UNIVERSITI MALAYSIA KELANTAN

THE MALAYSIAN SOLID STATE SCIENCE AND TECHNOLOGY SOCIETY
MASS

2022 RCSST

CONFERENCE PROGRAMME BOOK

31ST REGIONAL CONFERENCE ON SOLID STATE SCIENCE AND TECHNOLOGY (RCSSST 2022)

"Emerging solid state science and technology for global sustainability"

06th - 08th September 2022.
Kota Bharu, Kelantan, Malaysia

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CONFERENCE PROGRAMME BOOK

31st Regional Conference on Solid-State Science & Technology (RCSSST 2022)

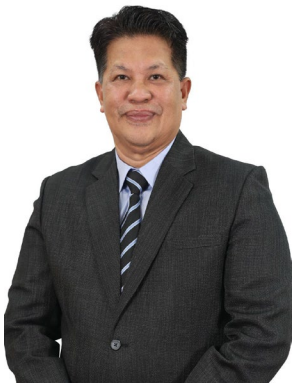
6th - 8th September 2022.
Kota Bharu, Kelantan, Malaysia

Editors:

Siti Roshayu binti Hassan
Nadiah bte Ameram
Nik Alnur Auli binti Nik Yusuf

MESSAGE FROM THE PATRON OF RCSSST 2022

Assalamu'alaikum, Salam Sejahtera and Greetings to all attendees,



I am delighted to welcome all of you to the 31st Regional Conference on Solid State Science and Technology (RCSSST) 2022. On behalf of Universiti Malaysia Kelantan (UMK), I would like to express my deepest appreciation for your presence in this impactful conference. Welcome as well to the state of Kelantan, famed for its unique history, cultural diversity, white sandy beaches and lush flora and fauna.

This conference aims to facilitate the exchange of information and knowledge between research institutions and the industry, as well as showcasing recent materials research innovations, encouraging the cultivation of new ideas and foreseeing future trends in materials engineering, science and technology, and any progress that is solid state science and technology in all aspects of physical and chemical properties. Thus, it is fitting that the theme of this year's conference is "Emerging solid-state science and technology for global sustainability".

I am sure that your presence and participation will help contribute to a successful and impactful RCSSST 2022. With that, I would like to thank the participants, along with the members of RCSSST 2022 organizing committee, reviewers, sponsors, exhibitors and other contributing parties, for making this conference a reality. Not to forget, my heartfelt thanks also go to MASS for presenting UMK with the chance to organize this great event. I wish all a pleasant experience in Kota Bharu, Kelantan, and a wonderful RCSSST 2022.

Thank you.

YBHG. PROF. DR. RAZLI BIN CHE RAZA
VICE-CHANCELLOR
UNIVERSITI MALAYSIA KELANTAN

MESSAGE FROM THE PRESIDENT OF MASS MALAYSIA 2022

Assalamualaikum, Salam Sejahtera and a very good day,

Dear delegates of RCSSST 2022,

As the Chairman of the Malaysian Solid-State Science and Technology Society (MASS), it is an honor to warmly welcome all delegates and participants to this 31st Regional Conference on Solid State Science and Technology (RCSSST) 2022. On behalf of MASS, it is a great pleasure to formally express our gratitude to the Faculty of Bioengineering & Technology (FBKT), Universiti Malaysia Kelantan, for organizing this conference in collaboration with MASS.

The Regional Conference on Solid State Science and Technology (RCSSST) is a biennial event in Malaysia. This year, Universiti Malaysia Kelantan has pledged to host the conference, for the first time, in this warm and friendly city, Kota Bharu, Kelantan. During this meeting, all aspects of preparation and characterization techniques, physical, optical and chemical properties, related to solid state science and technology will be discussed and highlighted.

Solid State Technologies are indeed the most important field not only for physical sciences especially for materials engineering but also for the medical field. Therefore, a conference such as RCSSST 2022 is very timely to assess the current development and recent innovation, and to introduce new ideas on the development and future trends in the applications of these techniques. RCSSST 2022 should serve as an excellent platform to deliberate research output that could be utilized and innovated in future applications in both the academia and industrial world. I am sure that each one of you will identify subjects of your interest and will benefit from many fruitful and enriching discussions which finally lead to a healthy scientific networking and collaborations.

I would like to take this opportunity to once again thank the organizers from both FBKT and MASS, specifically to all organizing committee members, MASS executive committee members, who have given their full commitment to ensure the success of this conference. In addition, I would also like to express utmost gratitude to our sponsors and exhibitors for their contributions that have facilitated the smooth running of this conference. Finally, to all delegates, the keynote speaker, plenary speakers, invited speakers, oral and poster presenters, who are here to make this conference a success, I wish you a great experience in Kota Bharu and have a pleasant and fruitful conference at the RCSSST 2022.

PROF. DR. ABDUL HALIM SHAARI, FASc, FMASS, FIFM
PRESIDENT,
MASS MALAYSIA

MESSAGE FROM THE CHAIRMAN OF RCSSST 2022

Assalamualaikum, Salam Sejahtera and very good day,

I am pleased to welcome you to the 31st Regional Conference on Solid State Science and Technology (RCSSST) 2022 which will take place in the beautiful scenery of Kota Bharu, Kelantan on 06th to 08th September 2022. It has been a great privilege and honor to serve as the Chairman of this conference. This conference is jointly organized by the Faculty of Bioengineering and Technology, Universiti Malaysia Kelantan (UMK) as the host, in cooperation with the Malaysian Solid-State Science and Technology Society (MASS). Other institutions also greatly support this conference which are Universiti Teknologi Mara (UiTM), Universiti Kebangsaan Malaysia (UKM), Universiti Pertahanan Malaysia (UPNM) and Universiti Putra Malaysia (UPM). As we can see, great numbers of participants came from these institutions.

