications. Importantly, the solar cell performance has also been calculated using SCAPS-ID and the obtained optimum efficiency of 16.91% and 17.34% for Cu_2S and $Cu_{o.95}\ Ag_{0.05}Se$ based solar cells respectively. The findings of the present work would be helpful to clarify the experimental reports and promote the development of novel, highly efficient Cu_2S/Se based thin film solar cells.

PP-46: Synthesis and Characterization of $BaTiO_3$ Thin Films from Ball-Milled derived Nanopowder and Precursor Solution by Spin Coating

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Barium titanate ($BaTiO_3$) is a ferroelectric perovskite material with unique dielectric properties. It has been widely utilized in the fabrication of inorganic coatings or thin films, capacitors, sensors, or the production of devices for energy storage and conversion. In this study, two synthesis routes: One ball-milled derived $BaTiO_3$ nanopowder dispersed in Polyethylene Glycol and another from precursor solution by the sol-gel method were used separately to fabricate $BaTiO_3$ thin films on steel, quartz, and soda-lime glass (SLG) substrates by spin coating method. Barium acetate, Titanium Oxide, Acetic acid, Polyethylene Glycol (PEG), Potassium Hydroxide (KOH) were used in the sol-gel process. Some of the pristine thin films were also subjected to air-annealed at 250 ºC for one hour. Pristine and annealed thin films from both synthesis routes were characterized by UV-Vis-NIR Spectroscopy, Contact angle goniometer, Raman Spectroscopy, and Photo Luminescence (PL) spectroscopy - all carried out at room temperature. The optical band gap estimated from UV-Vis-NIR diffuse reflection data and PL was found to be in the range of 3.10 eV - 3.28 eV. Both approaches effectively produced high-quality thin films with homogeneous microstructure and thickness. The broad peaks in Raman spectra showed the polycrystalline character of the pristine $BaTiO_3$ thin films, and those peaks were seen to be narrowed when the annealing temperature was raised further. Our studies showed that even annealing at moderate temperatures increased the crystallinity and optical properties of $BaTiO_3$ thin films, making it a suitable, cost-effective, and environmentally friendly material for low-thermal budget energy storage devices. A parallel plate capacitive configuration of Graphene/$BaTiO_3$/Graphene based device is currently under investigation and the outcome will be presented at this conference.

PP-47: Fabrication of Cu_2ZnSnS_4(CZTS) thin films by ultrasonic spray pyrolysis at a low substrate temperature and effect of tin concentration on the characteristics of the CZTS thin films

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In this paper, Cu_2ZnSnS_4 (CZTS) thin films fabricated on glass substrates using spray pyrolysis method with different concentration of Sn content were studied. To minimize the formation of secondary phases, all the CZTS thin films were prepared at substrate temperature 200°C. Here we show how the variation in Sn content concentration influence the optical and structural properties of the CZTS thin films. The XRD patterns reveal that the concentration of Sn content has to be optimized to minimize the formation of secondary phases at fixed substrate temperature. In turn, band gap of the CZTS this films are highly influenced by formation of secondary phases. We have found that the films prepared from the precursor solution with 1.8mM Sn content concentration have the best crystal structure and an optical band gap of 1.55eV. The CZTS thin films also have good carrier concentration ranging from $4.2x10^{19}$ cm^{-3} to $22.9x10^{20}$ cm^{-3}.

PP-48: Optical Characterization of the Plasma Polymerized Methyl Acrylate-Vinyl Acetate Composite Thin Films

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Organic materials have been in focus because of their multifunctional advantages and easy processing at room temperature and normal pressure. The composition of two organic monomers adds extra polymerization kinetics and a wide range of potential polymer properties. Besides, the composite thin film would be a straightforward but essential tool to understand the assembly of molecules in the nanoscale, the structure they form, and how the structure determines their properties. Plasma polymerization is a distinctive technique for direct polymeric thin films deposition from different organic monomers. The organic compounds methyl acrylate-vinyl acetate (MA-VA) are chosen to deposit plasma polymerized (PP)MA-VA composite thin film. The polymerization is carried out by using a capacitively coupled glow discharge reactor by optimizing the plasma parameters, where the plasma is created at the ac source. Thicknesses of the films are varied by varying MA and VA monomer ratios for the exact deposition times and input powers. Optical parameters of the deposited PP(MA-VA) thin films, such as the transmittance, absorbance, absorption coefficient, optical band gap energies, Urbach energy, extinction coefficient, refractive index, etc., are obtained from UV-visible spectra and are correlated to understand their applicability. It is observed from the UV analysis that the values of direct and indirect bandgap energy vary from 3.1 to 2.68 eV and 2.4 to 1.64 eV, respectively, for the PP(MA-VA) thin films of different monomer ratios. The Urbach energy and steepness parameter varies from 0.34-1.94 eV and 0.074-0.013 eV, respectively.

PP-49: Inorganic/Organic Hybrid Thin Films for Optoelectronics

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Organic-inorganic hybrid thin films have drawn massive attention due to their potential applications in optoelectronics, energy storage devices, sensors, thin-film transistors, solid-state lighting devices, etc. Organic materials offer attractive properties, including high light absorption ability and low carrier mobility, whereas inorganic materials possess high carrier mobility and weak absorption ability. A synergistic effect of these properties can be obtained by fabricating hybrid thin film, which is suitable for optoelectronic devices. The as-prepared

hybrid films could have improved thermal and mechanical stability, higher gas permeability, short response times, strong light absorption abilities, and enhanced electrical and optical properties. In these study ZnSe/plasma polymerized OMA (ZnSe/PPOMA) hybrid films has been prepared and its different properties are being studied. The organic molecules in hybrid films are expected to be covalently bonded to the atoms with the inorganic layers, forming interlinked inorganic-organic polymer hybrid chains. Thus homogeneous, smooth, chemically inert, highly resistive ZnSe/PPOMA hybrid thin films would be synthesized, which are expected to have a moderate band gap depending on their thicknesses. This type of hybrid film might have tuneable optical properties. The results obtained from these studies could explore suitable applications of the hybrid thin films in different electronic, microelectronic and optical instruments.

PP-50: First principles calculations to investigate interesting physical properties of $(Ba_{0.82}K_{0.18})(Bi_{0.53}Pb_{0.47})O_3$ single-cubic-perovskite superconductor

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In the present study, the pseudopotential plane-wave (PP-PW) pathway in the scheme of density functional theory (DFT) is utilized to investigate the various interesting physical properties on $(Ba_{0.82}K_{0.18})(Bi_{0.53}Pb_{0.47})O_3$ (BKBPO) single perovskite superconductor. We have analyzed mechanical properties, elastic constants, and moduli at ambient temperature with zero and elevated pressures (up to 25 GPa) as well. The calculated values of Poisson's ratio, Pugh's indicator, and Cauchy pressure of the studied superconductor are found to be brittle in nature at ambient conditions. The calculated machinability index and hardness values of BKBPO perovskite indicate its superior industrial applications to similar ones. The compound might be considered as a promising thermal barrier coating (TBC) material base on Young's modulus (E) and thermal shock coefficient (R) data. We also have investigated the anisotropic nature incorporating both the theoretical indices and graphical representations in 2D and 3D dimensions, which express a high level of anisotropy of the studied compound. The flatness of the energy bands near EF is a sign of Van-H_f singularity that might increase the electron pairing and origination of high-T_C superconductivity. The computed band structure exhibits its metallic

characteristics which are confirmed by band overlapping in the diagram. A band of DOS is formed for the strong hybridization of the constituent elements where the orbital electrons of O-2p contribute most dominantly at EF in contrast to all orbital electrons. The orbital electrons at the EF are higher from both the partial density of states and charge density mapping investigation. The coexistence of the electron and hole-like Fermi sheets exhibits the multi-band nature of the BKBPO superconductor. On the other hand, Fermi surfaces with flat faces promote transport features and Fermi surface nesting as well. The calculated value of the electron-phonon (e-ph) coupling constant (λ = 1.46) is slightly lower than the isostructural superconductor, which indicates that the studied BKBPO can be treated as a strongly coupled superconductor similar to the previously reported isostructural perovskite superconductors. Furthermore, the thermodynamic properties have been evaluated and analyzed at elevated temperature and pressure by using harmonic Debye approximation (QHDA).

PP-51: Influence of Ni^{2+} on the structural, morphological, and magnetic properties of Sol-gel synthesized Mn-Zn ferrite nanoparticles

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Ni-substituted Mn-Zn ferrites with the compositions of $Ni_xZn_{0.6-x}Mn_{0.4}Fe_2O_4$ ($0.0 \leq x \leq 0.4$) nanoparticles (NPs) have been synthesized using the sol-gel method. The structural, morphological characterization of the compositions has been performed by Fourier Transform Infrared (FTIR), X-Ray Diffraction (XRD), and Quantum Design Physical Properties Measurement System (PPMS). The crystal structure and cell parameters were refined by the Rietveld analysis, confirming their crystallinity and single-phase cubic spinel structure with space group Fd3m. The lattice constants of $Ni_xZn_{0.6-x}Mn_{0.4}Fe_2O_4$ are found with increasing Ni^{2+} concentration while the average grain size (6–12 nm) has a noticeable decrease as Ni^{2+} content is increased when the sample is annealed at 500 ℃. When all the samples sintered at 600 ℃, the lattice constants decrease linearly from 8.410 Å to 8.370 Å with the increase of Ni^{2+} ions except for x = 0.1, the crystallite size varies from 12-58 nm. The decrease in lattice parameter is due to the replacement of larger Zn^{2+} (0.74 Å) ions by smaller Ni^{2+} ions (0.69 Å) in the unit cell. Moreover, the X-ray density slightly reduces with Ni substitution. The room temperature hysteresis curve of the as-synthesized $Ni_xZn_{0.6-x}Mn_{0.4}Fe_2O_4$ NPs shows the typical superparamagnetic behavior with small coercivity. The saturation magnetization (Ms) and Bohr magnetic moment (μ_B) increase with Ni contents except for (x=0.3, 0.4) while the coercivity increases with the increase in Ni^{2+} contents successfully explained by critical size effect and Neel's collinear two sub-lattice models, respectively. The maximum saturation magnetization was recorded at 42.47 emu/gm (for 500 °C) and 58.07 emu/gm (for 600 °C). Critical particle size has been estimated from the D_{XRD} vs. Ms, Hc plot. The coercivity value varies between 8.6 Oe to 41.8 Oe which is very low and strongly influenced by the

microstructure, anisotropy field, and lattice strain. Hence, the superparamagnetic Ni doped $Zn_{0.6-x}Mn_{0.4}Fe_2O_4$ NPs with small in size, and small coercivity can be used for various potential biomedical applications including magnetic hyperthermia treatment, drug delivery, cancer treatment, and high-temperature magnetic device applications.

PP-52: Study the effect of sintering temperature on structural and thermal properties of Ag doped $ZnFe_2O_4$ nanoferrites

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Nanocrystalline Ag doped Zn ferrites were synthesized by the Sol-gel technique. In this study Ag was doped in the tetrahedral (A) site of $Zn_{1-x}Ag_xFe_2O_4$ compositions with x = 0.0, 0.1, 0.2, 0.3 and 0.4. The as–dried gel of these samples was formed by heating the gel of solution of raw materials at 80 °C for 14 hours. The as-dried gel was calcined at 250 °C for 3 h. Then the samples were sintered at three different temperatures (400, 600 and 800 °C) to get better crystalline properties. The effect of sintering temperatures on the structural properties of the prepared Ag doped Zn ferrites was analyzed by the XRD technique. The presence of all existing elements as well as the purity of the samples had also confirmed from the XRD pattern. From the XRD pattern, it was seen that the as-dried Ag doped $ZnFe_2O_4$ was not fully crystalline whereas the samples sintered at 250, 400, 600 and 800 °C represent the single phase spinal cubic structure with privileged orientation along (311). It was discovered that the value of crystallite size was decreased with the increase of sintering temperature. Although at all the temperatures by increasing Ag doping the value of crystallite size was found to be increased gradually. The average particle size was found to range from (18-29) nm. The lattice constant, X-ray density, volume, hopping site and other microstructural parameters had traced as a function of the Ag content (x). These parameters were also found to be increased by increasing of doping amount of Ag. The dispersed particle size in liquid of these compositions were determined by the Dynamic Light Scattering (DLS). It had observed that aggregated particle size decreased with the increasing sintering temperature. This aggregated particle size gets down from 253 to 45 nm. Moreover, the thermal stability of the Ag doped $ZnFe_2O_4$ were studied by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) analysis. The TGA was confirmed two stage weight loss and DSC analysis was traced two exothermic reaction peaks present at the temperature range of 80–800 °C.

PP-53: Microstructural and Electrical Transport Properties of Zn Substituted Li-Cu-Mg Ferrite

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The effect of Zn substitution on the structural, microstructural and electrical transport properties of Li-Cu-Mg ferrites are observed in this study. The samples were synthesized using the conventional ceramic technology, where the samples are sintered at 1050 ^{o}C. The structural property has been performed with X-ray diffraction (XRD) technique. It shows that the crystalline structure of all samples is found to be a single phase cubic spinel structure. The lattice parameter was calculated from the XRD data using Nelson-Riley (N-R) function. It indicates that the lattice constant increases with the increase of Zn content, which could be ascribed to the difference in ionic radii. The Field Emission Scanning Electron Microscopy (FESEM) was used to examine the surface morphology for all the samples. It clearly demonstrates that the grain growth of Li-Cu-Mg ferrites is strongly dependent on the Zn content and increases from 2.75 to 7.15μm as the increase of Zn content. The dielectric constant, dielectric loss, ac conductivity, and impedance spectroscopy of Zn substituted Li-Cu-Mg ferrites are investigated at room temperature as a function of frequency. The dielectric property of the sample follows Maxwell-Wagner type interfacial polarization. The enhancement of the ac conductivity could be attributed to the increase of hopping of electrons between Fe^{2+} and Fe^{3+} ions due to the activity of grains of the samples in higher frequency region. The impedance spectroscopy has demonstrated that conduction mechanism takes place predominantly through the grain property.

PP-54: Crystallization Kinetics of $Co_{72}Fe_8B_{10}Si_{10}$ Amorphous Ribbon Using Differential Thermal Analysis

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The soft magnetic amorphous metallic glass is of scientific interest as it represents phase transformation occurring under extreme situations that are widely used in various applications such as the transformers and the inductive devices as well. In this work, amorphous metallic alloy $Co_{72}Fe_8B_{10}Si_{10}$ has been prepared by rapid solidification technique. Using Differential Thermal Analysis (DTA), technique has been used to study the crystallization kinetics of $Co_{72}Fe_8B_{10}Si_{10}$ alloy is direct and effective technique for analyze in respect of phase transition is taken in nitrogen atmosphere with continuous heating rate of 10^0C to 60^0C/min in step of 10^0C has been investigated. Two exothermic peaks have been observed which has been shifted with increasing the heating rate ranges as 10^0C to 60^0C that indicating the samples losses its thermal stability. Two exothermic peaks in the DTA curve has been noticed that primary crystallization of bcc α-FeCo(Si) and secondary crystallization of Fe_2B. The activation energy

for bcc α-FeCo(Si) and Fe_2B phase has been calculated using Kissinger's equation. Since only the α-FeCo(Si) phase is responsible for the desired soft magnetic behavior.

PP-55: Effect of step annealing temperature on the crystallization kinetics of $Fe_{30}Ni_{50}B_{20}$ metallic glass

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$Fe_{30}Ni_{50}B_{20}$ amorphous metallic ribbon has been prepared by rapid solidification technique and their amorphous nature has been confirmed by X-ray Diffraction (XRD). The crystallization kinetics has been studied by differential thermal analysis (DTA). The metallic glass has been annealed in a controlled way in the temperature range 200 to 300^0C at constant annealing time one hour and 30 min. The kinetics of primary crystallization α-Fe(Ni) phase and secondary crystallization Fe_2B phase was studied as affected due temperature. The activation energy has been calculated using Kissenger's plots for as-cast, 200°C, 250°C, and 300°C and found that the activation energy for 30 min slightly increases in compare with the holding time 1 hour as well as as-cast ribbon. Step annealing time effects in DTA results at constant annealing temperature observed that crystallization phase practically small changed but activation energy slightly increase in short annealing time means kinetics anisotrophy reorientation depends on the instantaneous state interms of activation energy products can be used as soft magnetic glass materials.

PP-56: Phase stability and physical properties of a B-site ordered Nd_2CrFeO_6 double perovskite: A first-principles study

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In this investigation, the first-principles predictions on the structural stability, magnetic behavior and electronic structure of B-site ordered double perovskite Nd_2CrFeO_6 have been

reported. To explore the properties of Nd_2CrFeO_6, the ground state of the parent single perovskites $NdCrO_3$ and $NdFeO_3$ was first analyzed to establish the relevant Hubbard U parameter. The thermodynamic, mechanical, and dynamic stability analyses indicate that the Nd_2CrFeO_6 double perovskite may be synthesized at ambient pressure. The compound shows a ferrimagnetic nature with 2 μ_B net magnetic moment and the magnetic ordering temperature has been estimated to be ~265 K. With a band gap of 1.85 eV, the electronic structure suggests that direct photon transitions have a higher probability over indirect transitions. Additional effects of Nd (4f) spin and spin–orbit coupling on the band edges have been found to be negligible for this 4f–3d–3d spin system. Because of its ferrimagnetic nature and significantly lower band gap compared to its antiferromagnetic parent single perovskites, the B-site ordered Nd_2CrFeO_6 double perovskite could be a promising material for spintronic and visible-light driven energy applications.

PP-57: Sol-gel synthesized double perovskite Nd_2FeCrO_6: Structure and magnetic properties

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A new double perovskite, Nd_2FeCrO_6 has been synthesized by citrate-based sol-gel technique. The crystal structure was studied from Rietveld refined powder X-ray diffraction data. Rietveld fits to the pattern showed that this compound has an orthorhombic symmetry defined in the space group Pnma, where the Fe and Cr cations are randomly distributed in the B-sublattice of the perovskite structure. Both bright field transmission electron microscopy (TEM) and high-resolution TEM imaging were carried out to determine the size and inter-planar spacing of the synthesized nanoparticles. The field-dependent magnetic hysteresis loops demonstrated the coexistence of weak ferromagnetic and antiferromagnetic domains in Nd_2FeCrO_6 nanoparticles. The temperature-dependent magnetization curves exhibited magnetization reversal (MR) behavior in this double perovskite at 6 K in the field cooled mode. In addition, at 10 K and 150 K positive and negative exchange bias (EB) effects were observed, respectively which were found to be tunable by applying magnetic field. The presence of both MR and EB in Nd_2FeCrO_6 double perovskite might be worthwhile for potential applications in the next generation spintronic devices.

PP-58: Study of Pb doped lanthanum manganite synthesized by solid state reaction technique

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We synthesize the perovskite type $La_{1-x}Pb_xMnO_3$ (x = 0.2, 0.3, 0.4 and 0.5) manganite using solid state reaction technique to study the various properties such as structural, elastic, electronic, magnetic and so on. All these samples crystallize in a rhombohedral structure with space group $R\bar{3}c$. The energy dispersion, computed by first-principles calculations under the framework of density functional theory (DFT), of these perovskites show metallic behavior at ambient condition. The prime contribution for the highest portion of electronic states occupying the valance band energy comes from Mn-3d and O-2p orbitals while the electronic states occupying the conduction band from Mn-3d and La/Pb-5d orbitals.

PP-59: Effect of Ho-Substitution on Structural, Electrical and Magnetic Properties of $Ni_{0.25}Cu_{0.20}Zn_{0.55}Ho_xFe_{2-x}O_4$ Polycrystalline Ferrites

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The present work is acquainted with the study of Ho^{3+} doped $Ni_{0.25}Cu_{0.20}Zn_{0.55}Ho_xFe_{2-x}O_4$ (x=0.00, 0.02, 0.04, 0.06, 0.08) chemical compositions which are prepared by conventional solid state reaction technique. The samples are sintered at 1050^0C for holding time of 4 hours. X-ray diffractograms confirm that all the samples possess spinel structure with the appearance of small peaks representing secondary phases and oxides of Ho^{3+}. The theoretical density (ρ_{th}), bulk density (ρ_B), and porosity are calculated from the XRD data and using appropriate formulae. The lattice constant, the bulk density and X-ray density follow the increasing trend with increase of Ho^{3+} content whereas the porosity follows the decreasing trend. Value of theoretical density is found to be greater than the value of bulk density indicating the formation of pores inside the bulk specimen. The microstructural and compositional investigation has been done using Field Emission Scanning Electron Microscope (SEM) and Energy Dispersive Spectroscopy (EDS). From SEM it is found that the average grain size decreases with the increase of Ho^{3+} content. The complex permeability, loss tangent, dielectric properties are investigated as a function of frequency up to 120 MHz at room temperature by using impedance analyzer. The initial permeability decreases with the increase of Ho^{3+} substitution. The M-H loop was obtained by Vibrating Sample Magnetometer (VSM). Saturation magnetization (M_s) reduces with the Ho content, whereas the remanent magnetization (M_r) and coercivity (H_c) increase with the concentration of Ho^{3+} in the composition. The M_r/M_s ratio also increases which is desirable for magnetic recording and memory devices. The dielectric constant shows dispersion in the lower frequency range and is independent of frequency at high frequency region having lowest loss which may be used in practical applications. The maximum value of real part of dielectric constant is obtained for the composition, x=0.02. The variation of

electrical properties in Ho^{3+} doped Ni-Cu-Zn ferrites are explained on the basis of Fe^{2+}/Fe^{3+} ion concentration with effect of Ho^{3+} ions as well as the electron hopping frequency between Fe^{2+} and Fe^{3+} ions. The lowest resistivity is observed for the composition x=0.02 and the highest is observed for the composition x=0.06. Impedance spectroscopic study confirms that all the compositions have only grain effect to the conduction mechanism.

PP-60: Structural and Electromagnetic Properties of Dy^{3+} Substituted Ni-Cu-Zn Ferrites

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Polycrystalline $Ni_{0.5}Cu_{0.15}Zn_{0.35}Dy_xFe_{2-x}O_4$ (x=0.00, 0.02, 0.04, 0.06, 0.08) ferrites are synthesized by conventional solid state reaction method. Structural, surface morphology and compositional analysis are characterized by X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), respectively. The magnetic properties of these ferrites such as frequency dependent complex initial permeability, relative quality factor (RQF) are measured by Wayne Kerr Impedance Analyzer at room temperature in the frequency range 100 kHz to 120 MHz and the DC magnetizations as a function of applied magnetic field are performed by Vibrating Sample Magnetometer (VSM). The frequency dependent dielectric properties are also studied by Impedance Analyzer. The XRD patterns confirm the formation of spinel structure with the appearance of very few impurity peaks. The exact lattice parameter, a_o, X-ray density, bulk density increases with the increase of Dy content. It is clearly observed that the porosity of the sample behaves exactly opposite to the bulk density. The crystallite size decreases with the increase in Dy concentration. For undoped sample the crystallite size is maximum and the lowest size is obtained for x = 0.02 sample. It is also shows that the grain size D increases with increasing Dy^{3+} substitution up to x = 0.08 which could be attributed to the higher ionic radius of Dy^{3+} than Fe^{3+}. From the M-H loop, it is observed that with increasing Dy content saturation magnetization decreases and the coercivity, H_c increases with Dy content except for x=0.04. The imaginary part of initial permeability, μ_i'' , decreases with increasing frequency. Frequency dependence of magnetic loss tangent ($\tan\delta_m$) is observed to have the lowest value for the sample with x=0.06. The maximum RQF is obtained for the undoped sample. The frequency variation of dielectric constant is studied at room temperature in the frequency range of 100 Hz-120 MHz regions. Maximum dielectric constant is obtained for x=0.04 composition. Impedance spectroscopic study confirms that all the compositions have only grain effect to the conduction mechanism. The variation of imaginary part of dielectric modulus (M″) reveals that M''_{max} shifts towards lower frequency side on increasing Dy content in the composition except for x=0.06. The ac conductivity is found to be maximum for x =0.08. The most probable conduction mechanism is electron hopping between Fe^{2+} and Fe^{3+} ions.

PP-61: Hot-injection synthesized lead-free $CsSnCl_3$: A combined experimental and theoretical investigation

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Alternate lead-free perovskites have gained significant attention because of their promising light-harvesting properties. Here, we have demonstrated the successful synthesis of thermally stable cubic $CsSnCl_3$ perovskite nanocrystals with an average crystal size of ~300 nm by adopting a rapid hot-injection method. The as-synthesized nanocrystals demonstrated an improved morphology and excellent crystalline quality which were confirmed from the field emission scanning electron microscopy and transmission electron microscopy imaging. Moreover, the surface chemical states and binding of the organic ligands were characterized by employing X-ray photoluminescence spectroscopy and nuclear magnetic resonance spectroscopy. A bandgap around 2.98 eV was obtained from the UV-visible absorption spectra, which was further corroborated by carrying out the steady-state photoluminescence spectroscopy. Later, to exploit these favorable bandgap positions, we have conducted photocatalytic degradation experiments towards the degradation of rhodamine-B (RhB) dye under the irradiation of both visible and UV-visible light, and up to 58% degradation was obtained under UV-visible light without the assistance of any co-catalyst. By employing our experimentally obtained structural parameters, we have carried out density functional theory (DFT) based first-principles calculation within the generalized gradient approximation (GGA) and GGA+U methods with a 90% accurate estimation of the experimentally obtained optical bandgap by employing U_{eff} = 6 eV. The ratio of the effective mass of the hole and electron ($D = m_h^*/m_e^*$), a crucial parameter to predict potential photocatalytic performance of nanomaterials, was also calculated for U_{eff} = 6 eV. From our theoretical calculation and experimental demonstration of the photocatalytic performance of $CsSnCl_3$ nanocrystals, we proposed a more coherent interpretation of this "D" value, and we believe that a "D" value of either much smaller or much larger than 1 can be instrumental to predicting the low recombination rate of the photogenerated electron-hole pairs and the better photocatalytic efficiency of a photocatalyst. We expect that our extensive investigation might be helpful for the efficient synthesis of thermally stable analogous cubic nanocrystals and can be contributory to further elucidation of the rationale behind their potential photocatalytic and photovoltaic applications.