My deepest gratitude goes to our Silver sponsor by Bruker and Novatiq. Last but not least, I would like to thank all the members of RCSSST 2022 organizing committee and MASS committee members who have worked tirelessly in this conference.

I am confident that RCSSST 2022 will be an excellent opportunity to exchange views in emerging solid-state science and technology for global sustainability. Furthermore, RCSSST 2022 will offer plenty of networking prospects, providing you with the opportunity to meet and interact with the leading scientists and researchers, friends and colleagues as well as sponsors and exhibitors.

RCSSST 2022 will be conducted in hybrid mode with 187 oral presenters and 43 E-poster presenters. This conference is further enriched by one keynote speech and 12 invited talks and complemented by a high-quality workshop on 06th September 2022.

I hope RCSSST 2022 will be a stimulating week of insightful presentations, fruitful discussions, and sharing of technical ideas with colleagues from around the world. I would like to thank you for your support and your attendance, and wish you enjoy your visit to Kelantan, Malaysia.

ChM. TS. DR. NOR HAKIMIN BIN ABDULLAH
Chairman,
RCSSST 2022

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(Faculty of Plantation and Agrotechnology, Universiti Teknologi Mara, UITM)

Prof. Dr. Abdul Razak Ibrahim
(School of Physics, Universito Sains Malaysia, USM)

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1030 - 1100	**Workshop 1 Bruker (Online)** **Dr Lin, Wen-Jih (Wayne)** *(Business Development Manager, Thin Film Application, Bruker AXS)* Title : 'Advanced X-Ray Diffraction Studies of Thin Film Materials'	Zoom
1100 - 1130	**Workshop 2 Novatiq** (Online) **Mr. Chok Xun Hao** Title: Field-free Analytical UHR SEM for Materials Characterization at the Nanoscale	Zoom
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	Electrical Performance of Proton Ceramics Fuel Cells at Intermediate Temperature: AN Overview	
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0930 - 1000	**Plenary Talk 5 Novatiq (Recorded VDO)** **Mr. Petr Klimek** Title: Efficient Analytical Workflows with TESCAN's Scanning Electron Microscopes	Ballroom
1000 - 1030	**Plenary Talk 6** **Prof. Ir. Ts. Dr. Julie Juliewatty Binti Mohamed** *Universiti Malaysia Kelantan* $CaCu_3Ti_4O_{12}$ Electroceramic for Capacitor Applications: Trends and Challenges	Ballroom
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7 SEPTEMBER 2022

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0930 – 1000	**Plenary Talk 5** **Speaker: Petr Klimek** Title: Efficient Analytical Workflows with TESCAN's Scanning Electron Microscopes (Recorded VOD)			
1000 - 1030	**Plenary Talk 6** **Prof. Ir. Ts. Dr. Julie Juliewatty Binti Mohamed** *Universiti Malaysia Kelantan* $CaCu_3Ti_4O_{12}$ Electroceramic for Capacitor Applications: Trends and Challenges			
Theme	**Materials & Energy**	**Metals and Alloys**	**Ceramics and Glasses**	**Electrochemical and Solid State** **Defence and Security** **Devices and Materials for Biology and Medicine**
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1230 – 12450	**UITM028** **Nur Ain Nabilah Binti Mohamad Nor** *Universiti Teknologi MARA* Hubbard U Approach on Structural, Electronic and Optical Properties of Kesterite and Stannite Cu2MnSnS4 from First-Principles Study	**UMT007** **Nor Azlia Binti Aziz** *Universiti Malaysia Terengganu* Crystalline Structure, Optical Properties and Surface Morphology of CdS Photocatalyst Synthesized Via Precipitation for Water Remediation of Aqueous Rhodamine 6G	**UKM009** **Nur Jannah Binti Md Hassan** Universiti Kebangsaan Malaysia The Effect of Sodium Alginate on Properties of Sodium Carboxymetyl cellulose (NaCMC)/ Hydroxyethyl cellulose (HEC) membrane As a Bio-Based Plastic Mulch For Agriculture Application	**UPNM006** **Intan Juliana Binti Shamsudin (Dr.)** *Universiti Pertahanan Nasional Malaysia* Biopolymer Electrolyte Host Based on Newly Synthesized Benzoyl Kappa Carrageena
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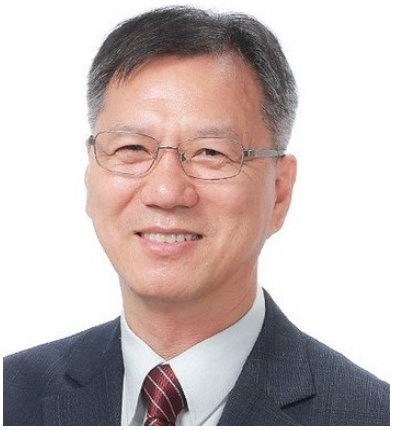
1400 – 1415		**Kijang 1** **Chairperson: Dr. Hidayani Binti Jaafar (UMK)** **Co-chairperson: Dr. Mohamad Bashree bin Abu Bakar (UMK)**	**Kijang 2** **Chairperson: Dr. Nabilah Afiqah Mohd Radzuan (UKM)** **Co-chairperson: Dr. Siti Roshayu binti Hassan (UMK)**	**Kijang 3** **Chairperson: Assoc. Prof. Dr. Yap Wing Fen (UPM)** **Co-chairperson: Nur Ain Najihah binti Muhamad Darus (UTM)**

1400 - 1430		**Invited Speaker:** **Muhammad Azwadi Sulaiman (Assoc.Prof. Dr.)** *Universiti Malaysia Kelantan* Synthesis of Advanced Ceramic Using Microwave Sintering Method	**UPNM001** **Norli binti Abdullah (Assoc. Prof. Dr.)** *Universiti Pertahanan Nasional Malaysia* Effect of Acid Treatments and Surfactant on MWCNTs Nanofluids: Structural, Morphological and Thermal Conductivity	**Invited Speaker** **Roslan Abd Shukor (Prof. Dr.)** *Universiti Kebangsaan Malaysia* Metal Sulfide Effects on AC Susceptibility and Electrical Properties of Bi1.6Pb0.4Sr2CaCu2O8 Superconductor
1430 - 1445		**UNMP002** **Abdullah bin Abdul Samat (Dr.)** *Universiti Malaysia Perlis* Thermal Decomposition, Phase Formation and Microstructure Analysis of Carbon Nanotubes Assisted Sol-Gel Derived La0.6Sr0.4CoO3-δ Materials	**UPM007** **Syazwan Afif Mohd Zobir (Dr.)** *Universiti Putra Malaysia* Nitrogen/Phosphorus-Doped Carbon Quantum Dots Synthesized using Chitosan/Hydrothermal Method for Plant Protection	**USU001** **Syahrul Humaidi (Dr.)** *Universiti Sumatera Utara* Superconductivity in Tl2-xTexBa2 CaCu2O8-δ prepared using different precursor powders
1445 - 1500		**OTRS007** **Siti Noorazidah Binti Mohd Sabri** *Department of Mineral & Geoscience Malaysia* Synthesis of Precipitated Calcium Carbonate (PCC) as the Function of Carbon Dioxide Gas Flow Rate	**UITM043** **Azra Umairah Binti Anuar** *Universiti Teknologi MARA* Structural and Morphological Properties of Graphene Oxide from Regenerated Carbon Black (rCB) of Waste Tyre	**UMP005** **Bryan Andrew Balasan** *Universiti Malaysia Pahang* Current Density and Activation Energy of Bi-2223 Superconductors Synthesised Via Electrospinning
1500 - 1515		**UITM033** **Muhammad Aman Haikal Bin Razali** *Universiti Tekonologi MARA* First Principles Study of the Structural and Electronic Properties of Ag-Doped ZnO by using DFT and DFT+U	**UPM004** **Loh Zhi Wei** *Universiti Putra Malaysia* Mechanical Properties of Bioactive Glass with various CaF2/P2O5 ratios	**IIC001** **Choon Min Cheong (Dr.)** *Imperium International College* Charge Distribution Study oF Ce0.8Sr0.2NiO2

1515 - 1530	[redacted]	**UMK029** **Wan Hazwani Binti Wan Mohd Fakri** *Universiti Malaysia Kelantan* Effect of Magnesium Oxide (MgO) as an Antifungal Agent on Singgora Roof Tile	**UITM019** **Muhammad Ashraff bin Hamdan** *Universiti Teknologi MARA* Electronic and Superconducting Properties of Y-247 Ceramic via Computational Method.	**UITM022** **Nur Fatin Najihah binti Abdul Yami** *Universiti Teknologi MARA* Structural, Electronic and Optical Properties of Low Dimensional Hybrid Perovskite $(C_6H_{10}N_2)XI_4$ (X = Pb, Sn) Using Density Functional Theory

KEYNOTE SPEAKER

PROFESSOR SANG-WOOK HAN



Professor Sang-Wook Han is a professor in the Department of Physics Education, Jeonbuk National University. He completed his Ph.D. in Physics from University of Missouri-Columbia in 1999. Currently he is Chair of the Korean XAFS Society. He has published over 100 research papers on condensed matter physics, nanoscience, and nanotechnology and given over 30 invited lectures. His major research field has been focused on micro-structural properties of various nanomaterials including, semiconductors, magnetic materials, superconductors, metal-insulator-transition materials, spintronics, catalysts, sensors, and others, using XAFS and diffraction techniques. He also has intensive experiments on crystal growths with MOCVD and sputtering depositions.

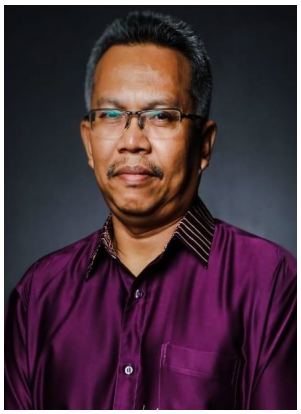
LIST OF PLENARY SPEAKERS & INVITED SPEAKERS

PLENARY SPEAKERS

ASSOC. PROF. DR. NAFISAH BINTI MOHD ISA @ OSMAN

Nafisah Osman (Osman N) is a Professor at the Department of Physics, Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM). She completed her Ph.D. at Universiti Kebangsaan Malaysia (UKM) in 2010 and her MSc as well as undergraduate studies at the same university in 2002 and 1990, respectively. At the national level, she has been a Secretary of the Malaysian Solid State Science Technology and Society (MASS) since 2016-present and a member of the Malaysian Association of Hydrogen Energy (MAHE) since 2017-present. Her research interests lie in the area of advanced materials, solid-state ionic, materials chemistry, and generally, the materials for proton ceramic fuel cells (PCFCs). In a recent study, she focused on better techniques for synthesizing ceramics compounds at relatively low temperatures and fabricating anode- supported single cells with various pure and composite materials of cathode and anode. She actively collaborates with researchers from other universities and research institutes in several other disciplines of science and technology, particularly in materials for ionic conductors. Osman N leads the Physics and Chemistry Materials Research Group (PCMaG) and Proton Conducting Fuel Cell Research Group (PCFCRG) in UiTM.