PP-62: Design and Construction of a low-cost Light Source with variable Wavelength, Intensity, and Illumination period for Photophysical and Photochemical studies of Semiconducting Materials

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A light source of selective wavelengths and intensities is desirable in numerous fields of research and analysis such as investigating performance parameters and efficiency as well as quality of different layers and interfaces of solar cells, photoelectrochemical water-splitting devices, characterization of photocatalysts, and photodegradation studies of organic pollutant from textile and leather industries etc. Conventional light sources used for these types of research are costly, space consuming, cumbersome to work with and limited to specific applications. To address these issues, we have developed a light source with variable wavelength, intensity and illumination period using an illumination period control unit (IPCU), voltage regulator, neutral density (ND) filter, alterable LEDs etc. The variable wavelengths of this light source range from 360 nm - 800 nm, the illumination period can be of any seconds or minutes and the light intensity ranges from 0 - 100% or 0 - 100 mW/cm^2. Our objective is to develop a low cost and low power consuming, versatile, portable light source which can be used in the above-mentioned fields as well as to determine any photophysical or photochemical properties of samples under investigation. As a proof-concept, we employed our constructed light source to investigate the intensity, wavelength, illumination period modulated photovoltaic and impedance properties of inorganic and organic solar cells which will be presented at the conference. We hope to use this light source for photocatalytic and photoelectrochemical studies of metal oxides materials used for sunlight driven hydrogen production.

PP-63: Mineralogical analysis of rock samples collected from Jaflong and Bholaganj areas of Sylhet district

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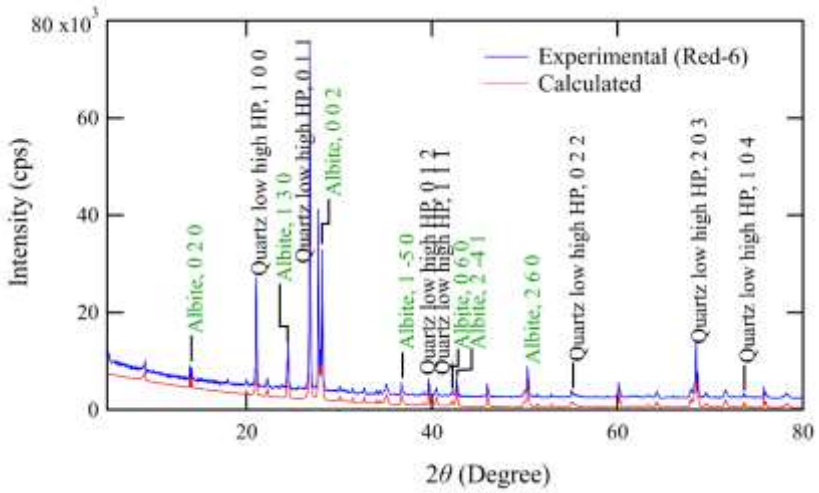
There exist plenty of naturally occurring various colored rocks in Jaflong and Bholaganj regions of Sylhet district. This work is aimed at discovering minerals reside in the rocks in those regions and to justify their potential uses. Samples have been collected from 10 locations of Jaflong and 10 locations of Bholaganj. Black, red and white rock samples are collected from each location. Rock samples are converted into powder form using a stainless-steel hammer for X-ray diffraction (XRD) measurements. Intensity versus scattering angle patterns of XRD have been analyzed by Rigaku Smartlab Studio-II software incorporated with Rietveld refinement. Very good diffraction patterns are obtained for white and red rocks. The patterns for black rocks are not so good, and it may be due to the destruction of crystalline state of the samples while hitting by the hammer. Various minerals are identified in the rocks. Identified minerals in black rocks are coesite HP (SiO_2), Ferro-holmquistite [$\{Li_2\}\{Fe^{2+}{}_3Al_2\}(Si_8O_{22})(OH)_2$], Quartz low HP, Potassium Titanium oxide, Albite low HP (sodium tecto-alumotrisilicate), albite intermediate, etc. White rocks contain quartz low high HP, Glagolevite ($NaMg_6(AlSi_3O_{10})(OH,O)_8$), quartz low HP, etc. Minerals detected in the red

rocks are silicon dioxide, quartz low high HP, Albite ($NaAlSi_3O_8$), Rutile HP (TiO_2), Microcline ($K(AlSi_3O_8)$), etc. Following is the XRD pattern observed from red rock (#6) due to Albite and quartz low high HP minerals.



PP-64: First-Principles Insights into the Lattice Parameter, Electronic, Optical, Mechanical and Thermodynamic Properties of ABO_3 [A=Ba, Ca, Sr; B=Ce, Ti, Zr] Perovskites

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The mineral perovskite ($CaTiO_3$) was discovered and named by Gustav Rose in 1839 from samples found in the Ural Mountains and is named after a Russian mineralogist, Count Lev Aleksevich von Perovski. Since then, the perovskite family of materials has gotten a lot of interest. Perovskite is a real engineering ceramic material with a wide range of uses in energy generation, environmental containment, and communications. Doping has been done to enhance the desired properties of perovskites. Both wide and narrow band gaps of perovskite-type semiconductors are important in optoelectronic industries. Mechanical and thermodynamic properties of perovskites are also important in fabricating mechanical or thermoelectric devices. Numerous investigations have been done on the perovskites with structure ABO_3. In this work, the first-principle based comparative study has been done of the materials structured ABO_3, where A=Ba, Ca, Sr and B=Ce, Ti, Zr. The lattice parameter, electronic, optical, mechanical, and thermodynamic properties of these nine materials have been investigated to their ground state under the same computational parameters.

PP-65: Structural, magnetic, and optical properties of Y_2FeCrO_6 double perovskite synthesized by sol-gel technique

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In this investigation, Y_2FeCrO_6 double perovskite nanoparticles have been synthesized for the first time by adopting the facile citrate-based sol-gel technique by optimizing synthesis steps and temperatures to investigate their structural, magnetic and optical properties. The Rietveld refinement of the X-ray diffraction pattern of the synthesized Y_2FeCrO_6 nanoparticles confirmed their single-phase orthorhombic structure with the pbnm space group. The average size of the nanoparticles was determined to be ~70 nm by both field emission scanning electron microscopy and transmission electron microscopy. The existence of mixed cationic states of Fe and Cr ions was confirmed by X-ray photoelectron spectroscopy. The field-dependent magnetic hysteresis loops exhibited the coexistence of weak ferromagnetic and antiferromagnetic domains in Y_2FeCrO_6 nanoparticles. The temperature-dependent magnetization curve demonstrated magnetic reversibility of this double perovskite material at 185 K in the field cooled mode. The UV-visible spectroscopy ensured that Y_2FeCrO_6 nanoparticles have a direct band gap of ~1.91 eV which was further confirmed by steady-state photoluminescence spectroscopy. This semiconducting material can be used for photovoltaic applications and photocatalyst because of its capability to absorb the visible spectrum of solar light efficiently.

PP-66: Structural and Electrical Properties of Bi_2O_3 added Ni-Co-Zn Ferrites

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The effects of various amount of Bi_2O_3 (x = 0.0, 0.3, 0.6, 0.9 and 1.2 wt %) addition on the structural and electrical properties of Ni-Co-Zn ferrites were investigated, where the samples were prepared by the solid state reaction technique and sintered at different temperatures (1000, 1100 and 1200 ^oC). The X-ray diffraction (XRD) patterns confirmed the single phase cubic spinel structure for all the samples. The lattice parameter, bulk density, x-ray density and porosity were calculated for all the samples. It is also observed from XRD patterns that there is no influence on the structural change from the cubic spinel phase due to the addition of Bi_2O_3. The exact ferrite formation has also been observed by the FTIR analysis with two absorption

bands at around 570 cm^{-1} and 364 cm^{-1} which is due to the stretching vibrations of metal-oxygen at tetrahedral and octahedral sites, respectively. The Field Emission Scanning Electron Microscopy (FESEM) was used to examine the surface morphology for all the samples. It clearly shows that the grain growth of Ni-Co-Zn ferrites is strongly dependent on the Bi_2O_3 addition. The dielectric constant, dielectric loss, ac conductivity, and impedance spectroscopy of Bi_2O_3 added Ni-Co-Zn ferrites are investigated at room temperature (300 K) as a function of frequency. The dielectric property of the sample follows Maxwell-Wagner type polarization. The Cole-Cole plots have demonstrated that the conduction mechanism takes place through the grain property.

PP-67: Dielectric and Magnetocaloric Properties of $La_{1-x}Sr_xMnO_3$ Perovskite Manganite

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The perovskite manganite of $La_{1-x}Sr_xMnO_3$ (x= 0.2, 0.3, and 0.4) has been prepared by the conventional solid-state reaction route using the planetary ball milling technique. The structural properties have been investigated with X-ray diffraction (XRD) technique and it clearly shows the rhombohedral structure with space group R-3C. Microstructure of the samples was observed by Field Emission Scanning Electron Microscopy (FESEM). The dielectric properties of the samples revealed that $La_{1-x}Sr_xMnO_3$ (x= 0.2, 0.3, and 0.4) possesses a high dielectric constant at room temperature in lower frequencies. It follows Maxwell-Wagner type interfacial polarization. For investigating of Magnetocaloric (MCE) properties of the samples, isothermal magnetizations were measured as a function of magnetic field ranging from 0 - 5 T at different constant temperatures with an interval of 5 K. The Nyquist plots of the samples at room temperature demonstrate that the domain wall relaxation with a single relaxation time constant is the type of magnetic relaxation for each composition of the studied samples.

PP-68: Structural and Magnetic Properties of Dy substituted Ni-Co-Zn ferrites

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The structural and magnetic properties of Dy substituted Ni-Co-Zn ferrites having the general formula $Ni_{0.52}Co_{0.03}Zn_{0.45}Dy_xFe_{2-x}O_4$ (where x=0.00, 0.005, 0.01, 0.03, 0.05 and 0.07) have been observed, where the samples are synthesized by solid-state reaction technique and sintered at 1100 °C for 3 h in air. It showed from an X-ray diffraction (XRD) technique that the samples were single-phase cubic spinel structures for $x \leq 0.01$. However, the cubic spinel phase coexists with the amount of $DyFeO_3$ phase for $x \geq 0.03$, which could be attributed to the larger ionic radius of Dy^{3+} (0.104 nm) compared to Fe^{3+}(0.067 nm). It has been observed that the crystallite sizes increased from 117 to 130 nm up to x = 0.03. However, at higher concentration (x > 0.03) it shows the anomalous behavior which may be related to the $DyFeO_3$ phase formation. The density of the samples was found to increase with Dy contents (x=0.0 to 0.05) and slightly decreased for higher Dy contents (x=0.07). The exact ferrite formation also has been observed by the FTIR analysis with two absorption bands at around 570 cm^{-1} and 364 cm^{-1} which is due to the stretching vibrations of metal-oxygen at tetrahedral and octahedral sites, respectively. A slight distortion of the absorption band with the increase of Dy^{3+} has been observed. The magnetic hysteresis loop was observed from PPMS investigation at room temperature. The coercivity, saturation magnetization and remnant field were observed for different samples. The saturation magnetization was found to larger value (for x=0.03) than that of pure system.

PP-69: Studies on the Structural and Magnetic Properties of Ti doped $Bi_{0.80}Ba_{0.20}FeO_3$ Ceramics

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$Bi_{0.80}Ba_{0.20}Fe_{1-x}Ti_xO_3$ ($0 \leq x \leq 0.10$) samples were synthesized by solid state reaction method. Bi^{3+} site is replaced with 20% Ba^{2+} ions which induced structural phase transformation from rhombohedral to pseudo cubic along with the creation of oxygen vacancies due to the charge compensation. All the samples exhibited similar morphology and no significant variation in grain size is observed by substituting Ti at Fe site. All of the samples showed ferromagnetic behavior which is attributed to the destruction of spiral spin structure and change in the strength of super-exchange interaction due to variations in Fe─O bond lengths along with the Fe─O─Fe bond angles. The decrease in magnetization with increase in the concentration Ti is attributed to the dilution of magnetic moment due to non-magnetic Ti^{4+} ions. An anomalous trend in magnetization is observed for magnetic measurements at low temperature (77K) where structural transformation from ferromagnetic to diamagnetic behavior was noted for 10% Ti content. Further, because of the incorporation of Ti^{4+}, an improved dielectric property was observed due to increase in resistivity and decrease in the defect concentration (oxygen vacancies). In the present study, it was concluded that optimum concentration of Ba^{2+} and Ti^{4+} co-doped BFO systems have shown enhanced multiferroic properties at room temperature.

PP-70: An Overview of Smart Technology for Textiles and Clothing

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We have always been inspired to mimic nature in order to create our clothing materials with higher levels of function and smartness. The development of microfibers is a very good example starting from studying and mimicking silk first, then creating finer & in many ways better fibers. However, up to now, most textiles & clothing have been lifeless. But it would be wonderful to have clothing like our skin, which is a layer of smart material. The skin has sensors which can detect pressure, pain, temperature etc. Together with our brain, it can function intelligently with environmental stimuli. In the last decade, research & development in smart/intelligent materials and structures have led to the birth of a wide range of novel smart products in aerospace, transportation, telecommunications, homes, buildings and infrastructures. Although the technology as a whole new, some areas have reached the stage where industrial application is both feasible & viable for textiles & clothing. Shape memory polymers have been applied to textiles in fiber, film and foam forms resulting in a range of high performance fabrics & garments. Fiber sensors which are capable of measuring temperature, strain/stress, gas & smell are typical smart fibers that can be directly applied to textiles. We have learnt a lot from nature. Viscose rayon, nylon, polyester & other synthetic fibers were invented initially for the sake of mimicking their natural counterparts like cotton, jute, flax, silk, asbestos etc. The technology has progressed so that synthetic fibers & their products surpass them in many aspects. We are living in the exciting era feeling the great impacts of technology on the traditional textiles & clothing industry. Traditionally, many fields of science and engineering have been separate & distinct. Recently, there has been considerable movement and convergence between these fields of endeavor. Smart technology for materials and structures is one of these results. Smart textiles are made possible due to advances in many technologies coupled with the advances in textile materials and structures. A partial list includes biotechnology, information technology, nanotechnology etc. Various technological domains are commonly used in smart textiles & clothing. Common and important ones are fiber optics, conductive fibers & yarns, polymers, nanotechnologies of fiber & fabric coating. And organic or plastic electronics are also involved.

Smart technologies are the most exciting innovation in the field of smart textiles & clothing. Smart textiles can sense and analyze the signals & response in an intelligent way. And the response can be electrical, thermal, mechanical, chemical, magnetic or from the other sources. This study aims to present the overview of smart technology, its types and functions for next generation textiles & clothing.

PP-71: Characteristic behavior of Single and Multi Junction ac Josephson Effect in Superconductor

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Recent research (20-25 years) on Josephson junction effects in superconductors has drawn a lot of attention in the scientific community, owing to the emergence of the unique physical phenomena which are applicable in diverse branches of Modern Science and Technology. SQUIDs (superconducting quantum interference devices), Qubits in Quantum Computers, Quantum Interferometers, Quantum Sensing, Imaging etc. are all historical examples of Josephson Junction Devices. In this study, we have reviewed how a proposed model of multi junction ac Josephson effects in a superconductor has worked. To evaluate Josephson junctions for technological applications, a few parameters describing their behavior are required. Here, we have estimated some characteristics parameters of the multi Josephson junction connected in parallel and provided some numerical results for specific superconducting samples based on this model.

PP-72: Spin transport and spin Hall effect in nonmagnetic semiconductors

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The transport of spins and its resulting effect in a nonmagnetic semiconductor device were studied. We started from the continuity equation taking into account spin relaxation and the equation for current density adding the terms for drift and diffusion contributions. The spins are injected by a ferromagnetic coupling through an insulating tunnel junction and a spin polarized current from the left of the device. We derived the spin drift-diffusion equation for the spin density of the injected spin current. The spin diffusion and spin density were studied. It was fond that spin diffusion length and longitudinal spin density increase with electric field. The spin diffusion length was also found to decrease with temperature. We derived the expressions for the transverse spin accumulation (spin Hall effect) and charge accumulation (anomalous Hall effect) and then analyzed them in dependences of device structure-parameters and spin-splitting parameter. It was found that the spin accumulation or spin Hall effect increases with spin-splitting parameter and transverse distance. It was also found that the spin accumulation or spin Hall effect deceases with increasing the device width exceeding the intrinsic spin diffusion length. The transverse field due to the spin-induced charge accumulation or the anomalous Hall effect increases with increasing the distance within the device width, i.e., at the boundary. Finally, in order to search for a possible way of enhancing the spin current, we studied the spin current and the electron statistics on the basis of the Einstein diffusion model. From the analysis of the spin diffusion coefficient for the different electron statistical regimes, we showed that the use of a semiconductor degenerate regime

could enhance the spin current or the effect in nonmagnetic semiconductors. The results, however, show that these might have useful applications in nonmagnetic semiconductor spintronic devices working in the drift-diffusion and degenerate regimes.

PP-73: The superconductivity of neutron Star

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To investigate the structural properties of strongly magnetized neutron star (NS), we have followed the Landau magnetization approach of quantized, degenerate electrons to obtain a new expression of the magnetization M, in the presence of super strong magnetic field B($\gtrsim 10^{13}$G). It has been shown that the susceptibility is positive square root function of B, hence the associated permeability (μ) will be than 1. Then, the conceptual issue regarding the impact of magnetization M on the Maxwell-quantum magneto hydrodynamic (QMHD) equations is addressed, the obtained modified QMHD model is followed to investigate the dispersive properties of low frequency waves in weakly ionized plasma, consisting of degenerate neutrons, electrons and ions in the atmosphere of degenerate NS. The dispersion relation of a new type of magnetosonic waves propagating perpendicular to the B field is obtained in the presence of quantized magnetic pressure, with Alfven speed being reduced by the factor μ. It is shown that magnetar flares may excite new type of Alfven waves propagating along the B field, Alfven frequency is found to have only decreasing trend with the increase of μ, to depict that the surface-crust of NS are magnetized enough to contain a quantum ordered superconducting fluid. Moreover, the Alfven speed, calculated here, is found to be a function of neutron mass density in contrast to the usual electron ion plasma case. We suggest an experimental search for Alfven-like waves in superconductors.

PP-74: Ab-initio investigation of structural, mechanical, thermodynamic, electronic and optical properties of $Sc_2Al_2C_3$

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In the past decades, the research on layered materials has attracted more and more attention, not only because they have many peculiar and anisotropic physical properties but also because they are the precursors of many fascinating two-dimensional (2D) materials. In this comprehensive report, we have made an effort to simulate the structural, mechanical, thermodynamic, electronic and optical properties of $Sc_2Al_2C_3$ within the instruction of density functional theory. The exchange-correlation potential is probed through generalized gradient approximation. The computed lattice parameters are consistent with the experimentally reported results. The mechanical and structural stabilities are defined through the computation of elastic constants and optimization of total energy, respectively. We have discussed the anisotropic properties and hardness values for the first time. Band structure and energy state distribution plots portray the semiconducting behavior for $Sc_2Al_2C_3$ and are consistent with experiment. The estimated Debye temperature, lattice thermal conductivity and lattice dynamical features are discussed in detail for the first time. The high melting temperatures of these compounds are beneficial for their potential applications at elevated temperatures. Important optical constants such as dielectric constants, refractive index, absorption coefficient, photoconductivity, reflectivity and loss function are calculated and discussed in detail. Optical conductivity is found to be in good qualitative agreement with the results of band structure calculations.

PP-75: Advances with Triphenylene Derivatives in Optics and Electronics

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Triphenylenes are significant due to their planar rigid structure and ability to accept a variable number of functional side arms. Due to the planar geometry of three benzene rings paired with flexible side arms, triphenylene derivatives offer tremendous promise in supramolecular and materials science. Due to the stacking interaction between the benzene rings and the van der Waals interaction between the triphenylene side arms, discotic liquid crystals may self-assemble into columns. When organic donor-acceptor molecular systems based on triphenylene are in solution and coupled by a non-conjugated flexible bridge, complementary optical spectroscopy may be utilized to investigate their photophysical characteristics. When diluted to an acceptable concentration, these chemicals may behave independently as molecules in solution. As a result, they have the potential to be exploited as multifunctional molecular receptors. Under UV light, these molecules emit a bluish purple fluorescence. This is facilitated by the fact that these molecules have a planar structure and a three-fold rotation axis composed of colorless needle-like crystals. As a result of these features, Triphenylene and its derivatives may be useful in optics and electronics. In our work we will discuss about the utilization of Triphenylene derivatives in optics and electronics.

PP-76: Electronic Structures and Magnetic Properties of (MgA)O Diluted Magnetic Insulators (A = Cr, Mn, and Co)

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The magnetic properties and electronic states of $(Mg_{1-x}A_x)O$ compounds (where A = Cr, Mn and Co, and x is the fractional concentration) are calculated using the Korringa-Kohn-Rostoker (KKR) Green's function method combined with the coherent potential approximation (CPA). The total energy of the ferromagnetic (FM) state and local moment disordered (LMD) state are calculated for all the compounds. The energy difference between FM and LMD states per unit cell is used to estimate the Curie temperature (T_C) within the mean-field approximation. The calculated value of T_C for $(Mg_{1-x}Mn_x)O$ is higher than that of the room temperature (RT) for x = 2% to 15% dopants. For the increment of concentration, the T_C for Mn-doped insulators follows a decreasing trend. Besides, for Cr doped substances, T_C is below the RT, and for Co doped situations, it is above the RT at 1%, but at greater concentrations, it has a low T_C. On the other hand, the energy difference in Fe-doped materials is zero and in Ti, V, and Ni-doped materials result in energetically lower values of the LMD states, where the super-exchange interaction dominates over the FM states.

PP-77: First principles calculations to investigate interesting physical properties of $(Ba_{0.82}K_{0.18})(Bi_{0.53}Pb_{0.47})O_3$ single-cubic-perovskite superconductor

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In the present study, the pseudopotential plane-wave (PP-PW) pathway in the scheme of density functional theory (DFT) is utilized to investigate the various interesting physical properties on $(Ba_{0.82}K_{0.18})(Bi_{0.53}Pb_{0.47})O_3$ (BKBPO) single perovskite superconductor. We have analyzed mechanical properties, elastic constants, and moduli at ambient temperature with zero and elevated pressures (up to 25 GPa) as well. The calculated values of Poisson's ratio, Pugh's indicator, and Cauchy pressure of the studied superconductor are found to be brittle in nature at ambient conditions. The calculated machinability index and hardness values of BKBPO perovskite indicate its superior industrial applications to similar ones. The compound might be considered as a promising thermal barrier coating (TBC) material base on Young's modulus (E) and thermal shock coefficient (R) data. We also have investigated the anisotropic nature incorporating both the theoretical indices and graphical representations in 2D and 3D dimensions, which express a high level of anisotropy of the studied compound. The flatness of the energy bands near EF is a sign of Van-H_f singularity that might increase the electron pairing and origination of high-T_C superconductivity. The computed band structure exhibits its metallic characteristics which are confirmed by band overlapping in the diagram. A band of DOS is formed for the strong hybridization of the constituent elements where the orbital electrons of O-2p contribute most dominantly at EF in contrast to all orbital electrons. The orbital electrons at the EF are higher from both the partial density of states and charge density mapping investigation. The coexistence of the electron and hole-like Fermi sheets exhibits the multi-band nature of the BKBPO superconductor. On the other hand, Fermi surfaces with flat faces promote transport features and Fermi surface nesting as well. The calculated value of the electron-phonon (e-ph) coupling constant (λ = 1.46) is slightly lower than the isostructural superconductor, which indicates that the studied BKBPO can be treated as a strongly coupled superconductor similar to the previously reported isostructural perovskite superconductors. Furthermore, the thermodynamic properties have been evaluated and analyzed at elevated temperature and pressure by using harmonic Debye approximation (QHDA).

PP-78: Dosimetric Comparison between Intensity modulated radiotherapy versus volumetric modulated arc therapy treatment plans for Breast Cancer

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Purpose: This study compared the dosimetric characteristics of volumetric modulated arc therapy and Intensity modulated radiotherapy techniques regarding target volume coverage and dose to heart, spinal cord, and lung for patients with breast cancer. We analyzed the dosimetric

differences of plans in the treatment planning system between VMAT and IMRT in treating breast cancer.