PROF. DR. AZHAN BIN HASHIM @ ISMAIL



Professor Ts. Dr. Azhan bin Hashim @ Ismail is a Professor in Physics. He obtained a PhD in Materials Science from Universiti Putra Malaysia in 2000. His area of expertise is High Temperature superconductor (HTS) and mainly focussed on cuprates superconductors such as YBCO and BSCCO systems. This research involved many fabrication techniques such as solid-state reaction, sol-gel and co-precipitation. Characterisation of this material was carried out by XRD, SEM, FTIR, RMS and ACS. Currently he is working on a computational method for superconductor materials. He is a fellow of Malaysian Solid-State Science and Technology Society (MASS) and was also appointed as council member of this society until today. He was awarded as Professional Technologist by Malaysian Board of Technologies (MBOT) in 2019. He is active in research and publication. Professor Azhan previously held the position of Deputy Rector of Research and Industrial Linkages (2009-2017) and Deputy Rector of Academic Affairs (2018-2020) at UiTM Cawangan Pahang. Currently he is a dean of Faculty of Plantation and Agrotechnology at UiTM Cawangan Melaka Jasin Campus.

PROFESSOR IR. TS. DR. AHMAD ZIAD SULAIMAN

Professor Ir. Ts. Dr. Ahmad Ziad Sulaiman is Senior Director for Research Management & Innovation Cemtre (RMIC), Universiti Malaysia Kelantan. Prof. Ir Ts Dr Ahmad Ziad Sulaiman holds a Bachelor of Chemical Engineering from Universiti Teknologi Malaysia (UTM), Master in Chemical Engineering from Universiti Teknologi Malaysia (UTM), and a PhD in Biochemical Engineering from Massey University (MU), Palmerston North, New Zealand.

He is Registered Professional Engineer (PEPC), Board of Engineers Malaysia (BEM), Profesional Technologies (PTech) MBOT, Chartered member of the Instituition of Engineers Malaysia (IEM) and panel of accreditation for Malaysian Qualification Agency (MQA), Engineering Accreditation Council (EAC), Engineering Technology Accreditation Council (ETAC) and Technology and Technical Accreditation Council (TTAC), Malaysian Board of Technology (MBOT).

He has published extensively in the areas of separation, biochemical processes, sonobioreactor technology, enzyme technology, microbial fermentation, herbal extraction technology (solvents and enzymatic extraction) and bioreactor design, to name a few. His more recent projects have focused on classical and novel approaches to the analysis of honey and detection of adulterants and kinetic correlations of gas-liquid mass transfer coefficient and oxygen uptake rate of heterologous protein cultivation by sonobioreactor. His impressive background both in research and academia landed him several prestigious awards which includes Gold Medal in Carnival Research and Inovation (CRI) Universiti Malaysia Kelantan 2019, Gold Medal and The Best Award (Invention and Innovation Awards) Malaysia Technology Expo (MTE) 2019, Gold Award and The Best of The Best Award (Educational Institutions) at The International Invention, Innovation & Technology Exhibition (ITEX) 2019. In recognition of his numerous contributions to the broad field of Chemical Engineering directly and society indirectly, he was the recipient of several honours and awards including the Pingat Setia Ahmad Shah Pahang (S.A.P.) in 2006, Pingat Jasa kebaktian (PJK) in 2009 and Pingat Kebaktian (PK) in 2012.

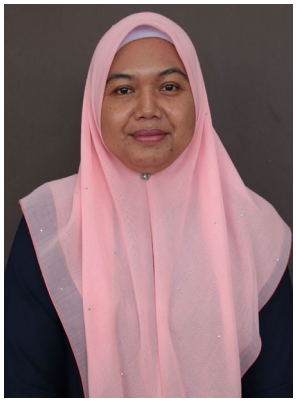
DR. CHEN JIANFENG (BRUKER)

Dr. Chen JianFeng holds a PhD in Polyemr Physics, from Chinese Academy of Sciences. He is an Application Scientist in Bruker since 2021. He has more than 10 years' experience on SEMs and their application. He is well known as a scientist in Thermofisher and Agilent.

DR. PETR KLIMEK (NOVATIQ)

Klímek is a Product Manager for TESCAN SEMs at the TESCAN ORSAY HOLDING in Brno, Czech Republic. He has 5 years of experience with SEMs and their application to routine microanalytical tasks. He obtained his Ph.D. in Materials Sciences at Mendel University in Brno and extended his materials research background through his internships at Fraunhofer WKI and Oregon State University (Fulbright Scholar).

PROFESSOR IR TS DR JULIE JULIEWATTY



Professor Ir Ts Dr Julie Juliewatty Mohamed is Director of the Intellectual Property and Commercialisation Division, Center of Research and Innovation, Universiti Malaysia Kelantan. Prof Ir Ts Dr Julie Juliewatty holds a Bachelor of Materials Engineering (USM), MSc in Materials Engineering – Composite (USM) and PhD in Materials Engineering – Electroceramic also from USM. She is a Registered Professional Engineer, Board of Engineers Malaysia (BEM). She has published extensively in the area of advanced ceramic - electroceramic materials such as dielectric (CCTO, NiO), piezoelectric (KNN, PZT), and also traditional ceramic (Mambong Pottery, Singgora roof tile). She has published more than 100 journals. Her recent projects have focused on development of $CaCu_3Ti_4O_{12}$ (CCTO) materials that have high potential to be used as supercapacitors, due to its giant dielectric constant behavior. Her impressive background both in research and academia landed her several prestigious awards which include Gold Medal in International Invention, Innovation and Technology Exhibition (ITEX) 2019, PECIPTA 2019, ITEX 2018, Malaysia Technology Expo (MTE) 2017, Carnival Research and Innovation (CRI) 2019, CRI 2018 and CRI 2017. She has won silver medals in ITEX 2019, MTE 2019, ITEX 2017, CRI 2018, and some other competitions. She has achieved 20 awards in innovation competitions.

INVITED SPEAKERS

PROFESSOR DR AB MALIK MARWAN BIN ALI

Prof. Dr. Ab Malik Marwan Ali is Deputy Head of Centre for Functional Material and Nanotechnology from UITM. He obtained his Bsc in physics and Msc in Advanced Materials from University Malaya. He was awarded his PhD in Advance Material from UITM Shah Alam in 2008. His research concentrated in the core area of organic chemistry namely synthesis of natural products, structural exploration of some pyrrolidinone-type compounds and new polymers. Currently working towards the total syntheses of dysidamides, codonopsinine, janolusimide and also on the novel polymeric materials namely polyimides (PI) and polyphenylene vinylene s (PPV).

PROFESSOR DR ZAINAL ABIDIN TALIB

Dr. Zainal Abidin Talib obtained his BSc Physics and MSc Physics in 1982 and 1985 respectively from Southern Illinois University, USA. He was awarded his PhD in Molecular Science from the same university in 1990. He was a Professor of Materials Physics at Universiti Putra Malaysia and held the post of Dean in the Faculty of Science from 2011 - 2017. He also led the Electrical Properties of Matter and the X-ray Diffraction Laboratories at the Department of Physics, Faculty of Science, UPM Serdang. His research interests encompass a broad area involving phonon-electron transport, dielectrics physics and applied optics. He is currently an adjunct Professor at the Department of Physics, Joenbuk National University, South Korea

PROFESSOR DR ONG KEAT KHIM

Prof. Dr. Ong Keat Khim is a professor in the Department of Chemistry and Biology Centre for Defence Foundation Studies (PAP) National Defence University of Malaysia. She obtained her Bsc, Msc and PhD from UPM. Her current research interest is in analytical chemistry and environmental chemistry.

ASSOCIATE PROFESSOR MOHAMAD FARIZ BIN MOHAMAD TAIB

PM Dr. Mohamad Fariz Bin Mohamad Taib is a lecturer and researcher at Universiti Teknologi MARA (UiTM) Shah Alam, Malaysia. He earned his Doctorate at the University Teknologi MARA (UiTM) Shah Alam, Malaysia in 2014. He received his Bachelor of Sciences with Honors in Physics in 2009. He becomes Head of Electroactive Research Group, UiTM. His expertise is in Density Functional Theory (DFT) which is related to solid-state and quantum electron theory. Apart from this, he has been involved in various fields which are Li-ion Battery, Nanogenerator and Graphene.

PROF. DR. ABD HALIM SHAARI

Prof. Dr. Abdul Halim Shaari is a professor in the Faculty of Science, UPM. His research concentrated in the core area of physics, glass ceramics and advanced optical materials. His current research interest is in the interplay between magnetism and superconductivity. Magnetic or superconducting materials are prepared in bulk form with the appropriate doping, addition or substitution to see the interplay behaviour. It can also be in thin heterogeneous films or multilayered films prepared via PLD or sputtering methods. Another research area is in Multiferroic materials. Again the interest is in the coexistance of ferroelectric and ferromagnetic behaviour.

DR. SARIZAM BIN MAMAT

Ts. Dr. Sarizam bin Mamat is a senior lecturer in the Faculty of Bioengineering and Technology, Universiti Malaysia Kelantan. He obtained a PhD of Engineering in Materials and Manufacturing Science from Osaka University, Japan in 2018. His area of expertise is welding metallurgy and arc physics, mainly focussed on the microstructure transformation behavior and mechanical integrity at heat affected zone (HAZ) of the weldment. Currently, he is working on the development of a new hybrid welding process, the welding`s mechanism and its feasible use towards various joining application such as dissimilar joining as well as wire arc additive manufacturing. The behavior of the transformed microstructure/ intermetallic compound mainly characterized by EBSD, TEM and EPMA. He is a member of Japan Welding Society (JWS), Malaysia Welding and Joining Society (MWJS) and recently appointed as Treasurer of Malaysian Engineer Society (MAE). In terms of international linkages, he was appointed as International Collaborator by Joining and Welding Research Institute (JWRI), Osaka University, Japan in October 2018 to March 2021. He was awarded as Professional Technologist by Malaysian Board of Technologist (MBOT) in 2018. Currently, he is a Deputy Dean of Research and Innovation in the Faculty of Bioengineering and Technology, UMK Kampus Jeli.

PROF. DR. MD. RAHIM SAHAR

Prof. Dr. Md Rahim Sahar is a professor in physics department, in Universiti Teknologi Malaysia. He obtained his Bsc in physic and Msc in Solid State Physics from UKM and University of Kent, Canterbury, UK, respectively. He was awarded his PhD in Glass Ceramics from University of Warwick, UK in 1990. His research concentrated in the core area of physics, glass ceramics and advanced optical materials.