Method and Materials: Treatment plans were analyzed for 10 patients. Patients were treated with a technique that concurrently combines IMRT beams and the VMAT technique. IMRT treatments are generated using 4 tangential fields IMRT and VMAT plans were made with one arcs fields for the same patients. IMRT and VMAT treatments plans were planned for 50 Gy in 25 fractions. All treatment plans were planned due to protocols & the patient's condition. Comparative endpoints were dose homogeneity within PTV, target dose coverage, doses to the critical structures and number of monitor units, treatment delivery time. Both plans were optimized to Dose-volume histograms values.

RESULT: The IMRT & VMAT average mean heart dose was (cGy), V30 (%) and V33 (%) for the heart were 453.7±75.5,0.85%±0.06% and 0.19%±0.017% by VMAT, and 421.7±48.6 ,0.25%±0.11% and 0.016%±0.011% by IMRT, respectively. The left lung mean dose (cGy), V10 (%), V20 (%) were significantly reduced from 1459.5±36.99, 36.5%±0.96% and 19.1%±0.51% with VMAT to 1356.2±48.77, 35.7%0.49% and 18.27%±0.64 with IMRT, respectively. The mean dose (Gy), 0.03 cc for the spinal cord were by 1 872.6 ± 25.64 cGy VMAT, and 872.6 ± 25.64 cGy by IMRT, respectively.

Conclusion: IMRT plans showed significantly higher mean dose coverage to the PTV and conformity, homogeneity Index better than the VMAT plans. The IMRT plans typically had more favorable dose characteristics to the lung, heart, spinal cord and body dose when compared with VMAT. The main important advantage of VMAT is MU & treatment delivery time better than IMRT.

PP-79: Estimation of Radiological Risk on Public around United Hospital Campus in Dhaka, Bangladesh

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Ionizing radiation in the hospital offers enormous benefit to patient. There are probable short-term and long-term risks associated to public with very low doses of ionizing radiation. Healthcare workers and public are getting radiation from hospitals during diagnosis & treatment of patients. Although recent radiation generating equipments have considerably improved patient care, inappropriate or unsafe handling of the radiation generating equipments as well as radioactive material may also cause possible health risks for patients, workers and also public. Thus, real-time radiation monitoring around the United hospital campus in Gulshan, Dhaka is carried out to identify the radiation hazard arising from medical use of ionizing radiation. The objective of the study is to monitor the real-time radiation around large hospital campus in Dhaka city and estimation of radiological risk on public based on annual effective dose. The real-time radiation monitoring around the large hospital campuses were carried out using digital portable radiation monitoring devices and those devices were placed at 1meter above the ground on tripod. 32 locations around the United hospital campus were

selected for monitoring the real-time radiation and data collection time for each monitoring point (MP) was 1.0 hour. The MPs were marked-out using the Global Positioning System (GPS) device. The real-time radiation dose rates around the United hospital campus were ranged from 0.049 – 1.300 μSv.h^{-1} with an average of 0.148 ± 0.047 μSv.h^{-1}. The excess life-time cancer risk (ELCR) on public who are residing nearby the hospital were ranged from 0.355 X 10^{-3}-9.424 X 10^{-3} with an average of 1.076 X 10^{-3}. The annual effective doses and ELCR on public in few locations around the United hospital campus in Gulshan, Dhaka are higher than those of the prescribed limit of the International Commission on Radiological Protection (ICRP). It is observed from the study that in every thousand people, one of them is at the risk of cancer caused by the scattered radiation exposure from the hospital without any knowledge of being exposed to ionizing radiation. Healthcare workers must handle the radiation generating equipments & radioactive material as per national regulations and IAEA guidelines for minimizing risk on public who are residing nearby area of the hospital.

PP-80: Real-time Radiation Monitoring around National Heart Foundation Hospital Campus and Estimation of Radiological Risk on Public

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Ionizing radiation plays an important role for diagnosis & treatment of patient in the hospital. The usage of ionizing radiation in the hospital is growing worldwide. More than 90% public radiation exposure comes from the medical procedures from the man-made radiation sources. Public who are living beside the large hospital campus is usually getting higher radiation comparing to others. The aim of the study is to monitor the real-time radiation around the National Heart Foundation Hospital campus, Dhaka and estimation of excess life-time cancer risk (ELCR) on public based on annual effective dose. The real-time radiation monitoring was performed from February-April 2021 using digital portable radiation monitoring devices and GARMIN eTrex HC Series Personal Navigator for location identification. The digital portable radiation monitoring device was placed at 1 meter above the ground on tripod and data collection time for each monitoring point (MP) was 1 hour. 32 MPs were selected for taking real-time radiation data around the National Heart Foundation Hospital campus. The measured dose rates due to natural and man-made radionuclides were ranged from 0.099-0.252 μSv/hr with an average of 0.140 ± 0.016 μSv/hr. The annual effective dose to the public due to hospital's radiation was varied from 0.173- 2.242 mSv with an average of 0.248 ± 0.079 mSv. ELCR on public around the National Heart Foundation hospital campus based on annual effective dose was calculated and varied from 0.718 ×10^{-3} to 9.279 ×10^{-3} with an average value of 1.027 ×10^{-3}. Real-time radiation monitoring around hospital is important for detection of the equipment's fault and improper operation of the radiation generating equipments. It is observed from the study that in every thousand people, one of them is at the risk of developing cancer caused by the scattered radiation exposure from the National Heart Foundation hospital during his/her life time.

PP-81: Real-time Environmental Radiation Monitoring in Dhanmondi Thana following In-Situ Method

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Real-time environmental radiation monitoring is very important for generation of the baseline database. The baseline database is required to know the changes after operation of the nuclear facility in the country. In this study, real-time environmental radiation monitoring was performed at area of Dhanmondi Thana under Dhaka city. The real-time radiation monitoring was carried out using digital portable radiation monitoring devices. The digital portable devices were placed at 1 meter above the ground on tripod and data collection time for each monitoring point (MP) was 1 hour. Total 40 MPs were selected for collection of the data in the outdoor environment of Dhanmondi Thana from August-November 2021. The MPs were marked-out using Global Positioning System (GPS) navigation. The real-time radiation dose rates were ranged from 0.110 ± 0.032 µSv/hr to 0.210 ± 0.056 µSv/hr with an average of 0.150 ± 0.040 µSv/hr for outdoor measurement. The annual effective dose to the public due to the outdoor environmental radiation were varied from 0.185 ± 0.056 mSv to 0.373 ± 0.098 mSv with an average of 0.265 ± 0.039 mSv. Excess Life time Cancer Risk (ELCR) on public is calculated based on the real-time radiation monitoring data. These values are lower than India, Azerbaijan & higher than Sweden, China, Czech Republic, Italy, Canada, Turkey, Indonesia, Belgium, Albania, New Zealand and some other counties. This kind of study is required to detect the presence of natural radionuclides and artificial radionuclides (if any) releasing from nuclear & radiological facilities in the country or from neighboring countries in normal operations or in case of accident/incident. From the study, it can be concluded that there is no radiation burden to the environment due to man-made sources.

PP-82: Assessment of Radiation Risk on Public around Cancer & Mitford Hospital Campuses in Dhaka, Bangladesh

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Clinical applications of ionizing radiation are grouped into diagnostic and therapeutic procedures. It is found in the international reports that public are getting maximum radiation (90%) from the hospital among man-made sources. There are possible short-term and long-term risks associated to public with very low doses of ionizing radiation. Healthcare workers

and public are getting radiation from the hospitals during diagnosis & treatment of patients. Even though, modern radiation generating equipments have significantly enhanced patient care, improper or unsafe handling of the radiation generating equipments & radioactive substances may also cause probable health risks to patients, workers and also public. So, real-time radiation monitoring around the National Institute of Cancer Research & Hospital and Sir Salimullah Medical College Hospital in Dhaka are performed to identify the radiation hazard arising from medical use of ionizing radiation. The objective of the study is to monitor the real-time radiation around large hospital campus in Dhaka city and estimation of radiological risk on public based on annual effective dose. The real-time radiation monitoring around the large hospital campuses were carried out using digital portable radiation monitoring devices and those devices were placed at 1meter above the ground on tripod. 64 locations around the two large hospital campuses were selected for monitoring the real-time radiation and data collection time for each monitoring point (MP) was 1.0 hour. The MPs were marked-out using the Global Positioning System (GPS) device. The real-time radiation dose rates around the Cancer & Mitford Hospital campuses were ranged from 0.049 – 0.252 $\mu Sv.h^{-1}$ (mean: 0.151 ± 0.023 $\mu Sv.h^{-1}$) & from 0.089 – 0.266 $\mu Sv.h^{-1}$ (mean: 0.135 ± 0.022 $\mu Sv.h^{-1}$) respectively. The excess life-time cancer risk (ELCR) on public who are residing nearby the hospitals were ranged from 0.355 X 10^{-3}-1.826 X 10^{-3} (mean: 1.091 X 10^{-3}) and from 0.645 X 10^{-3}-1.928 X 10^{-3} (mean: 0.976 X 10^{-3}) respectively. The annual effective doses and ELCR on public in few locations around the two large hospital campuses in Dhaka are higher than those of the prescribed limit of the International Commission on Radiological Protection (ICRP). It is observed from the study that in every thousand people, one of them is at the risk of cancer caused by the scattered radiation exposure from the hospital without any knowledge of being exposed to ionizing radiation. Healthcare workers must handle the radiation generating equipments & radioactive substances as per national regulations and IAEA guidelines for minimizing risk on public who are residing nearby area of the hospital.

PP-83: Characterization, Measurements, and Calibration of LiF:Mg,Ti Crystal Dosimeters (MTS-100) to High Energy Photon Beam for Radiotherapy Level

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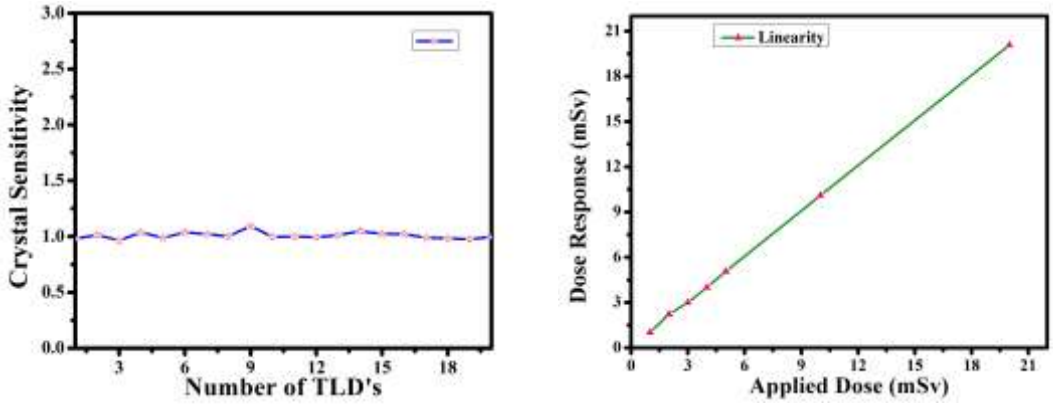

Commonly, TLD is used in individual control and monitoring devices to make sure quality assurance, and quality control of the received radiation dose, as well as at the radiotherapy level. This study was aimed at investigating the calibration process of TLD crystals, specifically, the crystal sensitivity and linearity of individual TLDs at different dose levels for the precise dosimetric purposes of radiotherapy after irradiation in the SSDL laboratory. Herein, a batch of ten LiF: Mg, Ti dosimeters was used for calibration purposes carried out using the RADOS RE-2000 reader. Firstly, dosimeters were annealed at 300°C for 15 secs and placed on the flat surface of an Alderson Rando Phantom. Zero dose calibration had performed for dosimeters and irradiated at a dose of 2 mSv by a standard Cs-137 source (20 Ci) at SSDL, AERE, Savar, Dhaka, Bangladesh. To obtain the desired dose, reference dosimetry was completed with the standard Ionization Chamber-NE 2575 (600 ccs) at a 100cm distance. Dosimeters were preheated at 150°C for 10sec and read out in the TLD reader. Reading had assigned in the reader sensitivity, the irradiation and preheating processes were repeated, and assigned the results in the local dose, standard dose, and crystal sensitivity. On the other hand, for the clinical practice of radiotherapy, another twenty LiF: Mg, Ti dosimeter was irradiated at 2 mSv by a Cs-137 source in the same manner as the calibration process. Crystal sensitivity of the dosimeters was found against the calibrated RADOS RE-2000 reader sensitivity. To check the linearity of the TLDs 1 mSv, 2 mSv, 3 mSv, 4 mSv, 5 mSv, 10 mSv, and 20 mSv doses were exposed and showed a good linear outcome corresponding to the dose-response (mSv). The individual crystal sensitivity of TLDs was determined, and the relative standard deviation had estimated at 0.029167 (approximately 3%) which allows for a tolerance of ±5% to be used. This result agrees to measure accurate dose for the clinical practice of radiotherapy.

PP-84: Nanoparticles induced deformation and poration in lipid vesicles under various sugar concentrations

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Cell membranes are a complex structure containing various amounts of lipids, proteins, cholesterols and lipopolysaccharides. Sugar in buffer solution plays a vital role for the

functioning of biomembranes during various environmental states. On the other hand, inhalation of nanoparticles (NPs) in the body may include lung inflammation and heart problems. Hence, the study of the effects of sugar concentration on the NPs induced various changes of cell like vesicles is important. The charged giant unilamellar vesicles (GUVs) were prepared by a **mixture of negatively charged 1,2-dioleoyl**-sn-**glycero-3-phospho-(1′**-rac-**glycerol)** and neutral **1, 2-dioleoyl**-sn-**glycero-3-phosphocholine lipids using the natural swelling method**. Anionic magnetite NPs of size 18 nm has been used in this investigation. The deformation and poration for a particular NPs concentration increased with the increase of time. But both of those quantities decreased with the increase of sugar concentration. To describe the degree of deformation, a special parameter compactness was considered. The poration in the membranes of GUVs was confirmed by the leakage of water-soluble fluorescent probe calcein from the inside to outside of GUVs. After forming pores, the GUVs remained intact with undetected break, suggesting the nano sized pores formation in the membranes by NPs. The enthalpy-driven interaction effect between sugars and lipid head groups at relatively lower sugar concentrations, and the entropy-driven repulsive effects influenced at relatively higher sugar concentrations can explain the results.

PP-85: Electronic Absorption Characteristics and Nonlinear Optical Responses in Thermal Regime of Bovine Serum Albumin and its Constituent Amino Acids

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UV-Visible absorption spectroscopy and continuous wave (CW) Z-scan of bovine serum albumin (BSA) and some of its constituent amino acids were examined to see the relationship between the optical properties of the protein molecule and its constituents. Analysis of the electronic spectrum of BSA and its constituent amino acids reveals that the absorption at 278 nm results from the cumulative effect of those from aromatic amino acids and cysteine disulfide bonds. Similarly, the closed aperture CW Z-scan studies of BSA and the amino acids at 74 to 106 mW incident optical power at 660 nm reveals that the third order optical response of BSA mostly originating from the aromatic amino acids that are active absorbers in linear regime at around a particular wavelength. Further analysis shows that the nonlinear optical phase-shift per unit power per mole of BSA can be expressed as the weighted sum of those of the contributing amino acids.

PP-86: Deformation and poration of giant lipid vesicles by magnetite nanoparticles under various concentrations of cholesterol in membranes

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The emission of nanoparticles (NPs) in the environment from various sources is one of the main causes for substantial mortality and morbidity in cardiorespiratory diseases. Medical implants, magnetic resonance imaging contrast agents, pesticides, food products processing are some sources of NPs entered the human body. Hence, the study of the interaction of NPs with cells is important for developing new medical and pharmacological technologies. In this study, we investigated the effects of cholesterol on the deformation and poration of cell like giant unilamellar vesicles (GUVs) by magnetite nanoparticles. The membrane of vesicles was prepared by a mixture of lipids and cholesterol using the natural swelling method for obtaining more biological relevance. The fraction of deformed GUVs increased with time while the fraction of poration at first increased and then remained constant. Both the fractions decreased with cholesterol. Neutral lipid and charged lipid in both cases both the fractions decreases with cholesterol. For determining the degree of deformation compactness was calculated and for ensuring the poration fluorescence intensity was measured. The thin-walled closed shell model and bilayer coupling model explained the deformation of vesicles. The increased line tension of membranes due to cholesterol was one of the important causes for decreasing the poration.

PP-87: Z-scan analysis of circulating cell free DNA from blood plasma for screening and diagnostic marker of breast cancer

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Nonlinear optical response of circulating cell free DNA (ccfDNA) extracted from blood plasma has been studied by Z-scan technique and the results were compared with their respective concentrations measured by fluorometric and spectrophotometric techniques. Concentrations of ccfDNA extracted from the blood plasma of five breast cancer patients and also from five non cancer individuals by the automated Maxwell system were measured using two alternative methods, Fluorometer and NanoDrop. qPCR technique was employed for confirmation of breast cancer. Concentrations of the ccfDNA in the blood plasma of breast cancer patients have been found to be higher (Sd # 0.08) than those of the non-cancer individuals (Sd # 0.0005). Simultaneous study of nonlinear optical response of the respective samples by the Z-scan technique showed significantly different results for the breast cancer samples ($\|\Delta\varphi\| = 0.03533$) from the non-cancer samples ($\|\Delta\varphi\| = 0.01333$). This comparative study indicates the possibility of using Z-scan as a precise and cost-effective supplementary method in oncology for diagnosis and prognosis.

PP-88: Measurement of total charge changing cross sections for ^{12}C + Al interaction using CR-39 nuclear track detector

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Study of heavy ion interaction is one of the key interests for the researchers since several decades. This kind of study has improved the ion therapy planning and treatment at the same time plays an important role for the analysis and shielding of space radiation for the astronauts in International Space Station (ISS). To optimize the effect of secondary particles during heavy ion cancer therapy it is important to know the nucleus-nucleus interaction mechanism accurately. Interaction of heavy ion is followed by two main process, called the electromagnetic and nucleus-nucleus interactions while propagating through the material. The theory of electromagnetic interaction is well developed but no concreter theory for the nucleus-nucleus collision yet. Models for nucleus-nucleus interaction have been still under progress through new experimental data. We measure the total charge changing cross section for ^{12}C on Al in the energy around 100 MeV/n, in this study that will help to enrich the model accuracy and help to understand the heavy ion interaction mechanism.

CR-39 is one of the mostly used track detector for the better's spatial resolution of ion track and ability to detect multi-fragments from one interaction which has been used since 1960. In this study, target sandwiched with CR-39 of 5 cm x 5 cm dimension was irradiated with ^{12}C ion at 55 MeV/n and 135 MeV/n at the Wakasa wan Energy Research Center (WERC) and Heavy Ion Medical Accelerator in Chiba (HIMAC), Japan, respectively. Exposed CR-39s were etched in 7N NaOH solution at 70 ˚C to visualize the ion tracks produced by primary ion beam and its fragmentations in the Research Institute of Nuclear Engineering, University of Fukui, Japan. The etching time was chosen between 15 and 25 hours for according to exposed densities of ^{12}C ions. The FSP-1000 imaging microscope[1] were used to get the image of front and back surface etch pit simultaneously[2]. Then by counting the projectile track before and after the target, the total charge changing cross section has been measured. The results will be shown on the conference.

PP-89: Modeling of Compound Nerve Action Potential and Fiber Diameter Distribution: An Analytical Approach

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The nervous system, which is made of an abundance number of nerve fibres, plays an essential role in regulating various functions of our body. The electrical impulse that propagates through a single nerve fibre can be termed as single fibre action potential (SFAP), and the combination of electrical stimulation of all fibres is called compound action potential (CAP), which depends on conduction velocity distribution (CVD). It is very tricky to find CVD analytically from available CAP.

Un et al. (2018) modelled the CVD which is equivalent to fibre diameter distribution (FDD) as 8^{th} order polynomial and estimated the unknown parameters using gradient optimization estimation procedure. Ward (1999) modelled the CVD as double Gaussian distribution and estimated the parameters using the nonnegative least square method (NNLS). Tu et al. (1997) estimated conduction velocity distribution using the regularized least-square method. As the nerves are made of an abundance number of nerve fibre, we can consider the CVD as discrete or continuous. Our study has proposed 6^{th} order polynomial, 7^{th} order polynomial, Weibull distribution and Lorentzian distribution as CVD. We have considered the CVD as having a bell-shaped pattern and fixed the total number of active fibres close to 300. From different functional forms of calculating SFAP, we have considered sinusoidal function. The parameters of the 6^{th} order polynomial and 7^{th} order polynomial are measured using the gradient optimization method. As the functional form of the squared error term gets complicated for the Weibull distribution and Lorentzian distribution, we have introduced the iterative estimation procedure to solve this problem and estimate the parameters. We have conducted a simulation study to see how well different models perform for selecting the proper model. We have observed that the predicted CMAP closely matches the predicted CMAP for continuous DCV and also for discrete DCV.

PP-90: A Genetic Algorithm Based Approach for Predicting Motor Nerve Conduction Velocity Distribution from Compound Muscle Action Potential

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Prediction of motor nerve conduction velocity distribution (NCVD) from compound muscle action potential (CMAP), also known as the inverse problem of nerve conduction, is one of the effective tools for assessing the peripheral neuropathies by evaluating the electrophysiological characteristics of the peripheral nerves. Few recent studies have utilized a continuous approach to solve the inverse problem exploiting the deterministic least square method. However, using the least square approach, the computation of non-linear distribution of conduction velocity (DCV) functions (except using a polynomial function having a degree of three or higher) is not

computationally feasible due to a higher time complexity except that the solutions are found iteratively. Hence, we assume that a probabilistic approach, for instance, genetic algorithm (GA) could be utilized here to solve the inverse problem of nerve conduction. We have collected the CMAP signals from the median nerves of some patients from BIRDEM General Hospital, Bangladesh. In our approach, we have utilized a damped sinusoidal function to design the motor unit action potential (MUAP) waveform. The modified single and double Weibull functions have been used to model the single and double peak DCV as these functions are well suited for modeling normal and skewed distributions to capture the conditions of health and disease in the DCV patterns. We have observed the influence of the MUAP parameters, that are, amplitude like scaling factor, time period, damping factor and decay constant in modeling the MUAP waveform and the DCV parameters, that are, shape, scale, scaling factor and location parameter in modeling both the single and double peak DCV. Thus, we have found the search domain of each parameter to be optimized by GA. We have imposed a constraint by allowing a total number of fibers between 260 and 300. Accordingly, we have designed two penalized objective functions based on the coefficient of determination (R^2) and mean squared error (MSE) for GA. We have observed that our GA model produced the optimal parameter values as the inverse solution that return the predicted DCV which results in producing a CMAP signal in the forward solution that turns out to be very similar to the corresponding collected CMAP signal (best R^2 around 99%). We believe our probabilistic approach may provide an effective non-invasive alternative tool to deal with this ill-conditioned inverse problem of nerve conduction.

PP-91: Kinetics molecular transport through the nanopore in the membrane of GUVs using COMSOL simulation

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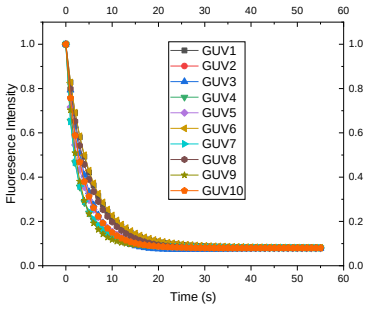
Biomembranes play a major role in cellular life controlling the transport of different essential substances between the outside and the inside of cells. As a mimic of biomembranes of cells, lipid membranes of giant unilamellar vesicles (GUVs) with diameters 10 μm or more were used to investigate the pore formation induced by various membrane-active agents such as antimicrobial peptides (AMPs) which are produced by various organisms such as amphibians, insects, plants and mammals, have activities that subdue bacteria and/or fungi. Among different AMPs, magainin 2, which was first isolated from the African clawed frog Xenopus laevis, has been extensively investigated [1,2]. To unearth the mechanism of pore formation clearly it is important to investigate the kinetics molecular transport through the nanopore in the membrane of GUVs. Recently, simulation work has been performed to explore molecular transport into vesicles through a single nanopore using COMSOL simulation [3, 4]. The sizes of GUVs and fluorescent probes were considered based on experimental data [2]. In this COMSOL simulation, we investigated the molecular transport into the GUVs through the single and multiple nanopore in a suspension area within multiple GUVs for various sizes (i.e. Stokes-Einstein radius) of fluorescent probes (Calcein, TRD-3K, TRD-10K, AF-SBTI, FITC-BSA and TRD-40k) and for various sizes of GUVs and pores. The obtained rate constants of molecular

transport have the similar result for same size GUV having same size nanopore where there are different results for different sizes of GUVs with a trend in case of both single and multipore. In addition, the fluorescence intensity decreased with increased times for a particular fluorescent probe having different sizes of GUVs (Fig.).