DR. NURUL AKIDAH BINTI BAHARUDDIN

Dr. Nurul Akidah Baharuddin is one of the young solid-state researchers. Her research has had a significant impact on the advancement of knowledge, particularly in the field of advanced materials for energy applications. She received her B. Hons in Mechanical Engineering (2011), MSc in Fuel Cell Engineering (2014), and Ph.D. in Fuel Cell Engineering (2017) from Universiti Kebangsaan Malaysia (UKM). She also received an Excellent Ph.D. Thesis Award at UKM;s 45th Convocation Ceremony and graduated on time. Throughout her four years of research-academic involvement, she has published over 30 peer-reviewed scientific papers, mostly as the first and corresponding author, with more than 500 citations (h-index of 12). She also received numerous awards and recognitions at the university, national, and international levels. Recently, she was appointed as a member of the energy committee under the Academy of Sciences Malaysia (ASM), as an affiliate member of the Young Scientists Network-ASM (YSN-ASM) and as a journal's Guest Editor for a special issue on advanced materials for sustainable energy and chemical processes. She was also invited to give a keynote speech at the international 4th edition of the Applied Science, Engineering, and Technology Webinar in 2021. She also received the Gold Award at the 4 th International Malaysia-Indonesia-Thailand Symposium on Innovation and Creativity 2021 (iMIT SIC2021), Bronze Award at the 5 th Materials Technology Challenge 2021 (MTC5.0 2021), and the Frontrunner 5000- Top Articles in Outstanding S&T Journals in China. At the national level, she is actively involved in industry-academia networking. She is currently the chairman of the Hydrogen Sub-working Group under MTSFB (Centre of Excellence (CoE) – Malaysian Communications and Multimedia Commission, MCMC) for Green ICT. She was also chosen as Malaysi;s delegate at the United Nations (UN) – International Telecommunication Union Telecommunication Standardisation Meeting (Geneva) for Environment, climate change and circular economy Section (2021–2022).

ASSOC. PROF. DR. MUHAMMAD AZWADI BIN SULAIMAN

Assoc. Prof. Dr. Muhammad Azwadi Sulaiman was born in Kuala Besut, Terengganu, Malaysia on 20th of Match 1984. He received degrees in BEng (2008), MSc (2009) and Phd (2013) from Universiti Sains Malaysia in the field of Materials Engineering. Universiti Malaysia Kelantan (UMK) recruited him as a lecturer for Materials Technology Programme in 2013 and positioned him to develop several new programmes at UMK. In 2022, he was appointed as the Dean of the Faculty of Bioengineering and Technology. He is actively involved in many materials science and engineering research activities and has organised conferences and seminars in these fields, such as RCSSST, ICXRI, IConBET, ICoST, AMCT, and SCMSM. He is also involved in many editorial journals such as the International Journal of Electroactive Materials (IJEM), Journal of Tropical Resources and Sustainable Science (JTRSS) and Malaysian Journal of Microscopy. He published more than 100 and edited more than 200 journal articles. He is very interested in X-ray-related techniques to investigate material properties and behaviours. He also practised in radiation protection, occupational safety, and health and supervised a Radiation Laboratory in UMK.

ASSOCIATE PROFESSOR DR. NORLI BINTI ABDULLAH

Prof. Madya Ts. Dr Norli Abdullah is a lecturer in chemistry at Universiti Pertahanan Nasional Malaysia since 2012. She received her M.Phil in Advanced Materials from University of Malaya (UM) in 2004. She worked as a research assistant at Fritz Haber Institute, The Max Plank Society, Germany from 2002 until 2003 as part of her master's degree internship. She obtained a PhD in Nanostructured Materials from UM. She was awarded several research grants under MOHE and as PI for an International Newton Fund in 2019. Her areas of interests include the synthesis and characterization of carbon-based material and their application as sensing materials, nanofluids and catalysts.

PROFESSOR DR. ROSLAN ABD SHUKOR

Professor Dato' Dr Roslan Abd Shukor is a lecturer at the Department of Applied Physics, Universiti Kebangsaan Malaysia. His research area is high temperature superconductors. He has written extensively on the Tl- and Bi-based high temperature superconductors.

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UMK044	Dr. Wee Seng Kew	Bioleaching of Iron (III) Impurities from Different Particle Sizes of Ilmenite Ores (FeTiO3) by Shewanella oneidensis MR-1	Online	186
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UKM009	Nur Jannah Binti Md Hassan	The Effect of Sodium Alginate on Properties of Sodium Carboxymetyl cellulose (NaCMC)/ Hydroxyethyl cellulose (HEC) membrane As a Bio-Based Plastic Mulch For Agriculture Application	Physical	74
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UKM011	Assoc. Prof. Dr. Noor Baayah Ibrahim	Bibliometric analysis on the research of yttrium iron garnet film magnetic properties	Online	200
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ABSTRACTS

KEYNOTE SPEAKER

Keynote Session
Professor Sang-Wook Han
Department of Physics Education, Jeonbuk National University

A Local Structural and chemical Probe XAFS and Its Applications

Sang-Wook Han

Department of Physics Education, Jeonbuk National University

Abstract. Synchrotron X-rays are widely used to study various fields, including physics, chemistry, material sciences, and life sciences. Since the first synchrotron x-ray source of SSRL was constructed in 1973 at Stanford University in the USA, several tens of synchrotrons have been built and are run in the world, including European Synchrotron Radiation Facility (ESRF, France), Advanced Photon Sources (APS, USA), and Super Photon ring-8Gev (Spring-8, Japan). Recently, the 4th generation X-rays sources with a sub-picosecond time resolution have been constructed in the USA, Japan, Korea, Germany, and others. X-ray absorption fine structure (XAFS) is one of X-ray absorption spectroscopy methods and is a powerful tool to investigate local structural and chemical properties around a selected element of compounds. XAFS can therefore describe the bond lengths, bond-length distributions and the species of the atoms located around the probe atom. XAFS does not depend on the density of material, nor on the types of the specimens, such as, powder, thin film, or even liquid. XAFS can be used to examine the structural properties of nanostructures, amorphous, and crystalline materials. Orientation-dependent structures are also precisely determined using polarization-dependent XAFS measurements. XAFS is sensitive to the chemical valence state of a selected element in the matter. I will introduce the XAFS techniques and present some results of its applications to nanomaterials, crystalline growths, and in-situ studies.

ABSTRACT

PLENARY TALK

Prof. Dr. Nafisah Mohd Isa@Osman

Universiti Teknologi Mara

Electrical Performance of Proton Ceramics Fuel Cells at Intermediate Temperature: An Overview

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Abstract. Proton ceramic fuel cells (PCFCs) with a perovskite-type proton conducting electrolyte without a doubt outperform conventional oxygen ion-conducting ceramic fuel cells in many ways, especially the electrical properties themselves. These properties can be distinguished in many aspects such as alternate current (a.c.) conductivity, direct current (d.c.) conductivity and power density which contribute to the efficiency of PCFCs. The ability of PCFCs to acquire low activation energy and higher bulk conductivity at a relatively low temperature is one of the reasons why they are intensively being investigated worldwide. In current studies, acquiring lower polarization resistance (R_p), ohmic resistance (R_{ohm}) and achieve higher peak value of power density(ρ_{peak}) is a three crucial trait to dominate the overall cell resistance and reduce the activation energy which brings a significant impact in electrochemical performance of PCFC. This paper presents an overview of the evaluation and the importance of having a better understanding of the electrical properties of PCFCs. The high electrical performance together with other cell properties such as reliability, modularity, fuel adaptability, and very low levels of SO_x and NO_x emissions are required for efficient applications of PCFC towards commercially viable fuel cell technology.

Keywords: PCFC; electrical properties; d.c. conductivity; a.c. conductivity; power density

ABSTRACT

PLENARY TALK

Prof. Dr. Azhan bin Hashim @ Ismail

Universiti Teknologi Mara

A Study on Structural and Electronic Properties Of Ag And Sb-Doped In Ba-Site Of $Yba_2cu_3o_{7-\Delta}$ Superconductor Via Computational Method

Siti Fatimah Saipuddin[1,A,*], Azhan Hashim[2,B] And Mohamad Fariz Muhamad Taib[3,C]

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Abstract. The structural and electronic properties of YBa2Cu3O7-δ superconductors doped with Ag and Sb have been predicted theoretically. The Ag ionic radius of 126 pm matches the Ba atom, which is 134 pm, promoting electrical conductivity. When an Sb atom with a lower ionic radius of 76 pm is doped into the Ba-site of $YBa_2Cu_3O_{7-\delta}$, it undergoes structural modifications. To further understand its interatomic behaviour, the structural and electronic properties of both elements doped at the Ba-site of $YBa_2Cu_3O_{7-\delta}$ were computationally analysed, over a wide range of dopant percentages. Focuses were made at x = ±0.200, where Ag dopant enhanced electrical conductivity, and Sb dopant provided structural alterations from prior experiments. The CASTEP computer code was applied employing various exchange-correlation functionals such as Local Density Approximation and Generalized Gradient Approximation on standard DFT (LDA CA-PZ, GGA-PBE, GGA-PBEsol, and GGA-WC) with the VCA technique and 2×2×1 supercell Hubbard U correction method, DFT+U (LDA CA-PZ+U, GGA-PBE+U, GGA-PBEsol+U, and GGA-WC+U) with U = 10.0 eV. Based on the computational calculation, the GGA-PBEsol and GGA-PBEsol+U give the best-validated results as compared to the referred experimental and theoretical studies. The lattice parameters of all samples differ by less than 5% from the previous experimental investigation. DFT via GGA-PBEsol indicated considerable bond length changes along the Cu(1)-O(1) and Cu(1)-O(4) by +0.62% and -0.38%, respectively. CuO chain behaves as the charge reservoir to the conducting CuO2 plane. The bond length along Cu(2)-O(2), Cu(2)-O(3), and Cu(2)-O(4) changes to experimental by +0.52%, +0.36%, and -4.65%, respectively. As Ag dopant was added to the sample, the bond length on the CuO chain and CuO2 plane decreased, indicating contraction due to impurity addition at the Ba-site. As Sb dopant was added, an increment of bond length was observed along with Cu(2)-O(2) and Cu(2)-O(3) by +2.89% and +23.95%, respectively, showing an increment of bond length upon Sb doping. The electronic band structure, total and partial density of states (DOS), and electron density show that hybridization exists between the Cu 3*d* and O 2*p* atoms, verifying the Van Hove Singularity at the Fermi level. Applying GGA-PBEsol, the bandgap of 3.30 eV for pure YBa2Cu3O7-δ shows a 17.50% difference compared to other theoretical work. When the DFT+U method was employed via GGA-PBEsol+U, the calculated electronic bandgap for pure, Ag and Sb- doped samples was increased. The DOS on Cu(1) 3*d,* O(1) 2*p*, and O(4) 2*p* atoms along the CuO chain and Cu(2) 3*d,* O(2) 2*p*, and O(3)

2*p* atoms on the CuO2 plane were increased when doped with Ag atom. When doped with Sb atom, the increment of Cu(1) 3*d,* O(1) 2*p*, and O(4) 2*p* atoms are +132.84%, +136.73%, and +104.33% on CuO chain and along the CuO2 plane for Cu(2) 3*d,* O(2) 2*p*, and O(3) 2*p* atoms by +96.70%, +103.36%, and +121.01%, respectively. Impurity dopants have the highest concentration on O atoms due to their electronegativity, increasing their electron density. As Ag and Sb dopants were added to the Ba-site of YBa2Cu3O7- δ, respectively, the total charge on Cu(2) increased substantially where Cu atoms exhibit the most atomic population on orbitals. This work will help researchers understand the structural and electronic properties gained by computational methods. This approach could be used in future experiments to establish the Ag and Sb dopant percentages in YBa2Cu3O7-δ superconductor, resulting in high-performance sample preparation.