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PP-92: Effects of hydrocarbon chain on the vesicle size distribution, bending modulus, and elastic modulus of lipid membranes

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The effects of hydrocarbon chain on the size distribution of giant unilamellar vesicles (GUVs), bending modulus, and elastic modulus of lipid membranes have been investigated. 1, 2-dioleoyl-sn-glycero-3-phosphocholine (DOPC), 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) and 1,2-ditridecanoyl-sn-glycerol-3-phosphocholine (DTPC) lipids were considered. The number of hydrocarbon in the corresponding lipids were 18, 16, and 13. GUVs were prepared using the natural swelling method with incubation times of 20, 40, 60, 90, 120, and 180 min. GUVs were observed using an inverted phase contrast microscope. The size distribution of vesicles at different incubation times was fitted using the well-known lognormal distribution. The average sizes of DOPC, POPC, and DTPC-GUVs increased with the incubation time until 120 min, and then remained steady at 16.1, 14.1 and 12.1 μm for the corresponding lipids. The average size at 180 min (equilibrium state) increased with the number of hydrocarbon in lipid chain. The incubation time dependent average size of GUVs was fitted with an exponential growth equation, and then obtained the kinetic constant of the

changes of average size. The values of kinetic constant for DOPC, POPC, and DTPC were 2.8×10^{-2}, 3.6×10^{-2}, and 8.3×10^{-2} min^{-1}, respectively. The equilibrium size distribution was fitted by a theoretical equation that was obtained using Helmholtz free energy for estimating the bending modulus of membranes. The values of bending modulus for DOPC, POPC, and DTPC membranes were 19.5±0.7, 18.5±0.4 and 14.3±0.6 k_BT (where k_B is Boltzmann constant and T is absolute temperature), respectively. The bending modulus increased with chain length. The elastic modulus of these membranes was also obtained using the polymer brush model, that did not depend on chain length. On average, its value was 261 mN/m with 6% fluctuation. The average size of GUVs and the bending modulus increased with lipid chain length at equilibrium, as supported by theoretical analysis. These investigations provided novel aspects of some phosphocholine membranes with different chain lengths, that can be used in different biomedical, biophysical, and biochemical processes.

PP-93: Detection of COVID-19 Pneumonia Using Chest X-Ray Images – A Transfer Learning Approach

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COVID-19, a highly infectious virus, is sweeping the globe. The virus occasionally mutates, revealing new forms. Early detection and isolation of COVID-19 patients has been critical in preventing disease transmission. Due to the limits of current disease detection approaches, deep learning algorithms may be a potential alternative. This study suggests utilizing transfer learning approaches on convolutional neural networks pre trained with large CXR dataset and fine tuning to classify COVID-19 pneumonia, non-COVID19 pneumonia, and normal has been beneficial. The proposed model has shown a promising performance in terms of classifying COVID-19 pneumonia using CXRs. It has shown an accuracy level of 98% which is one of the top ranked accuracies comparing with other existing model of similar task.

PP-94: A facile preparation of carboxyphenylboronic acid grafted chitosan-based nanostructure for anticancer therapeutic delivery

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Abstract: Chitosan is an ideal candidate for the nano-fabrication of biopolymer-based drug delivery system because of its excellent properties; non-toxicity, biodegradability, ease of chemical modifications, and its responsiveness to environmental stimuli. Nanoparticles are

effective drug delivery nano-architectures because of the high surface-to-volume ratio, which results in intimate contact with the epithelium, and also because they are able to maintain the integrity and the biological activity of the molecules they encapsulate. Here we report a facile preparation of modifiedchitosan-based nano-structure for potential use as drug carriers. Four different variants were prepared, namely sodium tripolyphosphate-crosslinked chitosan (CS-TPP) nanoparticles, glutaraldehyde-crosslinked chitosan (CS -GA) nanoparticles, chitosan-polymethacrylic acid (CS-PMAA) semi-IPN nanoparticles, and chitosan-polyvinylimidazole (CS-PVIm) semi-IPN nanoparticles, as well as their conjugations with 4-carboxyphenylboronic acid (4-CPBA). The obtained chitosan-based nano-structureswere characterized for various parameters including morphology, particle size, zeta potential, entrapment efficiency and stability.The dynamic light scattering (DLS) analysis showed concentration-dependent particle size for CS-TPP in the range of 20 -300nm and for CS-GA in the range of 40-200nm respectively.The morphology analysis by FE-SEMalso confirmed the spherical shape of prepared chitosan based nanoparticle and corresponds to the DLS results. The FTIR results confirmed the conjugation of PMMA and PVIm with chitosan. The conjugation of CS nanoparticles with 4-CPBA was confirmed by FTIR and ninhydrin reaction followed by UV-visible spectroscopy. Finally the drug loading and release capacity were tested against model drugs. Therefore, 4-CPBA-conjugated nanoparticles have great potential as nano-carrier for the delivery of therapeutics for cancer treatment.

PP-95: Study of structural, electrical and magnetic properties of Ag doped cobalt manganese ferrites by sol-gel method

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Silver (Ag) doped cobalt manganese ferrites ($Co_{0.6}Mn_{0.4-x}Ag_xFe_2O_4$) were synthesized by Sol-gel method. Ag was doped in the tetrahedral (A) site of $Co_{0.6}Mn_{0.4-x}Ag_xFe_2O_4$ compositions with x = 0.0, 0.1, 0.2, 0.3 and 0.4. The solution of the stoichiometric amount of the raw materials was dried at 80°C for 20 hours. Synthesized samples were calcined at 250°C for 3 hours. Then the samples were sintered at 800°C for getting better crystalline nanoparticles. The formation of phase was carried out by X-ray diffraction (XRD) pattern. The XRD pattern confirms spinal cubic phase of this compounds. The values of lattice constant were increased with the increase of Ag^+ addition. The radius of Ag^+ ion (1.29 Å) is higher than that of Mn^{2+} (0.80 Å). The replacement of Mn^{2+} ions in tetrahedral A sites would cause the expansion of the unit cell resulting in higher lattice parameters. The average crystallite size was found to be in the range of 28 to 38 nm which confirms nanoscale ferrites. The X-ray density (ρ_x) was found in between 5.74 gm/cm^3 to 5.40 gm/cm^3. The bulk density (ρ_b) was found in between 3.07 gm/cm^3 to 5.13 gm/cm^3. The porosity of the sample was reduced with increasing Ag content, was found from 46.52% to 5.02%. Electric measurements were carried out by impedance analyzer. Dielectric constant was reduced with increasing Ag^+ doping. The variation of dielectric loss (tanδ) as a function of frequency (40 Hz to 130 MHz) at room temperature exhibited irregular Debye relaxation peaks. The behavior of frequency dependence of ac

conductivity for different compositions at room temperature shows that the ac conductivity increases sharply in the low frequency regime, while it increases slowly at higher frequencies for all compositions. The magnetic characterization was analyzed by the physical properties measurement system (PPMS). High saturation magnetization was found 49.62 emu/gm for $Co_{0.6}Mn_{0.3}Ag_{0.1}Fe_2O_4$ composition. Saturation magnetization were gradually decreased with the increase of silver doping due to the change of lattice strain. Remanent magnetization and coercivity were gradually enhanced after increasing of silver doping.

PP-96: Structural and Magnetic Properties of Yttrium Doped $BaFe_{12}O_{19}$ Nanoparticles Prepared by Sol-gel Method

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In this dissertation, synthesis and characterization of $BaFe_{12-x}Y_xO_{19}$ (x = 0.0, 0.2, 0.4, 0.6) nanoparticles (NPs) for different annealing temperature (800°C, 900°C, 1000°C, 1100°C) through sol-gel method have been reported. The FTIR spectroscopy analysis and XRD study confirm the formation of the M-type hexagonal structureof $BaFe_{12-x}Y_xO_{19}$.The lattice parameters ratio 'c/a' obtained from XRD data found in the range of 3.93 to 3.96 which exhibited the formation of M-type hexaferrite structure. The average crystallite size for $BaFe_{12}O_{19}$is found to decrease from 52.91 to 23.44 nm with increasing annealing temperature. Besides for doped $BaFe_{12-x}Y_xO_{19}$the crystallite size increase in the range of 30.70-96.19 nm with increasing annealing temperature, which generally depends upon the atomic size of the doping element. The room temperature hysteresis curve shows the typical hard ferromagnetic (H_c =1875 to 4586 Oe) behavior of the $BaFe_{12-x}Y_xO_{19}$ NPs. For $BaFe_{12}O_{19}$, the saturation magnetization (M_s) decreases from 82.6 to 54.56 emu/gm upon annealing up to 1000°C, then increase for the samples annealed at 1100°C. But for $BaFe_{12-x}Y_xO_{19}$(x = 0.2, 0.4, 0.6) the overall increasing tendency of $M_s$is observed and showed maximum (100.23emu/gm) for x=0.2 content at 1100°C. Besides, we found that the M_s decreases for $BaFe_{12-x}Y_xO_{19}$annealed at 800°C and 900°C due to the the decreasing of the number of the Fe^{3+} ions in spin up sites and magnetic dilution or noncollinear structure. For $BaFe_{12}O_{19}$, the coercivity (H_c)decrease from 4039.4 to 2936.2 Oewith increasing the annealing temperaturedue to decrease in crystallite size. However, increasing trend of H_c from 1875 to 4586 Oeobserved for $BaFe_{12-x}Y_xO_{19}$with increasing the annealing temperature due to the increase in crystal size and showed maximum 4586.5Oe for x=0.4 content at 900°C. We found that $H_c > M_r/2$ and these NPs is useful in high-frequency applications.

PP-97: Incorporation of Copper Nano-colloids to Enhance the Nonlinear Optical Responses of Blood Plasma

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The nonlinear optical response for the blood plasma can be observed using the Z-scan technique with a highly intense laser. But the required high power laser is not always available. In this work, we have shown that the incorporation of Copper (Cu) nano-colloids enhances the nonlinear optical response for blood plasma in the Z-scan experiment. We used the Pulsed Laser Ablation (PLAL) technique to produce the Cu nano-colloids in distilled water. The UV-Vis spectroscopy of the prepared nano colloids are used to compute the indirect bandgap energies (≈ 2 eV). To observe the third order nonlinear response, we used the Z-scan experiment at 56.76mW of laser power on the samples. We have found that the nonlinear response of blood plasma increases. The magnitude of the nonlinear phase shift $\Delta\phi$, is found to be much higher (-1.16) than individual plasma (-0.89) or nano-colloids (-0.17).

PP-98: Polyethylene Glycol (PEG) Coated $Mg_xCo_{1-x}Fe_2O_4$ Nanoparticles: A Comparative Study of Anticancer Drug Loading and Drug Release for Drug Delivery Process.

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Nowadays nanoparticles are being designed widely with a biocompatible surface coating for effective drug delivery applications. Here, we have inspected Magnesium doped Cobalt ferrite nanoparticles $Mg_xCo_{1-x}Fe_2O_4$ (x=0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0) for drug delivery purpose. These nanoparticles are prepared by precipitation method and coated with Polyethylene Glycol (PEG) by sonication. We have coated these nanoparticles with PEG to improve their blood circulation time. Coating has been confirmed by Fourier Transform Infrared spectroscopy (FTIR). Dynamic Light Scattering (DLS) confirms that these PEG coated nanoparticles have hydrodynamic size 270 nm on average and polydispersity Index (PDI) less than 0.35 at room temperature. Doxorubicin, a widely used anticancer drug, is

conjugated with these coated nanoparticles. Drug loading capacities of these nanoparticles are observed at 25℃ by means of UV Spectroscopy and High-Performance Liquid Chromatography (HPLC). Drug loading has been confirmed by FTIR. Time dependent Doxorubicin release of these PEG coated nanoparticles is observed by means of UV Spectroscopy and HPLC at 37.5℃ and 42℃ separately. It is observed that nanoparticles with higher concentration of Magnesium exhibits better drug loading capacity. We are analyzing the efficiency of $Mg_xCo_{1-x}Fe_2O_4$ nanoparticles to assist the transportation of chemotherapy drugs directly to cancer cells.

PP-99: MWCNT reinforced Gelatin; new-fangled electrode material with excellent Cyclic Stability for Designing Transient Energy Storage devices

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The creation of non-biodegradable e-waste from electrical gadgets on a large scale is wreaking havoc on the environment. The use of biopolymer-based nanomaterials in the manufacturing of environmentally friendly, long-lasting electronics might be a viable strategy. A simple and cost-effective aqueous solution casting approach was used to create gelatin/multi walled carbon nanotube (Gel/MWCNT) nanocomposites in this study. The impact of MWCNT on the nanocomposite's structural, surface-morphological, electrical, and electrochemical characteristics was investigated. The degree of interaction between the MWCNTs and the Gel matrix was enhanced using Fourier transform infrared spectroscopy (FTIR) and field emission scanning electron microscope (FESEM). The insertion of MWCNTs into the Gel matrix transformed the surface wettability of the nanocomposites from hydrophilic to hydrophobic. The addition of MWCNTs to the nanocomposite also reduced the DC resistivity by four orders of magnitude. At a current density of 0.3 mA/g, MWCNTs boost the nanocomposite's specific capacitance from 124 mF/g to 12710 mF/g. The addition of MWCNT enhanced the double layer capacitance from 4 nF to 8.5 nF, according to electrochemical impedance spectroscopy data. After 2000 charging/discharging cycles at a current density of 100 mA/g, the Gel/MWCNT nanocomposite displayed cyclic stability, with capacitive retention of roughly 95 percent of its original capacitance. The nanocomposite dissolves fully in water after 30 hours, indicating that it is a good option for transitory energy storage. The Gel/MWCNT nanocomposite might be a novel way to improve the efficiency of biofriendly energy storage systems.

PP-100: Synthesis and Characterization of Nickel Oxide Decorated Molybdenum Disulfide Nanomaterials for Energy Storage Application

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We can synthesize nanomaterials to change their characteristics in such way that its advantages are maximized exponentially and their drawbacks can be minimized as well. Here, in a facile hydrothermal method we synthesized MoS_2 from Sodium Molybdate Dihydrate, Thiourea and NiO was fabricated from Nickel Nitrate Hexahydrate and Urea. To modify the characteristics of the MoS_2 we synthesized MoS_2/NiO composites via same technique by varying the concentrations (2,5,8 and 12 weight percent) of NiO. After successful synthesis the different features of the as-synthesized nanocomposites such as structural, optical, chemical and electrochemical properties were identified by X-ray diffraction (XRD), Field Emission Scanning Electron Microscope (FESEM), UV-Vis spectroscopy, and Three electrode electrochemical workstation, respectively. The investigation of crystallinity, structure and micromorphology was carried out through XRD and FESEM. The high crystallinity traits with all major characteristic peaks are confirmed from XRD analysis. The taken images of FESEM confirms the flower like shape of the MoS_2 and it is also confirming that the flower like shape is quite stable with the varying concentrations of NiO. We can ensure the prominent presence of the NiO in the composites from EDS spectra. The measurement of optical bandgap is calculated by Kubelka-Munk function from the UV-vis spectroscopy data. The investigation of specific capacitance, current density, power density, electrochemical impedance spectroscopy and the variation in these traits with changing weight percentages was performed by the three-electrode electrochemical workstation. MoS_2/NiO nanocomposites with improved and tunable physical properties synthesized from a simple and economic route may pave a new horizon for electrochemical and photocatalytic materials.

PP-101: Tinospora cordifolia leaf extract mediated green synthesis of copper oxide nanostructures for their application in cotton fibers as antibacterial coatings

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The present study reports a facile green method to synthesize copper oxide (CuO) nanostructures using Tinospora cordifolia leaf extracts. Plant extract mediated green synthesis method is an eco-friendly, economic and single-step process that can be easily scaled up for large-scale synthesis. The instant formation of nanoparticles was analyzed by visual observation of color change of the solution from light blue to dark green color and by a UV-visible spectrophotometer. The optical study showed the surface plasmon resonance peak at 262 nm. The powder X-ray diffraction study revealed the crystalline nature of nanostructures with an average size of ~50 nm. FT-IR study confirmed that phenols and primary amines were mainly involved in reducing copper ions. FESEM micrographs showed nanostructured grains and EDX spectra confirmed the presence of Cu and O. The antibacterial activity of the

synthesized CuO nanostructures was evaluated against both gram-positive and gram-negative bacteria. Further, the antibacterial activity of cotton fibers coated with CuO nanostructures was studied, which might be applicable for the fabrication of antibacterial cotton textiles.

PP-102: Hydrothermally synthesized $DyCrO_3$-rGO nanocomposites: A promising photocatalyst

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Reduced graphene oxide (rGO) incorporated heterogenous nanocomposites have gained unprecedented attention because of their intriguing solar light harvesting characteristics. In this investigation, we have synthesized orthorhombic $DyCrO_3$ nanoparticles with the Pbnm space group and for the first time in our knowledge, integrated them with rGO by adopting a facile energy-efficient hydrothermal method to synthesize $DyCrO_3$-rGO nanocomposites. The structural and morphological properties of the synthesized nanomaterials were studied by employing X-ray diffraction analysis and field emission scanning electron microscopy imaging, respectively. A noticeable absorption enhancement is observed in the UV region of the spectrum after rGO incorporation, as evident from the UV-visible spectroscopy analysis. This high photon absorption might be applicable for efficient light-harvesting applications including photocatalytic degradation and solar light-assisted water splitting. Later, to exploit this high absorption property, photocatalytic degradation of rhodamine B (RhB) dye and solar H_2 production through water splitting were investigated under the presence of $DyCrO_3$, $DyCrO_3$-rGO, and commercially available P25 titania nanoparticles. Interestingly, $DyCrO_3$-rGO nanocomposite demonstrated up to 87% degradation of RhB dye and approximately three times greater hydrogen generation rate than that of the P25 titania nanoparticles under the irradiation of visible light. For further understanding of the photocatalytic performance enhancement, we have proposed tentative mechanisms for photocatalytic degradation and H_2 generation. We believe that the outcomes of this investigation might be helpful for synthesizing and optimizing next-generation photocatalyst materials to remediate the environmental pollution due to the ongoing industrial revolution.

PP-103: Design and fabrication of novel $MnCr_2O_4$ nanostructure: electrochemically deposited on stainless steel strip with enhanced efficiency towards supercapacitor applications

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To address the demand of modern energy storage systems, innovative electrode materials with distinctive morphologies, cyclic stability, and electrical conduc- tivity must be synthesized. The strong electrical conductivity of the synthesized electrode material allows them to attain high specific capacitance while main- taining a high energy density. In present study, we have designed novel spinel MnCr2O4 nanostructures, which display better structural, morphological, and electrochemical performance confirmed from X-rays diffraction, scanning elec- tron microscopy, and potentiostat, respectively. The synthesized material attains crystallites size of 52 nm, and cubic shape morphologies with average particle size (59 nm). At low current density (0.1 Ag-1), the synthesized MnCr2O4 nanostructures electrode reaches a specific capacitance of 1656 Fg-1 and high specific energy (184 Whkg-1) with a specific power of 17.25 W kg-1. Up to 1000 charging discharging cycles, the fabricated electrode demonstrates high cyclic stability with 78% retention. MnCr2O4 nanostructure shows a great potential toward electrode material in future energy storage devices due to their high energy, power density and remarkable cyclic stability.

PP-104: Enhanced solar light driven photocatalytic activity of Gd^{3+} doped bismuth ferrite nanostructures

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In this investigation, 10% Gd doped $BiFeO_3$ (BGFO) nanoparticles were successfully synthesized by a facile hydrothermal technique at a lower reaction temperature of 160 °C. The physicochemical properties of the as-synthesized samples were evaluated following several characterization techniques. The Rietveld refinement of the X-ray diffractometry data revealed rhombohedral crystal structure with R3c space group, which was further validated by the Furrier transform infrared and Raman spectroscopy analyses. Both bright field transmission electron microscopy (TEM) and high-resolution TEM imaging were carried out to determine the size and inter-planar spacing of the synthesized nanoparticles. UV-visible diffuse reflectance spectroscopy result affirmed the reduction in the band gap from 1.95 to 1.18 eV due to Gd substitution. The photoluminescence spectra indicated lower intensity in the doped sample, signifying reduction in the recombination rate of the electron-hole pairs. The photocatalytic response of the nanostructures was examined for the degradation of industrial dyes; rhodamine B (RhB), methylene blue (MB) and pharmaceutical pollutants; antibiotic ciprofloxacin (CIP), levofloxacin (LFX) under solar irradiation. The enhanced photocatalytic activity of BGFO was attributed to the strong absorption of visible light, reduction in the optical band gap and the effective separation of photoinduced charge carriers. Moreover, the stability and long-time reusability of the sample was also examined by five recycles for the photodegradation testing of the pollutants. Based on the experimental findings a possible

photocatalytic mechanism was critically discussed and the results suggested the potential application of the synthesized nanostructures as an efficient photocatalyst to remove various organic dyes and pollutants under solar irradiation.

PP-105: Advances and challenges with Quantum dot nanomaterials in different industry.

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Nano structured materials are predicted to exert a major effect on industries and business in the twenty-first century, promising greater performance, safety, and revolutionary fabrication techniques. Quantum Dot (QD) nanoparticles have antibacterial, antifungal, photocatalytic, biosensing, and bioimaging properties. It will also seek to reduce production costs. The success of QD manufacturing depends on ongoing academic-industry cooperation. It helps both parties to be aware of current and future expectations. Finding the best method to produce QD nanoparticles with the least amount of impurities is crucial. Various industries are interested in QD nanoparticles due to their properties. QD nanoparticles are increasingly used in modern industries such as pharmaceutical, environmental, food, oil and gas, and electrical. Despite their widespread usage in practically every sector, QD nanoparticles must be treated with caution due to their toxicological effects. The toxicological consequences of QD nanoparticles on persons and the environment, as well as regulations limiting their use, pose issues in industry. QD nanoparticles have unique properties, industrial uses, and limitations due to their toxicity. In this review, we focus on significant uses and challenges with QD nanoparticles in different industries.

PP-106: Recent advances with Nano cellulose based nanomaterials in textile industry.

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Nanocellulose has a number of distinguishing properties. However, when it is used to produce nanocomposites with metal oxides, the surface area of the composite increases, as well as the characteristics of the composite enhance. Nanocellulose-based nanomaterials have a variety of properties, including photocatalysis, antibacterial activity, adsorption, biosensing, and a high degree of stiffness. These features makes them a concerning discussion in a multitude of areas of the textile industry, as they have the prospects to provide increased quality, improved safety,

and groundbreaking synthesis techniques, which also will have a serious influence across alltextile industries if successfully implemented. The reason for this is that it enables both parties to be aware of present requirements while also anticipating future issues. It is critical to discover the most efficient procedure for producing the necessary properties of these kinds of nanocellulose-based nanomaterials while simultaneously decreasing the quantity of contaminants present in the final product. Many applications for these nanoparticles are emerging in the current textile business, including wastewater treatment, textiles, and textile product packaging to name a few. Specifically, our study will look at the unique qualities of nanocellulose composites and how they might be used in the textile manufacturing business.

PP-107: Advances with nanostructured metal oxide/Polymer composites in water treatment processes.

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Nanostructured materials are predicted to provide possible benefits in performance, safety, and manufacturing efficiency. Among other properties, nanostructured metal oxide/polymer composites (n-MOPC) show antibacterial, photocatalytic, biosensing, desalination and adsorption capabilities. Additionally, it will make an attempt to reduce production costs. The manufacturing success of n-MOPCs is contingent upon the quality of the fabrication roads employed. It is vital to discover the most efficient method for employing n-MOPC nanoparticles. Numerous industries are interested in n-MOPC due to the water treatment paths it provides. Despite their widespread usage in the water treatment sector, n-MOPC nanoparticles are also effective in treating industrial waste water, ground water, sea water, and river water. They have the potential to be used to treat industrial waste water due to their photocatalytic characteristics. Additionally, their capacity to absorb heavy metals makes them advantageous for ground water treatment. Desalination, a property of these composites, is crucial for seawater treatment. In this review, we focus on significant uses of n-MOPC nanoparticles in different industries.

PP-108: To Estimate the Failure Probability of Reactor Fuel Clad using Monte Carlo Method

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A nuclear reactor is a device used to initiate and control a nuclear chain reaction which main component is core. TRIGA MARK-II reactor of Bangladesh has been taken as reference for the analysis for this work. The cladding of the core of a nuclear reactor can be destructed or failed sometime. The probability of failure of a core system can be measured by reliability based method. Such types of methods are FORM (First Order Reliability Methods), SORM (Second Order Reliability Methods), Monte Carlo Method. Where method like Monte Carlo simulation is mainly used to check the accuracy of the method FORM (First Order Reliability Methods) and SORM (Second Order Reliability Methods). The goal of this present work is to establish a methodology to calculate the failure probability of fuel clad with maximum accuracy by using a reliable method like FORM, SORM and Monte Carlo Simulation. Our motive is integrating of fast transient analysis in reactor with advanced methods of reliability assessment which have never been reported before. To complete our purpose computer code EUREKA 2//RR has been used. This code is a revised version of EUREKA-2 which was originally developed for reactivity accident analysis for nuclear power plants. The result of the study will reduce the failure probability of reactor core. This can help to decrease the probability of failure in some various incidents like reactivity initiated accident (RIA), loss of coolant accident (LOCA), loss of coolant flow accident (LOFA), etc. The major contribution will be the improvement of failure assessment technique to ensure safety of workers, environment, etc.

PP-109: Simulation of radiological dose distribution of radiocesium due to a postulated accident of TRIGA research reactor

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The present study focused on the radiological dose assessment for ^{134}Cs and ^{137}Cs due to a postulated accident of the TRIGA Mark-II research reactor at AERE, Savar, Dhaka, Bangladesh. The radionuclides ^{134}Cs and ^{137}Cs were selected because the nuclides are most responsible for radiation exposure to the general public. The HOTSPOT 3.1.2 code was used for the dose calculation which was created to equip emergency response personnel and planners with a fast, field-portable set of software tools for evaluating incidents involving radioactive material. The dose values of TEDE, Ground Deposition and Ground Shine were calculated for an 80 km radius from the reactor site. An assessment for organ doses of ^{134}Cs and ^{137}Cs as a function of distance was also performed. Local meteorological data were collected from Bangladesh Meteorological Department and the data were analyzed for the dose assessment. Considering all directions, wind from the south (“S”) direction was dominant. From the calculation, a higher dose for ^{137}Cs was obtained compared to ^{134}Cs due to its higher fission yield and longer half-life. Although the dose values were lower, there are many more other radionuclides that could be released during a nuclear accident and then the accumulated

radiation dose may be comparable to the permissible dose limit. If the accumulated dose exceeds the permissible limit, according to the national authority appropriate radiological protective measures like sheltering, relocation and use of prophylactic iodine tablets will have to be taken into consideration.

PP-110: Worldwide used Plasma confinement devices for nuclear fusion energy

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The world is now moving to industrial one and hence safe, secured, and unlimited source of energy is needed to meet the future energy demand. There are various sources of energy. The most popular source of energy is the fossil fuels, such as coal, oil and natural gas. In the case of fossil fuels, depletion is of special concern and over consumption can lead to serious environmental issues such as air pollution due to releasing carbon dioxide gas when it is burnt. In the case of renewable energy sources such as solar and wind power, the stable power cannot be supplied because it often relies on the weather for its source of power. Stable electric power is essential for manufacturing factories. An energy source that can produce a lot of energy is the nuclear power. Fission and fusion are the two processes to produce the nuclear power.

Nuclear fusion process is safer than nuclear fission process because there are no nuclear chain reactions in nuclear fusion. In nuclear fusion reactions, small amount of helium ash is produced which is inert gas and will not pollute the atmosphere. Many experiments related to nuclear fusion have been carried out in the world in various devices like HL-2A, Large Helical Device (LHD), Tore Supra, JT-60U, Heliotron J, ASDEX-U, NSTX, EAST Tokamak and world largest tandem mirror GAMMA 10 [1,2]. In order to demonstrate the possibility of fusion reactor, International Thermonuclear Experimental Reactor (ITER) has been under construction at Cadarache, France [3]. The schematic view of ITER is shown in Fig. 1.1. If ITER can finish its mission successfully, then it can solve our future energy demand which satisfies all necessary requirements of the future energy source. Detailed results will be presented in the conference.

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PP-111: Simulation of Radiological Dose Distribution of ^{134}Cs and ^{137}Cs Due to a Postulated Accident of TRIGA Research Reactor

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The present study focused on the radiological dose assessment for ^{134}Cs and ^{137}Cs due to a postulated accident of the TRIGA Mark-II research reactor at AERE, Savar, Dhaka, Bangladesh. The radionuclides ^{134}Cs and ^{137}Cs were selected because the nuclides are most responsible for radiation exposure to the general public. The HOTSPOT 3.1.2 code was used for the dose calculation which was created to equip emergency response personnel and planners with a fast, field-portable set of software tools for evaluating incidents involving radioactive material. The dose values of TEDE, Ground Deposition and Ground Shine were calculated for an 80 km radius from the reactor site. An assessment for organ doses of ^{134}Cs and ^{137}Cs as a function of distance was also performed. Local meteorological data were collected from Bangladesh Meteorological Department and the data were analyzed for the dose assessment. Considering all directions, wind from the south ("S") direction was dominant. From the calculation, a higher dose for ^{137}Cs was obtained compared to ^{134}Cs due to its higher fission yield and longer half-life.

PP-112: Radioactivity measurements and analyses of soil and sediment samples taken from Chittagong city and port area on the northern shore of the Karnaphuli river.

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The activity concentrations of naturally occurring radioactive elements ^{226}Ra. ^{232}Th and ^{40}K in the soil and sediment samples (total of 78 samples) collected from different locations on the northern shore of the Karnaphuli River, Chittagong, Bangladesh for 13 months (September 2020- September 2021) were determined by using High Purity Germanium (HPGe) gamma-ray spectrometry system. The average activity concentrations of ^{226}Ra, ^{232}Th, ^{40}K were found to be within the range of 15.17 ± 4.06 to 26.34 ± 4.59 Bq/kg, 33.67 ± 6.59 to 44.51 ± 7.97 Bq/kg and 440 ± 48.40 to 669.17 ± 95.44 Bq/kg respectively. However, no artificial radionuclide such as ^{137}Cs was found in the study area. From these values, monthly absorbed dose rates, radium equivalent activity, annual effective dose rates, the radiation hazard indices, gamma index, excess lifetime cancer risk and annual gonadal dose equivalent for these samples were evaluated. The absorbed dose rates for the period were found within the range of 41.14 ± 5.43 to 67.40 ± 5.21 nGy/hr. Statistical analysis was performed between the gamma dose rate and meteorological parameters, namely, atmospheric pressure, relative humidity, and temperature. No significant seasonal variations were observed. The correlation between the measured monthly gamma dose rates and meteorological parameters indicates that meteorological parameters do not significantly influence the outdoor gamma dose rates. The

radium equivalent activity, annual effective dose rates, the external and internal hazard index, gamma index, excess lifetime cancer risk and annual gonadal dose equivalent were found in the range of 98.19 to 137.33 Bq/kg, 0.051 to 0.083 mSv/y, 0.276 to 0.384, 0.325 to 0.456, 0.294 to 0.446, 0.185 to 0.185 and 0.141 to 0.341 mSv/y respectively. Observed values were compared with those from different regions within Bangladesh and other countries.

PP-113: Assessment of Shallow Groundwater of Greater Mymensing, Bangladesh: Using Hydrogeochemical and Isotopic Techniques

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In this present study, assessment of shallow groundwater of the greater Mymensing has been carried out using hydrogeochemical and stable isotopic techniques. For this, 53 shallow groundwater (depth < 71m) samples have been investigated to infer the hydro-geochemical processes that evolves the groundwater. Here, groundwater samples are slightly acidic to basic in terms of their p^H values, which range between 6.09 and 7.68. The electrical conductivity (EC) of the studied samples exhibits wide range of values ranging between 49 µS/cm and 1287 µS/cm with a mean value of 324.79 µS/cm. Ca^{+2} is the most dominant cations while K^+ is the lowest one. Among anions, HCO_3^- is the most abundant and SO_4^{2-} is the minor one. Conversely, in the studied groundwater samples the mean abundance of major cations follow the order of $Ca^{2+} > Na^+ > Mg^{2+} > K^+$ with their respective average values of 30.17, 20.81, 13.90 and 4.40 mg/L respectively; while the general dominance of anions was in the order of $HCO_3^- > Cl^- > NO_3^- > SO_4^{2-}$ with their respective mean values of 104.91, 13.10, 5.69 and 4.52 mg/L respectively. However, the hydro-geochemical processes which evolve the chemistry of these studied groundwater samples are inferred by sketching the bivariate plots. Here, carbonate dissolution is the dominant geochemical process that governs the ionic composition of our studied groundwater samples. Furthermore, the overall hydrochemical profiles revealed the main hydrochemical facies as Ca-Mg-HCO_3 water type which can be attributed to dissolution of minerals in the various rock units in the study area. However, in some points, aquifers are being contaminated by agricultural and other anthropogenic activities, which are revealed from the relatively high contents of NO_3^- and SO_4^{2-}. The result of stable isotope composition shows that $\delta^{18}O$ values of studied groundwater samples range from −7.7 to −1.5 ‰ with a mean value of -4.32‰, while values of δD vary from −50.0 to −9.0 ‰ with a mean value of -25.87‰. Furthermore, the isotopic signature of the studied groundwater samples revealed that groundwater is of meteoric origin which is recharged without going through any significant evaporation. Conclusively, the overall hydrochemical and stable isotope evaluations revealed a recharge predominantly derived from meteoric (rainfall) source while the corresponding low TDS is a reflection of low water–rock interaction and limited migratory history of the shallow groundwater system in the study area.

PP-114: AGRICULTURAL FIELD PLOUGHING MACHINE BASED ON ISOLATED SOLAR CHARGING STATION

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The demand of energy of this modern world is rising at a steep rate. The demand can increase by 70% by 2040. To cover up this huge energy demand renewable sources have become more popular around all over the world. Nowadays, research and development works are mainly focusing on new technology to overcome global demand of energy. Renewable energy sources have become a popular source of energy. It is good for the people and for the planet. Now it is the fastest growing source of energy in the world. Renewable energy emits no greenhouse gases and no air pollution. Which is good for the climate and people.

In this 21st century the utilization of solar energy is using in numerous works and projects. Presently in agriculture there are no utilization distinctive of innovation like ploughing tractor, ploughing machine run via solar energy, which reduce time and labor of a farmer. A solar charged ploughing machine has low equipment cost as there is no need of fuel cost. The people of the world are increasing and for that reason food requirement is also high. To meet the amount, we need some newest technology machine in agriculture, which can reduce manpower and can plough within a short time. Solar charged ploughing machine can be a solution with a high efficiency. As it has low maintenance and free source of energy it is very much cost effective than other conventional methods. To obtain solar energy using solar PV panel an efficiency of 18-20% can be achieved. The MPPT controller can help obtain the maximum power from the panel. MPPT can extract more current and charge the battery when the battery is deeply discharged if the state of charge in the battery is lower.

Combining all advanced methods and technologies it is possible to come up with an environment and user-friendly ploughing machine. A ploughing machine is designed and implemented through solar panel and MPPT controller which will be powered up with a PMDC motor integrated with ploughing blades connected to the shaft. The addition of MPPT controller will allow the machine to obtain maximum power from the PV panel.

PP-115: Photocatalytic activity of TiO_2 nanoparticles in an aqueous solution for the degradation of eosin yellowish dye

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In current decades, different types of dyes, pigments and other chemical compounds discharged from cosmetics, paint, leather and various textile industries are frequently contaminating the surface water all over the world. To treated this industrial waste water, advanced oxidation process has been received more attention because of their capability of complete mineralization of organic pollutants in wastewater. In this study, photocatalytic decomposition of eosin yellowish (EY) dye was investigated using TiO_2 nanoparticles as a promising photocatalyst. It was investigated that higher the catalyst concentration, lower the irradiation time for dye removal. The percentage of color removal also investigated by varying the pH of EY dye solution ranging from 3.5 to 9.7. It was observed that at lower pH, the percentage of dye decolorization was increased due to strong adsorption of dye on TiO_2 surface whereas at higher pH, it reduced drastically. The activity of two commercially availableTiO_2 catalysts with particle size of 21 and 25 nm were used to degrade of EY dye and lower particle size of TiO2 showed better photocatalytic activity.

PP-116: Evaluation of Wastewater Discharged from an Industrial Estate on the Adjacent River and Associated Human Health Risks in Northwest of Dhaka, Bangladesh: Using Water Quality Indices and GIS Interpretation

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This study aimed to have a concise look at the severe river water pollution mainly for effluents discharged from the industrial estate. Effluent samples were collected from five ejected points including CETP, twenty adjacent river water samples, and two pond water samples nearby Hemayetpur, Savar. The physicochemical properties of the samples showed that the values ranged from (29.6-32.5°C) temperature, (8.4-11.3) pH, (7058-9850 µS/cm) EC, (0.13-1.93 mg/L) DO, (3725-5480 mg/L) TDS, (3.4-5.7 PSU) Salinity, (34.4-78.4 mg/L) F, (5103.2-9758.8 mg/L) Cl, (169.6-728.3 mg/L) NO_3, (2953.9-4754.2 mg/L) SO_4, (30.6-48.9 mg/L) PO_4, (234.6-287.5 mg/L) Na, (75.6-87.8 mg/L) K, (6.7-33.8 mg/L) Ca, (21.2-114.4 mg/L) Mg and (406.2-1031.2mg/L) SiO_2 respectively. Heavy metal concentrations of Mn, Ni, Cr, Cu, Co and Pb of tannery effluents were 5.74-6.75, 1.07-1.16, 0.5-1.63, 0.51-0.68, 0.15-0.22 and 0.10-0.16 mg/L respectively. The concentrations of studied heavy metals followed a decreasing order of Mn>Cr>Ni>Cu>Co>Pb. Most of the effluent characteristics were beyond the discharge limit set by the E.C.R. '97, United States Environmental Protection Agency (USEPA) and World Health Organization (WHO). CCME water quality index derived 8.83 in effluent sites and 40.74 in river water samples. The entropy-based water quality index and CCME WQI presented effluent sites with consistent worsen quality, i.e., 'extremely poor' (>150) and 'poor' (0-44) for EWQI and CCME, respectively; in the case of river water, EWQI showed 5% 'medium',

10% ‘poor’ and 85% ‘extremely poor’ water quality. Carcinogenic and non-carcinogenic human health risks could be triggered mostly from water consumption due to high concentrations of Cr, Co and Pb. Therefore, through bioaccumulation, human health and the environment are affected nearby these areas. The use of river water for consumption, household works, or even for irrigation purposes is not advisable in any case. This study highlighted that it is required proper implementation of compatible policies and programs for improvement in the effluent treatment methods to provide biodegradability of the Dhaleshwari river.

PP-117: Fast Oxygen Gas Detection using Ultrasound

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Concentration of oxygen (O_2) in the air was successfully measured using ultrasound. The concentration of the gas can be measured based on speed variation of the ultrasound between two gases. Even the difference of speed of sound between air and O_2 is small; it is possible to measure O_2 gas concentration in air using this method. O_2 gas concentration in the air was measured as 20.991%, within the error range of 0.4%, which is close to the standard value of the air (20.9476%). We have investigated the influence of temperature and humidity on the speed of sound moreover on the gas concentration and showed that it is possible to compensate the influence of temperature and humidity by calculation. The response time of this method is fast as a few ms. O_2 concentration can also be measured in the inhalator by using ultrasound.

PP-118: A Novel Approach to Evaluate Surface Water Quality in theCoastal Region of Bangladesh: Hydro-chemical Characterization with Geostatistical Modeling

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Hydro-chemistry of surface water in the disaster-prone region of the southwest coast, Shaymnagar, Bangladesh, was investigated to assess the current ionic state, water class, origin, spatial distribution, and suitability for drinking and irrigation purposes. The investigation

encompassed physicochemical properties and major ion concentrations of the water samples, which were analyzed following the standard methods. Except for Ca^{2+}, Mn^{2+}, NO_3^-, CO_3^{2-}, HCO_3^- and dissolved oxygen status, all hydrochemical parameters exceeded the traditional standards for both irrigation and consumption with a mean salinity of 1.45%. Cations and anions followed the ionic order of $Na^+ > Mg^{2+} > Ca^{2+} > K^+$ and $Cl^- > SO_4^{2-} > HCO_3^- > CO_3^{2-} > NO_3^-$, where, similar to sea water, Na^+ and Cl^- both account for 87% of the cationic and anionic budgets, respectively. The predominance of these two ions classified the water as type III ($Na^+ – K^+ – Cl^- – SO_4^{2-}$) in Piperdiagram and further confirmed as brackish-salt extremely hard NaCl water with the dominance of cation exchange reaction in 93% of samples for salinization via Stuyfzand classification system. Moreover, the ionic ratios inferred that the origin of NaCl-type saline water was largely from halitedissolution from seawater along with cation exchange reactions. Results of irrigation suitability indices accord that water was not suitable for irrigation purposes owing to its excessive salinity and alkalinity hazards resulting from SAR, %Na, KI and MAR values. However, no risk was observed regarding PI and RSC in the coastal region studied. Geostatistical and spatial variability maps illustrated a common trend of high salinity, alkalinity and hardness in the south near the coast with decreasing pattern with distance from the sea. Correlation studies and factor analysis suggested the presence of multiple controlling factors that explain 81.81% of the total variation, i.e., saltwater mixing via tidal influence or frequent flooding, mineral dissolutions, soil-water interactions behind the excessive salinity attributes.

PP-119: Source apportionment and ecological risk of heavymetals in surface sediments ofKaptai Lake, Bangladesh: a multivariate statistical analysis

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Sediment samples from Kaptai Lake were collected and investigated to determine and evaluate heavy metal concentrations, source identification and potential ecological risks for aquatic biota and human health. Total 32 surface sediment samples were collected and concentration of 8 heavy metals (Cr, Fe, Co, Ni, Cu, Zn, As and Pb) in sediments of the lake were determined using atomic absorption spectroscopy (AAS) and neutron activation analysis (NAA) techniques. The quality of the analyses was evaluated by analyzingcertified reference materials IAEA-SL-1 (lake sediment), IAEA-Soil-7 and NIST-1633b. Different pollution indices like enrichment factor (EF), geo-accumulation index (I_{geo}) and contamination severity index (CSI) suggested that the contamination levels of the determined heavy metals were in the acceptable range. The potential ecological risk factor (E_r^i) values found with all considered elements were < 70, therefore they posed a low potential ecological risk at all sampling points. Multivariate statistical analyses were applied to reveal the origin of heavy metals, and indicated that Fe, Co,

Zn and Aswere possibly from anthropogenic sources while the other metals originated from geogenic sources. The present study recommended that proper monitoring of the attribution of the heavy metals should be done for the betterment of the environmental conditionsof the lake.

PP-120: Mapping of Project Opportunity Area for Mokarram Bhaban, Dhaka University

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Renewable energy ensures more environment friendly energy supply to reduce carbon dependency of fossil fuel. Transforming Dhaka University (DU) campus towards a green campus can be a sustainable and environment friendly model for the whole country. The main objective of this study is to identify potentially suitable area for PV installation by simulating different types of maps. For both resource potential and development feasibility, spatial multi criteria decision analysis approaches has been applied. ArcGIS software has been used to visualize the study area by placing various criteria that indicate the suitability of different locations for solar photovoltaic system placement. Parameters like global horizontal radiation, temperature, humidity, elevation, distance from a main road, distance from a major power line, and population density are important in making balanced decisions on energy development. For instance, the efficiency of solar PV module reduces noticeably as temperature and relative humidity rises. The goal of this study is to create a topographically detailed, and informative procedure to estimate financial potentiality and support decision making in the field of Renewable Energy. Finally, it identifies several key future research directions for GIS-based energy infrastructure design, with a focus on renewable energy.

PP-121: Hydrogeochemical evaluation, suitability and potential health risk of groundwater in northern Tangail, Bangladesh: Isotopic and GIS techniques

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This study evaluates the hydrogeochemistry of groundwater, groundwater contamination and potential health risk in northern Tangail, Bangladesh using isotopic and hydrogeochemical techniques and some statistical model and tools. The study area is comprised of Jamuna floodplain and Madhupur tract. The recent and old flood plains of the Jamuna river are positioned at the western portion of Tangail district, whereas an elevated Pleistocene terrace is located in the Eastern region. Total 50 diverse samples were collected from different depths of aquifers and rivers of the study area. The water types are mainly Ca-HCO_3^- to Na-HCO_3^- types. The most of the samples from the study area exceeds the WHO and BD permissible limits. High levels of SO_4^{2-} and NO_3^- are found in shallow and intermediate aquifers due to extensive uses agricultural fertilizer and manure. Moreover, unplanned sewage systems might be the vital cause of groundwater contamination especially in shallow aquifer. The potential health risk result showed that associated risk and major trace elements (Fe, Mn, NO_3^-, and As) are higher at shallow and intermediate aquifer compared to deep and Madhupur tract due to anthropogenic effect from land surface and geogenic enrichment. The isotopic compositions of (δ^2H and $\delta^{18}O$) confirmed that the source of shallow and intermediate groundwater samples are different from deep and Madhupur tract samples. From the health risk analysis, it was found that, the non-carcinogenic risk ranges from 0.0074-16.67 (adult) and 0.0094-21.22 (children) suggesting significantly higher risk than permissible limit. The carcinogenic risk also exceeds the permissible limit for both adult and children. The children are at vulnerable condition than the adult. This study suggests that groundwater aquifers should be carefully manage for the sustainable development of groundwater resources.

PP-122: Solid-phase redistribution of lead (Pb) and cadmium (Cd) in contaminated surface soils with time

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Bioavailability, toxicity, and mobility of heavy metals in soils are determined by their partitioning between solution and solid-phase and their further redistribution among solid-phase component. Solid-phase redistribution of lead (Pb) and cadmium (Cd), added as soluble salts to three different texture soils of Bangladesh incubated under 30% moisture regime, was studied for 1 month. The heavy metals were fractionated into six operationally defined fractions (water soluble, exchangeable, carbonate-, Fe-Mn oxide-, organic matter bound and residual fractions). The amounts of metals spiked were 100 mg-kg^{-1}. Metals in the incubated soil samples were fractionated at different time intervals (1 day, 3 days, and 30 days) by the sequential extraction procedure of Salbu et al. (1998), modified from Tessier et al. (1979). The heavy metals spiked in the soils were time-dependently transferred from the easily extractable fractions (the water soluble, exchangeable and carbonate-bound fractions) into less labile

fractions (Fe-Mn oxide- and the organic matter-bound fractions) and thus reduced mobility of the metals. No significant changes were found for the residual fractions of the heavy metals in the soil during the whole incubation. The higher mobile fraction (as a percentage of total) of Cd indicated the greater mobility of Cd compared to Pb. However, the redistribution pattern was more or less similar in all the three soils since their charactristics were almost similar.

PP-123: Properties of Indigenous Humic Substance (HS) in Bangladesh and Interaction of HS with Heavy Metal: Future Green Technology for Lead and Zinc Removal from Aqueous Solution

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4th Industrial Revolution has promoted the quality of living and working environment as well as interaction. However, existing environment are critical issue that has received research interest on heavy metal removal by green technology. Humic substances (HS) are complex and heterogeneous mixture of polydispersed material that are formed due to physical, chemical and biochemical changes in dead plant, animal and microbial residues. The polymeric organic compounds, HS is ubiquitous in soil, river, ocean and other ecological environments all over the world including Bangladesh. Two active components of humic substance i.e., humic acid (HA), fulvic acid (FA) was extracted from Khulna peat of Bangladesh and different properties including optical property, coagulation threshold, humification indexes were studied. The coagulation capacity of humic substance for Lead (Pb) and Zinc (Zn) was studied from synthetic and natural waste water. After the complete coagulation, the Pb and Zn present in supernatant was determined by atomic absorption spectrophotometer. Humic substance was considerably effective in removing Pb(II) and Zn(II) ions from standard solution as well as waste water. Though humic acid able to form stable complexes with Pb and Zn, Pb removal ability with HA is higher than Zn. Carbon concentration, pH and coagulation of the specific element should be tested before use for effective removal of Pb and Zn from aqueous solution.

PP-124: Phytochemical analysis of Moringa oleifera (Sojna) leaf using GC-MS technique

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Moringa oleifera (Sojna) is a plant that is native to areas of Indian Subcontinent, It is also grows in the tropical and subtropical areas all over the world. The leaves, barks, flowers, fruits, seeds, and roots are used in different medicinal purposes. As it can be grown cheaply and easily, and the leaves retain lots of vitamins and minerals it is considered as an important food source in some parts of the world. Because of having so many nutrients, it is called the "Dynamite of nutrients". The chemical constituents, such as volatile compounds of the leaves of *Moringa oleifera* were analyzed by GC-MS. *Moringa oleifera* contains proteins, vitamins, and minerals. As an antioxidant, it seems to be helpful to protect cells from damage. The chemical composition of the essential oil of *Moringa oleifera*(Sojna) leaves produced in Bangladesh were determined by GC-MS. The volatile compounds of leaves were extracted by hydro-distillation process. The sample was collected and washed. 100g of each sample was blended well and subjected to hydro-distillation for four hours. The distillate was collected nearly 2ml and further treated with Na_2SO_4.The GC-MS analysis of *Moringa oleifera* showed the presence 46 phytochemical compounds. The major components were: 2,4-Imidazolidinedione, 5-[3,4-bis[(trimethylsilyl)oxy]phenyl]-3-methyl-5-phenyl-1-(trimethylsilyl)- (13.73%); Hexadecanoic acid, methyl ester –(9.99%); psi.,.psi.-Carotene, 3,3',4,4'-tetradehydro-1,1',2,2'-tetrahydro-1-hydroxy-1'-methoxy-(9.2%); Methyl (Z)-5,11,14,17-eicosatetraenoate-(7.23%); Cephalotaxine, 11-(acetyloxy)-, acetate (ester), (11.alpha.)–(5.86%); Canthaxanthin-(5.51%); Spiro[9,9']difluorene, 2,2'-(2,5,8,11-tetraoxadodecane-1,12-diyl)- (2.56%); 3,7,11,15-Tetramethyl-2-hexadecen-1-ol-(4.46%); Pregn-4-ene-3,11-dione, 17,20,21 tris[(trimethylsilyl)oxy]-, 3-(O-methyloxime), (20S)- (2.16%) 3,9.beta.;14,15-Diepoxypregn-16-en-20-one,3,11.beta.,18-triacetoxy-(2.28%); 3,8,12-Tri-O-acetoxy-7-desoxyingol-7-one-(1.99%); Isobutyl ether-(1.96%). This research explores the use of *Moringa oleifera* for its nutrition facts, and prominent pharmacological properties of this "Miracle Tree".

PP-125: Investigation of carcinogenic Benzo (a) Pyrene (BaP) in urban river soil sediments affected by tannery effluents

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Benzo(a)pyrene compound is environmental concern due to its toxic nature. Our investigation goal is identification and quantification of carcinogenic Benzo(a)Pyrene (BaP) in soil samples

of a tannery port in the Dhaleshwari river of Bangladesh, which is supposed to be extensively polluted by tannery wastewater discharges. A total of twenty five soil samples from five sampling sites were collected to determine the concentration of benzo(a) pyrene. A suitable method was developed for analysis the BaP in soil samples. The method validity was checked by standard addition method, BaP were detected using the indicated valid method. All the samples were treated by dichloromethane-hexane (1:1) mixture and refluxed for three hours at 45 °C. The extracted samples were evaporated to 20 mL and pre-concentrated to 1-2 mL by using nitrogen gas. Prepared samples were subjected to GC-MS analyses for the identification of organic compounds. Results showed that the concentration of BaP in soil samples e.g. S-27, S-29, S-40, S-41, S-42, S-43, S-45, S-46 and S-48 were found to be 19.83 µg/kg, 0.64 µg/kg, 0.59 µg/kg, 0.55 µg/kg, 3.86 µg/kg, 9.21 µg/kg, 0.636 µg/kg and 0.236 µg/kg, respectively. The highest concentration of S-27 was found to be 18.83 µg/kg in the depth soil samples of side and lowest concentration was found 0.236 µg/kg in the surface soil of boring site. Detection limit of Benzo[a]pyrene (BaP) was (DL=0.02 µg/kg). The spike recovery of the BaP was observed 64.90 to 92.7% demonstrated the perfect reliability and accuracy of the methodology employed in this disquisition.

PP-126: Assessment of fine particulate matter and black carbon in winter season from 2014 to 2018 at a semi residential area in Dhaka city

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Fine particulate matter ($PM_{2.5}$) and black carbon (BC) were collected from a semi residential site located at Dhaka University campus in every winter season from December, 2014 to January, 2018 using Gant sampler. To understand the contribution of the black carbon (BC) and fine particle ($PM_{2.5}$) to the particulate matter pollution, the ratio of BC/PM2.5 is considered. This study reveals the changes in the mass concentration of $PM_{2.5}$ and BC in these periods with respect to the change of meteorological condition (humidity, temperature, wind speed). To detect the presence of specific emission sources that enhance the pollution over receptor sites, the conditional probability function and conditional bivariate probability function techniques are employed in the present study. Concentration weighted trajectory analysis using back trajectory (by HYSPLIT-4 model) is also employed in the present study to discover the impact of transboundary pollution. Air mass trajectory analysis with HYSPLIT model showed that the long range transport may be significantly contributed to the particulate matter concentration at that mentioned area. Hence there was a huge pollution during winter season.

PP-127: Biosorption of heavy metals (zinc and lead) by tea leaves

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Heavy metals are elements whose density is equal to or greater than 6.0 g/cm^{3}eg. Lead (Pb), mercury (Hg), cadmium (Cd) and zinc (Zn). Heavy metals generally pose many problems to mankind.We chose to explore the suitability of tea leaves as an adsorbent for the removal of heavy metals from aqueous solutions.This process will be carried out as a function of contact time, initial metal ion concentration, biosorbent dosage. Tea leaves samples of different ages will be taken from different regions of Bangladesh at various latitudes and longitudes. Stock solutions will be prepared of 0.1M of lead (II) nitrate ($Pb(NO_3)_2$) and 0.1M of Zn. Then 5 different concentrations of Pb^{2+} and Zn solutions will be prepared (0.02M, 0.04M, 0.06M, 0.08M and 0.1M). The solutions with different concentrations and bio-sorbent materials of different weights (2 g, 4 g, 6 g and 8g) will be put into orbital shaker at different temperatures (between 30^0C-60^0C) for different time periods. The solutions will be filtered by Whatman filter paper and the concentrations of resulting filtrate will be determined using AAS(Atomic Absorption Spectrometer). This study will evaluate the performance of Camellia sinensis biomass as an adsorbent in the removal of lead and zinc from a contaminated aqueous phase or solution.Thus tea leaves can be an important aspect to save the environment by reducing the amount of heavy metals.

PP-128: Design and Performance Analysis of a Home-Based Solar Desalination System for Drinking Water Crisis in The Coastal Region of Bangladesh

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Access to safe and drinkable water is alarmingly getting limited due to groundwater salinity in Bangladesh. Roughly 20 million individuals living along the coast are influenced by shifting degrees of saltiness in drinking water. It is imminent that the approaching water crisis of Bangladesh can never be met with traditional solutions rather a more techno-natural treatment becomes necessary to form sure its water security. Solar Powered desalination can provide a sustainable way to produce fresh water. In this study, an attempt has been made to develop a family-size solar desalination plant using black cotton fabric and produce desalinated water from a vapor that meets the drinking water demand in the coastal area and remote regions. A modified basin type solar still, incorporating multiple low thermal inertia porous absorbers was made in this study. The porous absorbers were made up of ordinary fabric (woven or nonwoven). It is observed in the experiments that the solar radiation flux rose rapidly after sunrise and peaked approximately at 12:00 later it declined gradually. The air temperature also rose gradually in the morning till 13:00 and declined gradually in the afternoon. Whereas the

production was recorded from 10:00 in the morning (clearly indicating that there is a distinct time lag between evaporation and production or condensation), increased gradually up to noon, and then declined in the afternoon. The average daily production rate for the Still is found as 1.17 lit/m^2; with 1,75 liter highest and 0.6 liters lowest respectively. The result presented in this study gives clear information to understand the behavior of production rate and other related information for the Solar Still.

PP-129: Biodistribution and progeny transfer effects of chitosan-coated cobalt ferrite nanoparticles

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Cobalt ferrite nanoparticle (CFN) is a promising material for its enticing properties for different biomedical applications, including MRI contrast, drug carrier, biosensor, etc. Previously we reported that coating of CFN with chitosan enhanced the biocompatibility of CFN and the chitosan-coated CFN (CCN) nanocomplex showed promise as an MRI contrast dye. The effects of CCN on the progeny are still unknown, and this should be unveiled before any in vivo biomedical application of CCN in pregnancy. This study first reported the effects and transfer of CCN in progeny following a single intravenous injection of CCN in pregnant albino Wistar rats. Previously synthesized (~11 nm) CCN were administered CCN (and PBS as control) intravenously at 20 mg/kg, 40mg/kg or 60 mg/kg dose on gestation day 18. Experimental rats were sacrificed at 24 and 48 h of post-injection. Biochemical and histopathological results confirmed that CCN was tolerated with maternal organ functions (e.g., liver, kidney). While atomic absorption spectroscopy (AAS) results revealed that CCN or CCN leached iron could pass the placental barrier and deposit into the fetus. Moreover, this deposition increased lipid peroxidation in the placenta and fetus.

PP-130: Wintertime Exposure of Indoor Particulate Matter and Health Risk Assessment of $PM_{2.5}$ on the Residents in Dhaka, Bangladesh

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This study investigated the indoor exposure of particulate matter in Dhaka, Bangladesh during January- February, 2020. Real time concentration of indoor $PM_{1.0}$, $PM_{2.5}$ and PM_{10} were measured using IGERESS Air Quality Monitoring Detector at residential homes of six locations (Bashundhara, Cantonment, Chankharpul, Dhanmondi, Mirpur and Uttara). Indoor $PM_{2.5}$ samples were collected on quartz filters for 24 hours using SIBATA mini volume sampler (Model: MP- ∑500 NII, Japan) to quantify six metals (Pb, Cr, Zn, Fe, Cu, and Mn) by Atomic Absorption Spectroscopy (AAS) technique. The mean concentration of indoor PM of all size ranges at night were 1.69 times higher than their corresponding daytime concentration. Mean I/O ratio (I/O_{day}= 0.95 and I/O_{night}= 0.93) and strong positive correlation (R^2_{day}= 0.90 and R^2_{night}= 0.80) between indoor and outdoor particulate matter confirmed infiltration of outdoor air in households. The 24- hour average $PM_{2.5}$ concentration for Dhanmondi, Mirpur, Cantonment, Chankharpul, Uttara, and Bashundhara were 123 ± 48.2, 123 ± 17.7, 96.3 ± 17.7, 96.3 ± 13.6, 84.8 ± 6.67, and 77.1 ± 6.68 μgm^{-3}, respectively. Enrichment factor analysis revealed that Pb, Cr, Zn, and Cu had anthropogenic origin, whereas Fe and Mn originated from crustal sources. Four sources of indoor $PM_{2.5}$ were identified by Positive Matrix Factorization (PMF) model - industrial emission (4.8%), crustal sources (17.6%), traffic sources (44.6%), and mixed sources (32.9%). Health risk assessment indicated that, children were at 2.18 times greater non- carcinogenic risk than adults, the hazard index values for children and adult being 8.28 and 3.79, respectively. The total cancer risk was 5.18×10^{-4} (1 in 1930 individuals), which was higher than the acceptable limit (1×10^{-6}). The average peak flow rate and blood oxygen saturation of thirty inhabitants in six sampling locations were 353 L min^{-1} and 98.7%, respectively. Strong, negative correlation (R^2 = 0.82) between peak flow rate and indoor $PM_{2.5}$ concentration suggested that, inhalation of elevated level of $PM_{2.5}$ was probably responsible for reduced lung efficacy of the residents. However, blood oxygen saturation was independent of indoor $PM_{2.5}$ concentration. The average hazard ratio for indoor $PM_{2.5}$ was 6.68, which indicated highly degraded indoor air quality in the residential environment of Dhaka, Bangladesh.

PP-131: Chemical composition of the essential oils of Moringa oleifera (Sojna) leaf produced in Bangladesh.

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Moringa oleifera (Sojna) is a plant that is native to areas of Indian Subcontinent, It is also grows in the the tropical and subtropical areas all over the world. The leaves, barks, flowers, fruits, seeds, and roots are used in different medicinal purposes. As it can be grown cheaply and easily, and the leaves retain lots of vitamins and minerals it is considered as an important food source in some parts of the world. Because of having so many nutrients, it is called the

"Dynamite of nutrients"The chemical constituents, such as volatile compounds of the leaves of Moringa oleifera were analyzed by GC-MS. Moringa oleifera contains proteins, vitamins, and minerals. As an antioxidant, it seems to be helpful to protect cells from damage. The chemical composition of the essential oil of Moringa oleifera(Sojna) leaves produced in Bangladesh were determined by GC-MS. The volatile compounds of leaves were extracted by hydro-distillation process. The sample was collected and washed. 100g of each sample was blended well and subjected to hydrodistrillation for four hours. The distillate was collected nearly 2ml and further treated with Na_2SO_4 .The GC-MS analysis of Moringa oleifera showed the presence 46 phytochemical compounds. The major components were: 2,4-Imidazolidinedione, 5-[3,4-bis[(trimethylsilyl)oxy]phenyl]-3-methyl-5-phenyl-1-(trimethylsilyl)- (13.73%); Hexadecanoic acid, methyl ester –(9.99%); psi.,.psi.-Carotene, 3,3',4,4'-tetradehydro-1,1',2,2'-tetrahydro-1-hydroxy-1'-methoxy-(9.2%); Methyl (Z)-5,11,14,17-eicosatetraenoate-(7.23%); Cephalotaxine, 11-(acetyloxy)-,acetate (ester), (11.alpha.) –(5.86%) ; Canthaxanthin-(5.51%); Spiro[9,9']difluorene, 2,2'-(2,5,8,11-tetraoxadodecane-1,12-diyl)- (2.56%); 3,7,11,15-Tetramethyl-2-hexadecen-1-ol-(4.46%); Pregn-4-ene-3,11-dione, 17,20,21 tris[(trimethylsilyl)oxy]-, 3-(O-methyloxime), (20S)-(2.16%) 3,9.beta.;14,15-Diepoxypregn-16-en-20-one,3,11.beta.,18-triacetoxy-(2.28%); 3,8,12-Tri-O-acetoxy-7-desoxyingol-7-one- (1.99%); Isobutyl ether-(1.96%). This research explores the use of Moringa oleifera for its nutrition facts, and prominent pharmacological properties of this "Miracle Tree".

PP-132: Environmental Radiation Surveillance by Using Thermoluminescent Dosimeter around AECD Campus

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Using thermoluminescent dosimeters (TLDs) for environmental surveillance of external radiation around the Atomic Energy Centre Dhaka (AECD) has been studied from 2019 to 2021. It is important to measure background radiation because human beings are always exposed to environmental radiation. Environmental radiation generally known as background radiation is emitted from both natural and manmade radioactive sources. The measurements were performed at different locations in the AECD campus, using TLD-100 (LiF: Mg, Ti) chip dosimeters were placed in the radiation monitoring post. There are 10 (ten) customized radiation monitoring posts each containing 5 (five chips) was placed 1m above the ground level (gonad height) in light-tight condition. The chips were collected to compare the seasonal variation by Thermo Scientific™ HARSHAW TLD™ Model 3500 Manual Reader. The result of the background measurements was also compared with the data of the digital beta/gamma survey meter. From this study, the result showed average background radiation in this area is ~ 1.23 mSv/y. The absorbed dose of TLD-100 remained in good agreement (typically within ±5% but in some cases extending beyond this) with the results from survey meter data.

PP-133: Assessment of natural radioactivity levels and radiological hazards in sediments of the Atrai river, Bangladesh

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The distributions of naturally occurring radionuclides (^{226}Ra, ^{232}Th and ^{40}K) in river sediments collected from the Atrai river in Dinajpur district of Bangladesh have been measured using a gamma-ray spectrometry system to evaluate the radiological health hazards and excess lifetime cancer risk (ELCR). The activity concentrations of ^{226}Ra, ^{232}Th, and ^{40}K were found to be 29.5 ± 12.4 to 138 ± 4 Bq kg^{-1}, 30.9 ± 9.9 to 289 ± 3 Bq kg^{-1} and 1640 ± 10 to 2330 ± 8 Bq kg^{-1}, respectively. The mean activity concentrations for these radionuclides with standard deviations were 57.3 ± 24.6 Bq kg^{-1} of ^{226}Ra, 85.9 ± 56.5 Bq kg^{-1} of ^{232}Th and 1960 ± 198 Bq kg^{-1} of ^{40}K, respectively which are higher than the world average concentrations of these radionuclides in the river sediments that is 25, 25 and 370 Bq kg^{-1}, respectively. The activity concentrations of ^{226}Ra and ^{232}Th in the Atrai river sediments are within the range of world values (8-160 Bqkg^{-1}, 4-130 Bqkg^{-1}). However, the activity concentrations of ^{40}K in all samples are higher than the range of world values (100-700 Bq kg^{-1}). To know the radiological characteristics of the sediments, these results were used to calculate the different radiological hazard parameters. Due to natural radionuclides in sediments, the calculated average value of Radium equivalent activity was 331 Bq kg^{-1}, gamma representative level index was 2.55, external absorption gamma dose rate was 160 nGy h^{-1}, the annual effective dose was 0.20 mSv y^{-1}, external hazard index was 0.89, Internal hazard index was 1.05 and excess lifetime cancer risk was 0.69×10^{-3}. In this study, the average annual effective dose is 0.20 mSv y^{-1} which is within the accepted range of 0.46 mSv y^{-1}. But the average values of gamma representative index, external absorption dose rate, internal hazard index and excess lifetime cancer risk are relatively higher than the acceptance ranges. Therefore, the sediments of this river would carry a radiological threat to the population when they are used as a building construction material.

PP-134: Study on Radiological Characterization and Classification of Unsealed and Unprocessed Solid Radioactive Waste of Central Radioactive Waste Processing and Storage Facility of Bangladesh

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The presence or absence of probable artificial radionuclides with their activity concentration levels in unsealed and unprocessed solid radioactive waste stored at the interim storage room of Central Radioactive Waste Processing and Storage Facility (CWPSF), Health Physics and Radioactive Waste Management Unit (HPRWMU), INST, AERE, Savar, Dhaka, Bangladesh were analyzed. The research was conducted for characterization and quantitative classification of the unsealed and unprocessed solid radioactive wastes to decide the subsequent management steps of the wastes. A total of twenty-one samples were collected from three different storage drums. The samples were analyzed by gamma spectrometry technique using a High Purity Germanium (HPGe) detector with 20% relative efficiency. Besides, airborne particles inside the CWPSF were collected using a Staplex High Volume Air Sampler with glass fiber filter. The filters were also analyzed by gamma spectrometry technique. Gamma spectral analysis of the collected samples indicated the presence of two artificial radionuclides; ^{60}Co and ^{137}Cs. The activity concentrations of ^{60}Co were found in the range of 33.15 ± 8.74 Bq kg-1 to 702.61 ± 48.36 Bq kg-1 with an average of 175.17 ± 22.82 Bq kg-1. The activity concentration of ^{137}Cs was found 39.37 ± 9.14 Bq kg-1 in only one sample. No artificial radionuclide was detected in any of the filters used for air sampling in the facility except the naturally occurring radionuclides. Radioactive waste characterization and classification were conducted according to IAEA Safety Standard GSG-1. The results of the current study would help to decide the final disposal option of these wastes.

PP-135: Cross-section evaluation of neutron-induced ^{232}Th reaction up to 20 MeV

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As ^{232}Th has important applications in nuclear science and technology, a perfect understanding of its various cross-sections in the low energy range is indispensable. The scarcity of experimental data, particularly of elastic cross-section, makes theoretical evaluation essential. Various cross-sections are evaluated for n + ^{232}Th reaction in the energy range up to 20 MeV. LINUX-based GNU FORTRAN compiled TALYS 1.95 and Windows-based EMPIRE 3.2.3 computer codes are used for the evaluation. The nuclear optical model, local and global parameterizations of Koning and Delaroche are used during this evaluation. An evaluation of this calculation is done by comparing the calculated data with the experimental data, collected from the EXFOR data file of IAEA NDC. Existing evaluated data from the available international nuclear data libraries are used to check the validity and reliability of our evaluation. Our new calculated data in most of the investigated cases show good agreement

with the earlier experimental and evaluated data except fission cross-section data. However, any discrepancies found are mitigated by adjusting the parameters.

PP-136: A detailed study on how to make affordable, strong and durable manhole cover with banana and jute fiber reinforced epoxy resin composites

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Due to some remarkable mechanical properties, advanced composites are now widely used in various fields of engineering. One of the features that distinguish it from other components is its anti-corrosion behavior. Other notable features are its flexibility against fatigue and its lightweight. Its electrical resistance is also a notable feature like its other properties. One of the goals of this study is to encourage the use of natural fibers composites as jute, banana, hemp, coir and so on, which are abundant in nature. Products made with these ingredients are lighter than other products and are capable of making any product affordable. So, in this study, we will also discuss in detail the effectiveness and usefulness of these components in making a manhole cover. Manhole covers are quite heavy and economically expensive, as the precious material iron is used extensively in its manufacture. So, we have focused on how manhole covers can be made from jute and banana composites and how to popularize these eco-friendly green composites. In this research, fiber reinforced epoxy composites were fabricated with jute and banana fibers of fiber length 5-7 mm with different weight percentages of fiber content (0%, 15%, 30%, 45%, 60%). These synthesized composites were characterized to study the mechanical properties such as hardness, tensile strength, impact strength and flexural strength and electrical properties. The result shows higher tensile strength for banana fiber reinforced composite.

PP-137: Electro-chemical Exfoliation of Graphite to Graphene in Various Electrolytic Solution for Different Voltage

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Abstract: Graphene Oxide (GO) and Reduced Graphene Oxide (RGO) have become the main focal point of research interest for their extraordinary physic-chemical properties of materials performance and potential fields of applications in various sectors, especially in electronic, optoelectronic device and circuit etc. The purpose of this study is to investigate the easiest and cheapest path for graphene oxide production maintaining better product quality and rate. The electrochemical exfoliation method was followed to exfoliate GO's from Graphite powder. At first the Graphite powder were under gone some pretreatment by applying concentrated mixed acids wash to remove the foreign materials. Conc. Sulfuric acid and Nitric acid (ratio 50:50) were used to pretreat Graphite applying heating and stirring. Then it washed until pH around 7.0. 1% polyvinyl alcohol was used as binder to make Graphite powder moldable. Then it was molded to graphite sheet applying 60.00 KN pressure. The Graphite sheet was then exfoliated applying electricity at different fixed Voltages of 10.0V,12.5V and 15.0V in different electrolytic solution of KCl and NaCl. Then they were purified by boiling in water and then washed with distilled water applying centrifugation until pH around 7.0. The GOs thus obtained were characterized using FT-IR, UV-Vis. The effect of voltage and electrolyte on the GOs properties and rate were found to be satisfactory, correlated and easy controllable.

PP-138: Influence of iron-deficiency on the structural, elastic and magnetoelectric properties of some multiferroic composites

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In this research, (1-y) $[Ba_{0.90}Ca_{0.10}Zr_{0.10}Ti_{0.90}O_3]$ + (y) $(Ni_{0.25}Cu_{0.13}Zn_{0.62}Fe_{2-x}O_{4-3x/2})$ (x = 0.00 to 0.12; in step of 0.04; y = 0.5) multiferroic composites are fabricatedusing solid state reaction method and sintered at 1200 ℃.X-ray diffraction pattern and Fourier transform infrared spectroscopic analysesvalidate the formation of individualphases.There is a slight variation of lattice constants which may be attributed to the strain originated at the interface between two phases as a consequence of the crystal lattice mismatch. The moduli of elasticity, Poisson's ratio, and Debye temperature are calculated from infrared spectroscopic data and also the electromagnetic properties are measured for $[Ni_{0.25}Cu_{0.13}Zn_{0.62}Fe_{2-x}O_{4-3x/2}]$ phases. FESEM images of the composites exposethat thegrain diameter increases with iron deficiency.The existence of the necessary elements as per the stoichiometric ratio are establish by EDX.The dielectric constants of the compositesexhibit dispersive behavior at low frequency which can be explained by the Koop's and Maxwell-Wagner's two-layer models. The ac electrical conductivity data of composites fitted the universal law of Jonscher with large dispersion at higher frequencies. Nyquist plot is fitted by ZSimpWin software which proclaimed that the electrical conduction is mainly due tothe contribution of the grain boundary.The complex permeability of the composites is highest for x = 0.04. The highest value of magnetoelectric

coefficient (α_{ME} ~ 169 mV/cm-Oe) is realized for thecomposite(x=0) due to the elastic interaction mediated by strain between two phases. Finally, the studied materials have the potentials role in designing and developing futuristic novel multifunctional devices.

PP-139: Assessment of ambient air quality in Dhaka city and sources of pollutant identification

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Particulate air pollution is the major concern in Bangladesh and thus it is necessary to understand the characteristics of the pollutant as well as sources for further improvement of the air quality. In this research work, particulate matter (PM) sampling was donebetweenSeptember2019toAugust2020 at a residential site (Atomic energy centre, AECD) in Dhaka .PM sampling was performed using a GENT sampler, which collects samples in two size fractions: $PM_{2.5}$and $PM_{2.5-10}$.A total no of 128 fine samples were analyzed for mass, black carbon (BC) and elemental compositions. Mean $PM_{2.5}$and BC concentration was found to be 77.06 μgm^{-3} and 15.52 μgm^{-3} respectively. The impact of meteorological variables on particulate matter was also studied which shows $PM_{2.5}$ and BC both makes negative correlation with the variables. Data on the concentrations of17elements (Na, Mg, Al, Si, S, Cl, K, Ca, Ti, V, Mn, Fe, Ni, Cu, Zn, Br, and Pb), black carbon, and mass were available for data analysis. Source apportionment of the trace elements in $PM_{2.5}$was done by using Positive Matrix Factorization (PMF) technique. The identified sources include brick kilns, soil dust, road dust, motor vehicle, fugitive Pb, Zn source, Biomass burning and sea salt sources. Among them, Brick kiln contributes the highest followed by road dust and motor vehicle. It was found that more than 49.5%ofthefine particle mass comes from anthropogenic source such as brick kilns, biomass burning, and motor vehicles.

PP-140: Synthesis and characterizations of nanohydroxyapatite (nHAp) from eggshells waste by novel hydrothermal route for biomedical applications

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Plenty of bio-waste eggshells are being generated from food processing industries each day worldwide. These materials are directly discarded in the soil and those are creating odor and microbial growth in the environment. It is becoming a huge challenge for scientists to figure out an eco-friendly path to transform these wastes into wealth. Our main target in this study is to develop inexpensive and sustainable approaches to synthesize bioactive nanohydroxyapatatite (nHAp) from eggshells waste. Interestingly, nHAp has numerous biomedical applications especially as scaffold for tissue engineering and in orthopedic implants. To achieve these important goals, firstly, calcium precursor nanoparticles were synthesized from powdered eggshells (PES) by sol-gel method followed by calcination and chemical processes. Afterwards, nHAp was synthesized from calcium precursors by hydrothermal route at 280 ^{o}C. Moreover, nHAp was also prepared from commercially available chemicals by the similar method to compare the purity and phase of the produced nHAp from PES. To the best of our knowledge, nHAp prepared from eggshells waste via our novel hydrothermal technique is reported for the first time.

Initially, the produced calcium precursors, $CaCO_3$, $Ca(OH)_2$ and CaO were characterized by XRD, SEM, FTIR, EDS and TGA techniques to achieve desired nHAp. The X-ray diffraction patterns of nHAp, obtained from both eggshells waste and market available chemicals show the existence of the almost pure apatite phase with hexagonal structure (a = b = 9.423 Å; c = 6.915 Å) as presented in the paper. The exhibited XRD patterns also imply that although the nHAp was obtained from two different sources, but their purity and crystallinity were found dominantly analogous. FTIR spectra of nHAp confirm the presence of all relevant functional groups and boding of calcium (only inorganic element) to their corresponding wavenumbers. The morphological and particle size of our prepared HAp was investigated by SEM that reveals predominantly agglomerated spherical particle shapes with average particle size of ~200 nm. EDS analysis confirms the existence of all elements in nHAp with their percentage. From TGA data it is quite clear that nHAp suffers no decomposition and/or no mass change below 800 ^{o}C that confirm the superior stability of synthesized nHAp for future biomedical applications.

PP-141: First principles calculations to investigate interesting physical properties of $(Ba_{0.82}K_{0.18})(Bi_{0.53}Pb_{0.47})O_3$ single-cubic-perovskite superconductor

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In the present study, the pseudopotential plane-wave (PP-PW) pathway in the scheme of density functional theory (DFT) is utilized to investigate the various interesting physical properties on $(Ba_{0.82}K_{0.18})(Bi_{0.53}Pb_{0.47})O_3$ (BKBPO) single perovskite superconductor. We have analyzed mechanical properties, elastic constants, and moduli at ambient temperature with zero and elevated pressures (up to 25 GPa) as well. The calculated values of Poisson's ratio, Pugh's indicator, and Cauchy pressure of the studied superconductor are found to be brittle in nature at ambient conditions. The calculated machinability index and hardness values of BKBPO perovskite indicate its superior industrial applications to similar ones. The compound might be considered as a promising thermal barrier coating (TBC) material base on Young's modulus (E) and thermal shock coefficient (R) data. We also have investigated the anisotropic nature incorporating both the theoretical indices and graphical representations in 2D and 3D dimensions, which express a high level of anisotropy of the studied compound. The flatness of the energy bands near EF is a sign of Van-H_f singularity that might increase the electron pairing and origination of high-T_C superconductivity. The computed band structure exhibits its metallic characteristics which are confirmed by band overlapping in the diagram. A band of DOS is formed for the strong hybridization of the constituent elements where the orbital electrons of O-2p contribute most dominantly at EF in contrast to all orbital electrons. The orbital electrons at the EF are higher from both the partial density of states and charge density mapping investigation. The coexistence of the electron and hole-like Fermi sheets exhibits the multi-band nature of the BKBPO superconductor. On the other hand, Fermi surfaces with flat faces promote transport features and Fermi surface nesting as well. The calculated value of the electron-phonon (e-ph) coupling constant ($\lambda = 1.46$) is slightly lower than the isostructural superconductor, which indicates that the studied BKBPO can be treated as a strongly coupled superconductor similar to the previously reported isostructural perovskite superconductors. Furthermore, the thermodynamic properties have been evaluated and analyzed at elevated temperature and pressure by using harmonic Debye approximation (QHDA).

PP-142: MAGNETIC PROPERTIES OF Li DOPED Ni-Zn-FERRITES

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Li doped Ni-Zn-ferrites were prepared by auto-combustion synthesis method. The diffractograms obtained from X-ray diffractometer for each composition consented to the single-phase cubic spinel structure. The initial permeability, relative quality factor (RQF), and

magnetic loss were measured as a function of frequency with the help of an impedance analyzer. Moreover, dc-magnetization at the room temperature for each studied composition was measured using Vibrating Sample Magnetometer (VSM). It is noticeable that initial permeability is higher for the sample with higher bulk density. However, it is also observable that substitution of Li enhances magnetic properties up to its optimum concentration.

PP-143: Extraction, optical properties and ageing effect of natural dyes and its impact on the power conversion efficiency of dye-sensitized solar cells.

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The improvement of efficiency of dye-sensitized solar cells (DSSCs) mostly depends on absorption peak in the visible region including the band gaps of dyes. This work is focused on the extraction, ageing effect and optical properties of natural dyes extracted from some selective flowers and leaves which are available in Savar, Dhaka, Bangladesh. The FTIR spectra were recorded to evaluate the presence of functional groups present in these natural dyes. The UV-Vis spectrophotometric studies of these dyes have indicated broad absorption peaks in the visible region including clear bandgaps. Scanning Electron microscopy was done to evaluate the surface morphology of the studied electrode before and after the absorption of natural dyes onto its surface. Among the studied dyes, Celosia cristata showed the lowest direct bandgap of 1.96 eV and indirect bandgap of 1.79eV. These natural dyes were used as sensitizers for the semiconductor TiO_2 as an electron conductor in order to improve the efficiency. The ageing effects of natural dyes were conducted to understand how these dyes perform after a certain time that stored under different conditions e.g. sunlight, temperature, pressure, etc.

PP-144: Half-metallic behavior with high magnetic moment of half-Heusler alloys MCrPb (M = Hf, Zr): insights from DFT

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Half-Heusler alloys MCrPb (M = Hf, Zr) are studied utilizing the Full Potential-Linear Augmented Plane Wave (FP-LAPW) method as implemented in the WIEN2k code in the context of density functional theory (DFT). Both the alloys exhibit band gap in the up-spin states, while the down-spin states are conducting, revealing half-metallic nature of the alloys. The total magnetic moment is found to be around 4 μ_B, indicating that the alloys are ferromagnetic. The alloys overall electronic and optical characteristics support their potential for spintronics applications.

PP-145: Structural, electronic, magnetic and optical properties of full-Heusler alloy Zr_2NiB

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The structural, electronic, magnetic and optical properties of Zr based full-Heusler alloy Zr_2NiB was studied using the pin-polarized full- potential linearized augmented plane wave (FP-LAPW) method based on Density Functional Theory (DFT). The optimized lattice parameter was estimated to be 6.266 Å. Our study revel that for the alloy, both the spin up and spin down states are conducting, demonstrating the alloy o be in metallic nature. The total magnetic moment of this alloy is 0.99 μ_B, indicating the alloy is ferromagnetic. Optical properties such as dielectric tensor, reflectivity, refractivity, absorption coefficient, optical conductivity was also calculated.

PP-146: Enhancing the power conversation efficiency of Dye sensitized solar cells by using an alternative electrolyte to conventional Electrolyte

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Dye-sensitized solar cells are attractive as an alternative to conventional photovoltaic technology due to their low cost and eco-friendliness. The electrolyte is an important parameter of DSSCs and plays a significant role in the recombination of electrons inTiO_2 with I_3^-. In this study, (Br_3^-/I^-) and (I_3^-/I^-) have been used as electrolytes. As a sensitizer, dye extracted from pomegranate (Punica granatum) and teak leaves (Tectona grandis) have been used which was collected from local markets and gardens. To prepare photo anode, metal-oxide-semiconductor as TiO_2 nano paste (energy band gap with 3.2-3.35 eV) was coated on FTO glass substrate by using the doctor blade technique. The cells are fabricated as FTO/TiO_2/Dyes/electrolyte/Carbon/FTO. The synthesis of the TiO_2 paste was characterized by using XRD, SEM, UV–visible and FTIR analysis. The power conversion efficiency of the Dye-sensitized solar cells was determined by using a calibrated solar simulator with a 500W Xenon arc lamp and the light intensity was 100 mW/cm^2 in AM 1.5G. As a result of using (Br_3^-/I^-) with pomegranate (Punica granatum) and teak leaves (Tectona grandis) shows the power conversion efficiency 0.788% and 0.373%. On the other hand, using (I_3^-/I^-) with the same dye shows conversion efficiency of 0.255% and 0.108%. Comparatively, (Br_3^-/I^-) electrolyte improves the efficiency of power conversion by 209% and 245% more than the conventional electrolyte of (I_3^- /I^-) for the pomegranate (Punica Granatum) and teak leaf (Tectona grandis) dyes, respectively.

PP-147: Development of biocompatible hydrogel from natural polymers using electron beam technique

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Two sets of biocompatible hydrogels(soft and rigid lens) by electron beam irradiation were prepared by using HPC (Hydroxyl propyl cellulose), methacrylate monomers such as HEMA (2-hydroxyethyl methacrylate), MEMA (2-methoxyethyl methacrylate), X-22-164 a silicon-based monomer, KBM-1403 a silane coupling agent, and PEGDMA (polyethylene glycol dimethacrylate) (23G) as cross-linker. Physical properties like gel fraction, swelling degrees, and moisture contents of the hydrogels were investigated. ‘H’ and ‘HHG’ hydrogels had the highest and lowest values of the gel fraction and lowest and highest values of the

swelling degrees and moisture contents with the increase in the irradiation dose from 20 kGy to 30 kGy for the set-1 hydrogels and set-2 hydrogels from 10 kGy to 50 kGy. 'HKXGPR' and 'HHXGPR1 hydrogels had the highest and lowest values of gel fraction and lowest and highest values of swelling degrees and moisture contents. The mechanical property was investigated for two sets of hydrogels at an optimized dose of 20 kGy. This experiment revealed 'HHG' and 'H' hydrogels were the softest and rigid ones in the set-1. 'HHXGPR1' and 'HKXGPR' hydrogels were the softest and rigid ones in the set-2, respectively. FTIR analysis was done for both sets of hydrogels obtained at 20 kGy. The presence of polymer, monomer, and cross-linker were identified from characteristic peaks. As the results of the transparency test at 600 nm for both sets of hydrogels obtained at 20 kGy, 'HHG' and 'H' were the most and least transparent for the set-1 and 'HHXGPR1' and 'HKXGPR' were the most and least transparent for set-2, respectively.

PP-148: The simulation of heat wave events and construction of comfort index at Dhaka, Khulna, Jessore and Rajshahi using WRF-ARW models.

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High resolution Weather Research and Forecasting (WRF-ARW v4.12) model is used for the simulation of heat wave event which occurred during 24-27 April 2019. So, an attempt has been made for simulating the extreme temperature conditions over Bangladesh using WRF model and then an effort has been done to construct the Comfort Index (CI) by the Rayman model. National Centers for Environmental Prediction (NCAR) final reanalysis (FNL) data (1°×1°resolution) are used as initial and lateral boundary conditions (LBCs) which are updated at three hourly intervals. A single domain is used which is set up with 9 km horizontal resolution with a vertical level up to 100 hPa. The WRF model runs for 144, 120 and 96 hrs which are treated as 72, 48 and 24 hrs before the event using kesler microphysics (MP) schemes, YSU PBL schemes and Kain-Fritsch (KF) cumulus schemes. Physiological Equivalent Temperature (PET) is the human thermal comfort condition which is investigated at the extreme weather condition. To simulate Physiological Equivalent Temperature (PET), the primary meteorological parameters T2 (2-m air temperature), rh2 (2-m relative humidity), ws10 (wind speed at 10 m), SLP (sea level pressure) and FNL data are used. Survey is done for the stations Dhaka, Khulna, Jessore and Rajshahi division where the best result found. WRF model performance is very well to predict T2, RH2, SLP and ws10 values and Rayman model is good enough to compute CI.

PP-149: Instability of ion acoustic waves in irradiated streaming electronegative dusty plasma with dust charge fluctuation

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Dusty plasmas consists of micrometer or sub-micrometer sized solid particulates, which are either naturally growing in the ordinary ion-electron plasmas or can be inserted externally. The dust grains in plasmas are not neutral, but they are usually acquire negative or positive charge that depend on the various charging processes including plasma currents, photoelectric effects and secondary electron emission, etc. Electronegative dusty plasmas are composed of electrons, negative and positive ions, as well as dust grains. The understanding of electronegative dusty plasmas is important in various field such as industrial plasma processing and space environment. Many researchers studied the characteristics of ion-acoustic waves in electronegative dusty plasma using both fluid and kinetic theory. However, the effect of photoelectron current on the instability of ion-acoustic waves in irradiated, streaming and electronegative dusty plasma is not studied so far.

In this paper, the effects of photoelectron current on ion acoustic waves propagation in the irradiated streaming electronegative dusty plasmas with dust charge fluctuations have been investigated theoretically using fluid theory. In the presence of photoelectric effect, the dust charge fluctuations give instability of ion-acoustic waves i.e., the ion-acoustic waves grow with photon energy. The growth rates of ion-acoustic waves with both photoelectron and ion beam current are analyzed numerically using appropriate plasma parameters. Detailed derivation of the theory of ion-acoustic waves and results of the numerical analysis are given in the paper.

PP-150: Statistical Analysis of Long-term temperature trends in Bangladesh

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The monthly, seasonal and annual decadal trends of maximum temperature **(**T_{max}), minimum temperature **(**T_{min}) and average temperature (T_{ave}) during 1961-1990 and 1991-2020 were evaluated for 23 and 34 meteorological stations respectively all over Bangladesh using the trend free Pre-whitened non-parametric Mann-Kendall (MK) test. The magnitude of the trends was estimated using the Thiel-Sen slope estimator. The spatial distribution of monthly, seasonal and annual decadal trends of T_{max}, T_{min} and T_{ave} were plotted over Bangladesh Map using Surfer software. This distribution identifies the regional increasing and decreasing patterns of T_{max}, T_{min} and T_{ave} all over Bangladesh. The trends of T_{min} were increased in every month of the year at Dhaka, Cox's Bazar, Srimangal and Mymensingh during 1961-1990 and Dhaka, Cox's Bazar, Cumilla, Chattogram, Bogura and Rangpur stations during 1991-2020 and decreased at Rajshahi and Rangamati stations during 1961-1990. The trends of T_{max} were increased in every month of the year at Cox's Bazar and Hatiya during 1961-1990; Chandpur,

Hatiya, Khulna, Sandwip, Rangamati, Sylhet, Khepupara, Sitakunda and Teknaf stations during 1991-2020 and almost all the meteorological stations of Bangladesh during May to November. The trends of T_{ave} were increased in every month of the year and annual at Dhaka, Faridpur, Hatiya, Cox's Bazar and Bhola during 1961-1990; Dhaka, Faridpur, Hatiya, Cox's Bazar, Chattogram, Kutubdia, Patuakhali, Sitakunda, Rangamati, Cumilla, Chandpur and Sylhet station during 1991-2020.

The trends of T_{min} and T_{max} were increased in every season and annually at Dhaka, Chattogram, Cox's Bazar, Kutubdia, Chandpur, M. Court, Barishal, Srimangal, Saidpur and Sylhet during 1991-2020; T_{min} were increased at Cumilla, Mymensingh, Rajshahi, Rangpur, Dinajpur, Bogura, Satkhira and Ishwardi and T_{max} at Bhola, Khepupara, Patuakhali, Sitakunda, Rangamati, Teknaf, Hatiya, Sandwip, Feni, Khulna, Mongla, Faridpur, Tangail, stations during 1991-2020. The trends of T_{ave} were increased in winter, pre-monsoon, monsoon and post-monsoon season and annually at Dhaka, Faridpur, Bhola, Srimangal and Cox's Bazar stations during 1961-1990 and also 1991-2020. The highest increasing trends of T_{min} were 1.19°C/decade in November at Srimangal, 0.89°C/decade in December at Dhaka; highest increasing trends of T_{max} were 0.85, 0.75, 0.71 and 0.71°C/decade at Bogura, Bhola, Cox's Bazar and Dhaka in November respectively.

PP-151: Analysis of grain growth and reduction of porosity and functional properties of Mn substituted Ni-Cu-Zn nanocrystalline ferrites

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Nominal compositions of Mn Substituted $Ni_{0.50-x}Mn_xCu_{0.15}Zn_{0.35}Fe_2O_4$ with x = 0.00 to 0.25 in steps of 0.05 have been synthesized by Sol-gel Auto Combustion Technique and after making pellet and toroid shaped samples were sintered at various sintering temperatures. Phase formation and surface morphology were surveyed by the X-ray diffraction method (XRD) and field emission scanning electron microscopy (FESEM), respectively. Analyzing the XRD pattern it is observed that there are several significant intensity peaks, the position of the peaks comply with the cubic spinel structure where no traces of raw materials are obtained. Crystallite size is varied from 20-28 nm as well as average grain size is also varied from 69-126 μm with increasing Mn content. Bulk density increases while X-ray density decreases but porosity decreases with increasing Mn content where a small amount of Mn ions acts as a slight accelerator of grain growth and also favor densification. For increasing sintering temperature bulk density increases for all samples which contributes to the lessening of the material's porosity consequently enhances the magnetic induction of ferrite. The complex initial permeability graphs show that real part of initial permeability is increasing with the increase of Mn content in which maximum permeability (μ'_i =315) exhibits for Ni-Mn-CuZn ferrite when Ts =1300°C, interestingly which is 6.5 times greater than that of parent composition. The

magnetic hysteresis loop shows that with increasing Mn content saturation magnetization is increasing while coercivity is decreasing exhibits the soft magnetic materials.

PP-152: Instability of the dust-acoustic mode in irradiated collisional and streaming dusty plasmas with dust charge fluctuation

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Dusty plasmas consist of electrons, ions, highly charged and relatively massive dust grains and neutral particles. Dusty plasmas are present in the interstellar medium, planetary magnetospheres, ionospheres, etc. In such plasma, micron or sub-micron sized charged dust grains participate in the collective behavior of the plasma. Hence, the presence and the mobility of charged dust grains modify the existing plasma modes or may introduce new time and space scales leading to new modes, their instabilities and other related phenomena in the dusty plasmas.

In dusty plasmas, dust charge fluctuation occurs when the conditions in the plasma near the dust grains are changed due to variety of reasons, such as the wave motion. Photoelectric emission from the dust grains plays an important role in charging process in the irradiated natural as well as laboratory dusty plasmas.

In this paper, the photoelectric effect on the low frequency electrostatic dust acoustic (DA) mode, through dust charge fluctuation in dusty plasma has been investigated theoretically, assuming dust grains are negatively charged and ions and electrons are considered as a hot Boltzmann's gas at a finite temperature. Here, we use fluid model with considering lighter particles streaming in the presence of zero order electric field and collision between neutral and charged particles. It has been found that the DA mode become unstable due to dust charge fluctuation, streaming of lighter particles and the collision of the charged particles with the neutrals. It is also observed that the DA mode become unstable significantly due to photoelectric effect compared to the streaming and collisional effects.

The instability of the low frequency DA mode due to photoelectric effect make the dusty plasma unstable, i.e., plasma parameters such as plasma density and temperature are fluctuated. Hence, the formation of radar echoes in the polar mesosphere and communication of information from satellite to the Earth can be affected in the presence of intense solar radiation. It is thus concluded that the present study should be applied in understanding the photoelectric effect on the plasma properties in the irradiated space and laboratory dusty plasmas, such as the edge plasma of the fusion devises, etc.

PP-153: Study of structural, magnetic and electrical properties of Sm3+ substituted $Mn_{0.5}Cu_{0.2}Zn_{0.3}Fe_2O_4$

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This work is acquainted with the study of Samarium (Sm) doped Mn0.50Cu0.20Zn0.30Fe2-xSmxO4 (where x=0.00, 0.02, 0.04 and 0.06) prepared by solid state reaction method. The samples were pre-sintered at 800°C for 3h and sintered at 1200°C for 5h. The substitution of Sm for various ratio have remarkable effects on the structural, magnetic and electrical properties of Mn0.50Cu0.20Zn0.30Fe2O4. The phase identification has carries out by using X-ray diffraction (XRD). The XRD analysis revealed that undoped Mn0.50Cu0.20Zn0.30Fe2O4 shows formulation of cubic single phase (fcc) spinel structure without any impurity peak but other four Sm doped Mn0.50Cu0.20Zn0.30Fe2O4 show additional peaks manifested the formation of secondary phase presumably SmFeO3. The values of lattice parameter have the trend of decreasing with the increase of x. The bulk density also has a trend of decreasing with the increase of Sm content where the X-ray density increases. The magnetic properties were studied by investigating M-H curves that was obtained by vibrating sample magnetometer (VSM). The magnetic properties demonstrated a strong dependence of the variation of x. With the increase of x, saturation magnetization (Ms) decreases. The decrease of Ms with increasing of Sm substitutions has been explained as the effect of dilution of Fe magnetic moment by non - magnetic Sm.

PP-154: Crystallographic and Mechanical Features of Japanese Sword Prepared by TataraMethod

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Crystallographic and mechanical features of a Japanese sword (prototype) prepared by tataramethod were investigated by X-ray diffraction, Optical Microscopy, SEM-EBSD (Scanning Electron Microscopy with Electron Back Scattered Diffraction) and Vickers micro hardness studies. The X-ray diffraction study showed that the crystallographic structure of the sword was composed of martensite combinedwith a small fraction of retained austenite. The crystallographic parameters corresponding to martensite and austenite were determined by the WPPF (Whole Powder Pattern Fitting) analysis of X-ray diffraction data. EBSD studies showed good agreement with the X-ray data and revealed that the microstructure was martensitehaving the morphology of lath type. Vickers micro hardness study showed that the sharp edge of the sword is very hard and equivalent to that of high carbon steel. Present study revealed that the traditional method of preparation (tataramethod) offered the special characteristic features to the Japanese sword, unlike the ordinary steel.

PP-155: Investigation of the Structural & Magnetic Properties of Yttrium Substituted Co-Zn Ferrites for the Use of soft RE-ferrite material.

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The ferrite samples with composition $Co_{0.25}Zn_{0.75}Y_xFe_{2-x}O_4$ [where x = 0.00, 0.02, 0.04, 0.06 and 0.08]were prepared by standard solid-state reaction method to investigate it's structural and magnetic properties. The samples are pre-sintered at 850°C for 2 hours and sintered at 1100°C holding time 4hours.X-ray Diffractometer (XRD), Scanning Electron Microscope(SEM), and Vibrating Sample Magnetometer (VSM) are used to study the structural and magnetic properties of the specimens. XRD patterns showed that all the samples consisted of the single-phase cubic spinel structure with showing homogeneity at x=0.00**.** With incorporation of Yttrium ions (Y^{3+}) of x=0.02, 0.04, 0.06 and 0.08 orthoferrite phase was found. The microstructural analysis is done by Scanning Electron Microscopy (SEM). The SEM images showed that the sample exhibits uniform surface morphology with well-defined spherical grains. The characteristics of electromagnetism, excellent chemical stability, mechanical hardness, high coercivity, and moderate saturation magnetization have made RE Y^{3+} by Fe^{3+} ion replace Co-Zn ferrite a good candidate accumulated on the existing theories of magnetism to explain the suitable application of soft RE-ferrite material.

PP-156: Influence of Gd^{3+}Substitution onMicrostructural, Temperature Dependent Permeability and Electrical Properties of Mn-Ni-Zn Ferrites

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Microstructural, temperature dependent permeability, and electrical properties of various $Mn_{0.5}Ni_{0.1}Zn_{0.4}Gd_xFe_{2-x}O_4$ sintered at 1250ºC were investigated thoroughly. The samples were

synthesized by standard double sintering ceramic technique. The synthesized samples were characterized using various techniques. Temperature dependent permeability, electrical resistivity, dielectric loss factorand magnetic loss factor were measured using impedance spectroscopy. Microstructural analysis and phase identification were analyzed using field emission scanning electron microscope (FESEM) and X-ray diffractometer (XRD), respectively. The XRD patterns for all the samples confirm the formation of single phase spinel ferrite structure. FESEM micrographs show that the average grain size decreases with increasing Gd content. The bulk density and initial permeability show similar trend as average grain size with the variation of Gd content. The value of magnetic loss and dielectric loss are found to decrease with the substitution of Gd^{3+} for the frequencies greater than 0.54MHz and 10KHz, respectively.For Gd substituted compositions, the value of Néel temperature is observed to increase significantly, about 200ºC greater than that of the parent composition. It is found that the AC resistivity (ρ_{ac}) increases with the substitution of Gd^{3+} and the maximum value of ρ_{ac} is observed for the composition with x = 0.03, about 600 times higher than that of parent composition. Considering above facts these ferrites can be suitable for the applications in high-frequency microwave devices.

PP-157: Structural, electronic, magnetic and optical properties of full-Heusler alloy Zr_2NiB

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The structural, electronic, magnetic and optical properties of Zr based full-Heusler alloy Zr_2NiB was studied using the pin-polarized full- potential linearized augmented plane wave (FP-LAPW) method based on Density Functional Theory (DFT). The optimized lattice parameter was estimated to be 6.266 Å. Our study revel that for the alloy, both the spin up and spin down states are conducting, demonstrating the alloy o be in metallic nature. The total magnetic moment of this alloy is 0.99 μ_B, indicating the alloy is ferromagnetic. Optical properties such as dielectric tensor, reflectivity, refractivity, absorption coefficient,optical conductivity was also calculated.

PP-158: Internal Morphology Study of Madupur Clay BasedCox's Bazar Beach Sand and Minerals Incorporated Indigenous Radiation Shielding Composites by Thermal Neutron Imaging Using TRIGA Mark-II Research Reactor

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An attempt has been taken to study the internal morphology and radiation attenuation characterization of the fabricated indigenous shielding compositesby theinverted Neutron Imaging (NI) using the high penetrating behavior thermal neutron at 3MW TRIGA Mark-II research reactor. In this perspective, several locally developed composites were fabricated using Madupur clay as base matrix which was reinforced with the filler of Cox's Bazar beach sand (RBS)and beach minerals such as magnetite, Ilmenite (M-I) andinland sand (IS) which were compares with ordinary concrete (OC).The neutron imaging of the fabricated composites was illustrated by implementing Image J software for the stipulated region of interests (ROIs).The MI & RBS composites show uniformanddeep dark signals in neutron image (inverted) that indicates their homogeneity and highdensity along with the enhanced attenuation behavior. In contrast with that, the ordinary concrete has a mixture of deep dark and bright neutron image (inverted) with heterogeneous morphological structure. The chemical bonding of the cement ingredient makes the composite a moderate attenuation. The IS composite shows comparatively lower dark image than those of MI & RBS composites, which causes its lowest attenuation behavior among the studied composite materials.The ordinary concrete shows the fluctuating curves of gray values for various pixels (distance) at the stipulated ROIs which confirm the heterogeneous morphology of the ordinary concrete.The RBS and MI composites have shown the steady curves of gray values for the stipulated pixels at various ROIs which confirm the homogeneous morphology and fine grained structure of the prospective composites.The IS composite has shown thealmost steady curves of gray values for the stipulated pixels at various ROIs which indicates the nearly homogeneous morphology.The morphology study reveals that the finely structured clay based MI & RBS composites have lower gray values than that of ordinary concretes, which indicates the lower transmission and higher attenuation of the ionizing radiation.

PP-159: Investigating the Origins of Quantum Indeterminism

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The indeterministic nature of quantum mechanics has puzzled scientists for decades. In this paper we investigate the boundary at which determinism begins to fade. We analyse the quantum Venn diagram paradox and the Elitzur-Vaidman approach on interaction free measurement to understand how quantum particles exhibit their probabilistic nature. We study the relationship between Bell's theorem and the possibility of realism in quantum mechanics. Finally, we invoke Bell's theorem to explain the arguments supporting "no-hidden-variables"

theorems. Using this explanation we assess the search for hidden variables which is pivotal in understanding the intrinsic indeterminism of quantum particles.

PP-160: Numerical Studies of Plasma Emission in a Mega JoulePlasma Focus Device Using Lee Model Code

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Plasmaemission (bremsstrahlung radiation, line radiation and radiative recombination)in mega-joule plasma focus(PF1000) device are studiedusing Lee model code (version: RADPFV5.15) for nitrogen(N_2), oxygen(O_2) and argon(Ar) gases with pressure in the range of 0.05Torr to 4.5Torr. Ion density,plasma velocity, pinch temperature and peak current are also calculated for these gases. In this study, the computed maximum discharge currentsare:2262.4kAat 4.5Torr N_2,2264.8 kA at4.00Torr O_2 and 2255kA at 3.00Torr Ar. The optimum pressure point foreach type of plasma emissionof the used gases are found separately.The optimum pressure of N_2, O_2 and Ar gases are found to be for bremsstrahlung radiation 0.827 Torr, 0.567 Torr and 0.127 Torr whilst for radiative recombination 0.866 Torr, 0.567 Torrand 0.127 Torr, respectively.At optimum pressure, the computed line radiations of N_2 at 1 Torr, O_2 at 0.575 Torr and Ar at 0.127 Torr are 3872 J(91.3 % of total N_2XRs), 6232 J(84.48 % of total O_2 XRs) and 29576 J(97.27 % of totalAr XRs), respectively. In this study, we obtain the ion densitiesfor $N_2$12.23×10^{23} m^{-3} whilst for O_2 12.21×10^{23} m^{-3} and 76.06×10^{23} m^{-3} for Ar at their corresponding optimum pressure.It is found that the line radiation is predominant compared to bremsstrahlung radiation and radiative recombination. Significant correlation of plasma ion densities with the line radiations of the gases is found. Both line radiation and ion density is maximum for Ar compared to other two gases. Detailed discussion of the results is given in the paper.

PP-161: On Fuel Loading Strategy of BAEC TRIGA Research Reactor (BTRR)

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The TRIGA Mark II research reactor of Bangladesh Atomic Energy Commission (BAEC) has been operating since 1986 without any reshuffling or reloading yet. Optimum fuel burnup strategy has been investigated for the present BTRR core, where three out-to-in loading

schemes have been inspected in terms of core life extension, burnup economy and safety. In considering different schemes of fuel loading, optimization has been searched only varying the number of fuels discharged and loaded. Cost function has been defined and evaluated based on the calculated core life and fuel load and discharge. The optimum loading scheme has been identified for the TRIGA core, the outside-to-inside fuel loading with tens fuels for each cycle starting with five fuels for the first reload. The discharge burnup has been found ranging from 17% to 24% of U235 per fuel element for full power operation and optimum extension of core operating life is 100 MWD for each loading cycle. This study will contribute to the in-core fuel management of TRIGA reactor.

PP-162: Assessment of contamination level, pollution risk and source apportionment of heavy metals in the Halda River water, Bangladesh

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This study demonstrates the level of heavy metal pollution in the Halda River, the only natural breeding source of carps in Bangladesh. Water was collected from 12 different sampling points along the Halda River. Water at various locations was found satisfactory in terms of the assessed physicochemical parameters (pH, electrical conductivity, and total dissolved solids). The presence of various cations and anions was also studied using ion chromatography. Atomic absorption spectroscopy was used to identify and quantify various heavy metals in the collected water samples. Among the heavy metals, Cd, Cr, Fe, Pb, Cu, and As concentration exceeded the safe limit suggested by WHO. The calculated heavy metal pollution index and metal index were found higher than the critical index value. The single-factor assessment (P i) and Nemerow's multi-factor index (P N) of heavy metals was calculated to find out the degree of pollution in the Halda River. The maximum values of P i (Cd), P i (Pb), P i (As), P i (Cu), and P i (Cr) were determined to be 26.67, 260.00, 17.00, 208.76 and 2.80 respectively. The maximum value of P N was found to be 289.04. The discharge of effluents from various large and small industries near the Halda River is considered to be the major source of the identified heavy metals. Multivariate statistical analysis such as principal component analysis, Pearson correlation matrix and cluster analysis revealed that most of the heavy metals originated from different anthropogenic sources. Multivariate analysis also showed that Co, Mn, Cu, Cr, Pb, Cd, NH4 þ, NO3 - mainly came from artificial sources whereas Fe, Ca, As mainly originated from natural sources. Arsenic (As) also came from artificial sources with Cu

PP-163: Synthesis and Investigation of Structural and Dielectric Properties of Samarium and Chromium Co-doped Bismuth Ferrite ($Bi_{0.90}Sm_{0.10}Fe_{1-x}Cr_xO_3$)

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Samarium (Sm) and Chromium (Cr)-doped multiferroic bismuth ferrite $Bi_{0.9}Sm_{0.1}Fe_{1-x}Cr_xO_3$ (x = 0.00 to 0.10) ceramics were synthesized by solid-state reaction method at a sintering temperature of 850 °C. X-ray diffraction (XRD) tool confirmed the hexagonal crystal structure of Sm doped BFO and Sm and Cr co-doped BFO. Some impurity peaks like $Bi_2Fe_4O_9$and $Bi_{25}FeO_{39}$have appeared whose might be caused by sintering temperature. Crystallite size was calculated using the Scherrer formula and found at a range of 55-65 nm. Gold Schmidt's tolerance factor of these compounds was calculated from 0.838 to 0.839. The increasing fashion of tolerance factor indicates the change in stiffness of Bi^{3+} - O^{2-} the bond that distorted $BiFeO_3$ lattice. The lattice parameter a and c both decreased with Cr content indicating increasing lattice strain on the unit cell. The values of lattice parameters are a = b = 5.5554 Å to 5.5353Å and c = 13.7643 Å to 13.6641 Å that were nearly equal to the lattice parameter of BFO. X-ray density gradually increases and it is much higher than the theoretical density that confirmed the pores in these compounds. In the low-frequency region, the dielectric constant (ε′) shows a maximum decrease up 8 kHz frequency then the ε′ become independent of frequency. 5% Cr doped compound shows maximum dielectric constant and minimum imaginary part. Increasing trend of quality factor and decreasing trend of loss factor with increasing of frequency showing the good dielectric characteristics of the compounds. At low frequency, the conductivity of these compounds is independent of frequency that means dc conductivity is too small and at high frequency the value of the conductivity is high. 5% Cr doped compound possesses good multiferroic properties that can be used in multistate memory devices.

PP-164: Preparation and Study of Structural and Electrical Properties of Vanadium Doped-Bismuth Europium Ferrite ($Bi_{0.90}Eu_{0.10}Fe_{1-x}V_xO_3$) for Multiferroic Applications

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The crystal structure of natural multiferroic material ($BiFeO_3$) is modified by doping rare earth (Eu) and transitional metal (V) elements. Polycrystalline $Bi_{0.90}Eu_{0.10}Fe_{1-x}V_xO_3$ (x = 0.00 to 0.10) ceramics were synthesised by solid-state reaction method using 850 °C sintering

temperature. Structural and electrical characterizationswere done using X-ray diffraction (XRD) and impedance analyzer.XRD peak position revealed that all the samples possesshexagonal crystal structures with some impurity peaks. To observe the structural deformation c/a was determined. Crystallite size wasfound at a range of 33 nm to 65nm using Scherrer formula.Gold Schmidt's tolerance factor of the samples was found0.8436 to 0.8478 which represents more stability of the doped BFO than pristine BFO.Theoretical density gradually increases and it is much higher than bulk density that confirmed the pores in the samples. In the low-frequency region, the dielectric constant (ε′) shows a maximum decrease up to 8 kHz frequency then the ε′ become independent of frequency. 10% V doped compound shows maximum dielectric constant that is the optimum composition.At low frequency, the conductivity of the samples is independent of frequency that means dc conductivity is too small and at high frequency the value of the conductivity is high.It is summaries that doped BFO samples are a good candidate for application in sensors, magnetic tannable filters, multistate memory devices and capacitors.

PP-165: In-core fuel management of TRIGA reactor optimizing performance and safety

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TRIGA Mark II research reactor is under operation in Bangladesh since 1986 and postponed radioisotope production in 2008. The possibility to extend the length of operation cycle of the reactor core by compacting the inner region with fuels replacing the graphite elements has been investigated. This leads to the increment of core excess reactivity at the expense of reactor performance. And confirmation of the safety has been demonstrated by nucleate boiling analysis. The result finds promising invitation for the future analysis with explicit thermal hydraulic safety calculation for the compact core configuration of the reactor.

PP-166: Development and Characterisation of Cellulose Based Food Package Coated with Chitosan and Containing TiO_2 and Ag/TiO_2 Nanoparticles

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The study was carried out to develop a biodegradable packaging material for food packaging. Cellulose-basedpapers deep coated in chitosan (P-CS), chitosan-TiO_2 (P-CS-TiO_2) and chitosan-Ag/TiO_2 (P-CS-Ag/TiO_2), respectively were real-time aged for 4 months at 25˚C, 55% relative humidity, 15h light/9h dark cycle and characterized in relation to plain paper (P). Physicochemical properties were observed before and after ageing. The reduction in the chitosan crystallinity, N-deacetylation of chitosan and loss in the active agents (proven by SEM, FTIR, EDX techniques and physical-chemical-microbial measurements) occurred during ageing explains the deterioration of the barrier and antimicrobial properties of the active papers and subsequently the decrease in their preservation efficiency. During the study Ag/TiO_2nanocomposite was synthesized and using TEM technique the size of Ag nanoparticle was measured in 20 nm scale and shows excellent crystallinity. Compared with the uncoated paper the pores of the cellulose paper was filled finely after coating which is important for improving barrier properties of a package. SEM image showed that the surface of the paper was smooth, glossy and nothing unusual was observed and the molecular composition of all materials in packages were uniform. From the FTIR spectra, N-acetylation of paper during ageing was observed and the chitosan was not fully deacetylated. Photocatalytic activity of active paper were evaluated by decomposition rate of Methyl Orange using UV-Vis spectrophotometer. Experimental results indicate that before and after ageing for 4 months the most effective package was P-CS-Ag/$TiO_2$for which exhibits the highest levels of photocatalytic activity (20% degradation) andshowed highest inhibition zoneagainst E. coli (9.47 mm).

PP-167: Commissioning of Co-60 teletherapy machine at SSDL, Bangladesh: Verification and measurements of imperative machine parameters during installation

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IAEA Technical Report Series (TRS)-398 is acode of practice that fulfils the need for a systematic and internationally unified approach to the calibration of ionization chambers in terms of absorbed dose to water. In ICRU Report 24 the need for an accuracy of ± 5% or even closer limits in the delivery of an absorbed dose to a target volume is mentioned for the eradication of a primary tumor. Secondary Standard Dosimetry Laboratory (SSDL) should facilitate with highest possible standard equipments to offer the reducing of uncertainty in the dosimetry of radiotherapy beams. The focus of this study was to investigate the limits of tolerance in mechanical and dose values and evaluation of beam check parameters of a newly installed Co-60 teletherapy machine (Theratron Equinox100#2149, Initial Activity: 12000 Ci) at SSDL, Bangladesh.In the commissioning process, accuracy of some particular mechanical parameters such as optical indicator, gantry indicator, collimator angle indicator, field sizes as well as some dosimetric parameters such as absorbed dose to water, Percentage Depth Dose (PDD), beam profile etc. were determined for different filed sizes.IAEA water phantom,

CNMC 2D water phantom, IBA FC65-G Farmer chamber, IBA Dose 1 Electrometer etc. were used in thismeasurement.Checking of some functional parameters to ensure operational safetyand area radiation monitoring around the facility was also performed to ensure compliance with regulatory dose limits. The deviation of all mechanical parameters was found in good agreement with IAEA recommendations. The absorbed dose rate at reference field size (10×10 cm^2)was found 1.548 Gy/min with an uncertainty of ±0.020, the pattern of change in amount of output doseswith increasing field sizes (from 5×5 cm^2 to 15×15 cm^2)was achieved as per expectation.A deviation of 1.0 mm between measured and expected depth for maximum dose was found for different field sizes that might be occurred because of the uncertainty of effective volume of the ionization chamber.Beam profiles showed slight asymmetry in respect to the central axis. In radiation area monitoring around the facility, all values were measured within acceptable limits. On the basis of evaluation of all measured data it can be deduced that the installed Co-60 teletherapymachine can ensure the Quality Assurance and Quality Control of radiotherapy machines in countrywide radiotherapy centers.

PP-168: Design and Development of an Industrial Chiller for Heat Removal in Process Plant Operations

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Heat removal from many process plant operations is necessary to obtain proper product quality or for achieving required process conditions. In regular laboratory works often huge amount of valuable water is wasted for cooling where the water is not recycled. Heat removal and saving of resources during process operation holds considerable importance. According to the objective of a R&D project to design and calculate parameters for a cooling unit various cooling tower, industrial chiller models were studied. Amidst the Numerous options and custom design solutions to meet a wide range of process cooling needs an industrial chiller model was selected for the project. Industrial chillers are classified as a refrigeration system that cools a process fluid or dehumidifies air in commercial and industrial facilities. The refrigeration cycle contains four major components: the compressor, condenser, expansion device, and evaporator. Refrigerant remains piped between these four components and is contained in the refrigerant loop. After selection of the model the basic four components and their parts were collected, fabricated and assembled following design needs. For better performance and control a temperature controller on the unit was installed so that if a desired water temperature is set, then it will heat or cool as necessary to maintain that temperature.

PP-169: Investigation of the structural, electrical and temperature dependent magnetic properties of$(Fe_{90}Cu_{10})_{75}P_{15}C_{10}$ribbon

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Structural, transport, and electro-magnetic properties of Melt spun $(Fe_{90}Cu_{10})_{75}P_{15}C_{10}$ amorphous ribbon were studied. Large and broaden peaks observed in X-ray diffraction (XRD) spectrum confirms that amorphous structure of the as prepared sample. The samples were annealed at 430°C, 450°C, 470°C and 490°C temperatures respectively for 30 minutes and then analyzed by XRD to explore the re-crystallization phenomenon of the alloy. XRD data revealed that the samples showed amorphous behaviorat 430°C annealing temperature and exhibited crystallizationfrom 450°C annealing temperature. DTA curves show that this sample contains an exothermic peak at 448°C. The resistivity of the as-prepared sample decreases from room temperature (300K) to liquid nitrogen temperature (77K). The grain size of the compound increases withthe annealing temperatures.

PP-170: Structure, Surface Morphology and Magnetic Properties of Cu^{2+} ion Substituted Ni-Co ferrites

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Spinel types polycrystalline $Ni_{0.5}Co_{0.5-x}Cu_xFe_2O_4$ with composition x = 0.0, 0.1, 0.2, 0.3, 0.4 and 0.5 were synthesized by Solid State Reaction Method followed with sintered at 1200^{o}C for 3 hours. The samples were characterized by XRD, SEM and VSM utilized in order to investigate the effect of Cu^{2+} ions and impact on the crystal structure, grain size, microstructure and magnetic properties of Cu based Ni-Co ferrites. XRD of this samples indicated single phase cubic spinel structure without any detectable impurity phases. SEM studies revealed crystalline nature of this ferrites and using linear intercept method calculate grain size. The microstructures of Cu ions substituted Ni-Co ferrites show that grain growth is greatly enhanced is attributed to the liquid phase due to CuO and sintering temperature and grain size at optimized position. Magnetic hysteresis parameter was measured by VSM at room temperature. All this ferrites show lower coercivity which indicated experimental materials are class of soft nature magnetic materials and an influence of Cu^{2+} ions on the structure and magnetic properties observed.

PP-171: Structure, Dielectric and Magnetic Transport Properties of Rare Earth Y^{3+} Doped Mn-Zn Ferrites

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A series of Y substituted for Fe in Mn-Zn ferrites with composition $Mn_{0.5}Zn_{0.5}Y_xFe_{2-x}O_4$ where x = 0.00, 0.02, 0.4, 0.06, 0.08 and 0.1 were prepared by solid state reaction technique sintered at 1200^{o}C with holding time 2 hours. XRD analysis revealed that rare earth free Mn-Zn ferrite shows single phase cubic spinel structure but Y substituted Fe in Mn-Zn ferrites show additional peaks formation of secondary phase presumable $YFeO_3$. SEM was observed that the average grain size decreases monotonically with increasing Y^{3+} ions in Mn-Zn ferrites. Magnetic hysteresis parameter was measured by VSM at room temperature and saturation magnetization decreases with increasing nonmagnetic Y ion as the effect of dilution of Fe^{3+} ions magnetic moment. The Dc resistivity measured by two probe method of electrometer and decreased nature with increasing temperature manifesting semiconducting nature of Y doped Mn-Zn ferrites. The Dielectric constant as a function frequency measured by LCR meter and is found to decreases continuously with increasing lower frequency range but remain almost constant at higher frequency range. The local displacements of electrons which in turn gives dielectric constants due to arises dielectric polarization and conduction process.

PP-172: Biosorption of heavy metals (zinc and lead) by tea leaves

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Heavy metals are elements whose density is equal to or greater than 6.0 g/cm^{3}eg. Lead (Pb), mercury (Hg), cadmium (Cd) and zinc (Zn). Heavy metals generally posemany problems to mankind.We chose to explore the suitability of tea leaves as an adsorbent for the removal of heavy metals from aqueous solutions.This process will be carried out as a function of contact time, initial metal ion concentration, biosorbent dosage and pseudo first and second order models separately carried out on tea leaves and tea fibres.Tea leaves samples of different ages will be taken from different regions of Bangladesh at various latitudes and longitudes. Stock solutions will be prepared of 0.1M of lead (II) nitrate ($Pb(NO_3)_2$) and 0.1M of Zn. Then 5 different concentrations of Pb^{2+} and Zn solutions will be prepared (0.02M, 0.04M, 0.06M, 0.08M and 0.1M). The solutions with different concentrations and bio-sorbent materials of different weights (2 g, 4 g, 6 g and 8g) will be put into orbital shaker at different temperatures (between 30^{0}C-60^{0}C) for different time periods. Thesolutions will be filtered by Whatman filter paper and the concentrations of resulting filtrate will be determined using AAS(Atomic Absorption Spectrometer). This study will evaluate the performance of Camellia sinensis biomass as an adsorbent in the removal of lead and zinc from a contaminated aqueous phase

or solution.Thus tea leaves can be an important aspect to save the environment by reducing the amount of heavy metals.

PP-173: Thyroid Uptake of Tc-99m for Evaluation of hyperthyroid function and its comparison with I-131

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Presently it has been proven that taking thyroid using Tc-99m Pertechnetate is more convenient than I-131 iodide because of their improved image quality, fast in process, short half-life (only 6 hours), short biological and effective half-life, short retention in gland, and no Beta (β-) radiation. Also providing low dose to gland (10,000 times less than that of I-131), low cost, and readily availability, and the images have better quality for its gamma photon of 140keV, and the patient is given a lower radiation dose. On the other hand, I-131 with its high radiation burden (1-3 rad/mCi) has long half-life and causes Beta (β-) particle emission. Its main gamma photon has high energy (364 keV) which also causes poor image quality. This study had the aim of standardizing a simple and fast method for performing thyroid uptake and hence to identify which one is better for thyroid treatment by taking correlation between Tc-99m & I-131. The study was made for 110 patients (74 female and 36 male) with ages ranging from 14 to 75 years (mean of 39.2 years) were done with both Tc-99m and I-131. There were different type of patients like euthyroid, hyperthyroid and hypothyroid. The correlation between Tc-99m and I-131 was studied only for hyperthyroid patients. The results showed that 63 patients were positive with both Tc-99m and I-131 (true positive). 6 patients had negative results with Tc-99m and positive results with I-131 (false negative). Only 3 patients were positive with Tc-99m in the neck but negative with I-131 (false positive). Considering I-131 imaging as the gold-standard procedure, Tc-99m had a correlation of 91.30% for the detection of hyperthyroidism with I-131. The average uptake values for hyperthyroid patients are 51.77% and 7.27% using I-131 & Tc-99m respectively. However, to get better correlation; further study should be needed with more patients.

PP-174: Change of Temperature at different Meteorological Stations over Bangladesh during 1961-1990 and 1991-2020

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Climate change is observed globally and this also significant in Bangladesh. In the present study the change of monthly and annual maximum temperature, minimum temperature and average temperature were investigated at 23 meteorological stations all over Bangladesh during 1961-1990 and 1991-2020. In this research how much maximum, minimum and average temperature were changed during the later period have identified. The decrease of minimum temperature was found in the west, southwest southeast and southern region of the country in January and in every month at Rangamati and Sandwip stations. The minimum temperature was found to increase almost all the stations except Rangamati and Sandwip in all the months except January. The increase of minimum temperature was found maximum at Dhaka, Rangpur, Ishwardi, Sylhet, Bogura, Mymensingh, Chandpur, Chattogram, Cumilla, Dinajpur and Faridpur during 1991-2020 in February. The annual increase of minimum temperature was significantly higher at Dhaka, Sylhet and Rangpur region and maximum temperature in the south-southeastern and northeastern region of the country. The maximum temperature was decreased in the central to north, northwest and western region and increased in the south southeastern region of the country during January to April. In the months of June, July, August, September and October, the maximum temperature was found to increase all over Bangladesh. The highest increase of minimum temperature was found 1.73°C in March at Rangpur and maximum temperature 1.62°C in April at Cox's Bazar. The highest decrease of minimum and maximum temperature was found -2.48 and -1.62°C at Rangamati and Dinajpur respectively in January. The highest annual decrease of minimum temperature was found -0.94°C at Rangamati and increase of maximum temperature was 1.36°C Cox's Bazar.

PP-175: Prediction of lightning Activity over Bangladesh Based on diagnostic and Explicit Lightning Parametrizations of WRF Model.

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Lightning discharge from thunderstorms is a major weather hazard. In Bangladesh, the loss of lives and properties caused by lightning is high due to frequent lightning activity in the pre-monsoon season (March-May). In this study, numerical simulations in predicting the lightning flashes using diagnostic and explicit lightning parametrization options in WRF (Weather Research Forecasting) model are performed over Bangladesh for three selected pre-monsoon lightning events (12 May 2021, 16 May 2021 and 20 May 2021). WRF model sensitivity for six microphysics and three cumulus schemes are also investigated in this work. The combination of NSSL 2+CCN and Grell 3D is found to be the best configuration by comparing the RMSE (Root Mean Square Error) of rainfall and spatial distribution of model simulated reflectivity at 3 hours interval. The lightning flash counts are estimated by using five different (four diagnostic and one explicit) methods: (1) PR92 (Price and Rind, 1992) based on maximum w (updraft), (2) PR92 based on 20 dBZ top, (3) PR92 based on level of neutral

buoyancy from convective parametrization, (4) LPI (Lightning Potential Index) based on cloud hydrometeors and updraft and (5) an explicit, physics-based method from cloud electrification referred to as WRF-Elec. The NASA LIS (Lightning Imaging Sensor) observation is used to compare the simulated lightning flashes for the three events. The maximum reflectivity and 24-hour accumulated rainfall are also analyzed and the results show good consistency with the observations. Evaluations based on the performance diagrams are carried out for a better understanding of how model simulations perform on forecasting precipitation. In qualitative assessment framework, the spatial patterns of WRF-Elec-based simulations of lightning flashes to predict the primary regions of lightning occurrence exhibit good agreement with observations in most of the studied cases. The simulations based on LPI have performed considerably well. The findings of this research highlight the execution of an effective operational lightning prediction system to reduce lightning-related losses in Bangladesh.

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