Keywords: Superconductor, YBCO, Computational Method, DFT

ABSTRACT

PLENARY TALK

Prof. Ir. Ts. Dr. Julie Juliewatty Binti Mohamed

Universiti Malaysia Kelantan

$CaCu_3Ti_4O_{12}$ Electroceramic for Capacitor Applications: Trends and Challenges

J.J. Mohamed

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Abstract. $CaCu_3Ti_4O_{12}$ (CCTO) electroceramic has been received tremendous attentions in 2000s due to its colossal dielectric constant (CDC; $\varepsilon' \sim 12{,}000$), which is nearly constant over a wide range of frequencies (DC – 10^6 Hz) and temperatures (100 – 400 K), without showing any structural phase transition. This ε' value has been improved up to 300,000 by many researchers through several processing techniques, yet still not enough to be commercialized as its dielectric loss is slightly higher than the standard Electronic Industry Alliance (EIA), $\tan\delta \leq 0.05$. In addition, the origin mechanism of CDC effect is still not fully understood. Hence, this presentation tries to recap the trends and challenges for CCTO development. The main process was started in 2005, where a CCTO single phase has been successfully synthesized using a solid-state reaction method from three different oxides, followed by characterization details. There are many processing parameters involved including type of mixing process, powder compaction pressure, calcination temperature and duration and sintering. At the present study, the author is focusing on the field of electrode-sample contact due to the creation of Schottky diodes that lead to the formation of CDC effect.

Keywords: CCTO, dielectric, electroceramic.

ABSTRACT

PLENARY TALK

Prof. Ir. Ts. Dr. Julie Juliewatty Binti Mohamed

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$CaCu_3Ti_4O_{12}$ Electroceramic for Capacitor Applications: Trends and Challenges

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Abstract. $CaCu_3Ti_4O_{12}$ (CCTO) electroceramic has been received tremendous attentions in 2000s due to its colossal dielectric constant (CDC; $\varepsilon' \sim 12{,}000$), which is nearly constant over a wide range of frequencies (DC – 10^6 Hz) and temperatures (100 – 400 K), without showing any structural phase transition. This ε' value has been improved up to 300,000 by many researchers through several processing techniques, yet still not enough to be commercialized as its dielectric loss is slightly higher than the standard Electronic Industry Alliance (EIA), $\tan\delta \leq 0.05$. In addition, the origin mechanism of CDC effect is still not fully understood. Hence, this presentation tries to recap the trends and challenges for CCTO development. The main process was started in 2005, where a CCTO single phase has been successfully synthesized using a solid-state reaction method from three different oxides, followed by characterization details. There are many processing parameters involved including type of mixing process, powder compaction pressure, calcination temperature and duration and sintering. At the present study, the author is focusing on the field of electrode-sample contact due to the creation of Schottky diodes that lead to the formation of CDC effect.

Keywords: CCTO, dielectric, electroceramic.

ABSTRACT

INVITED TALK

Prof. Dr. Ab Malik Marwan Bin Ali

Universiti Teknologi Mara

Tuning electronic and magnetic properties of Zn-Ni-Co Ternary Spinel Oxides Based Co_3O_4 For Supercapacitors Electrode

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Abstract. Modifying the spinel Co3O4 via doping with other 3*d* transition metals provides a rich redox reaction, hence can improve the performance of the electrode. Herein, a theoretical work of the metal (*M*)-doped Co_3O_4 (*M*=Ni, Zn) is performed by using density functional theory (DFT) as implemented in the CASTEP to calculate the structural, electronic and magnetic properties. To form the ternary spinel oxide, the doped Zn into $NiCo_2O_4$ with different doping ratios (x=0.25, 0.50 and 0.75) were calculated. The introduction of Zn has provoked atomic bonding and structure due to the unsatisfied antiferromagnetic spin arrangement at the tetrahedral site as the substitution of Co^{2+} with non-magnetic Zn^{2+} ions. The density of states analysis shows that the value near the Fermi level at a higher doping ratio x=0.75, namely $Ni_{1.0}Zn_{0.75}Co_{1.25}O_4$ (16.13electron/eV) has increased from binary oxide, $NiCo_2O_4$ (12.30electron/eV). Such an increase in this value leads to an enhancement of electrical conductivity. The variation of doping concentration enables to adjustment of the suitable content and consequently can tune the properties of the material.

Keywords: Density functional theory, Co_3O_4, ternary spinel oxide, electronic properties, magnetic properties

ABSTRACT

INVITED TALK

Prof. Dr. Zainal Abidin Talib

Jeonbuk National University

Influence Of Citric Acid Concentration on The Particle Size and Optical Properties of Cuse Nanoparticles

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Abstract. The interest in metal chalcogenide semiconductor nanoparticles has continued to be vibrant in academia and industry because of their potential applications in numerous fields ranging from medicine, biology, optoelectronics, and catalysis to energy harvesting application. This interest arises because they have displayed remarkable and unique properties in their nanometre size range, especially their optical and electrical properties. Copper selenide (CuSe) nanoparticles are among intriguing groups of II-IV metal chalcogenides. It is a p-type semiconductor material with unique optical and electrical properties, making it a remarkable and technologically suitable material for many applications. In this paper we present our finding on the effect of citric acid concentrations on the structural and optical properties of CuSe nanoparticles fabricated using a straightforward microwave-assisted synthesis route. A facile microwave-assisted synthesis route was employed to synthesize CuSe nanoparticles. We discussed the interaction mechanism of citric acid with the precursor ions and investigated the effect of citric acid concentration on the particle size and optical properties of CuSe nanoparticles. We have characterized the final product of the reaction using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), energy-dispersive X-ray spectroscopy (EDX), field emission scanning electron microscopy (FESEM), atomic force microscopy (AFM), Raman spectroscopy (RS), UV-visible spectroscopy (UV-vis.) and photoluminescence spectroscopy (PL).

Keywords: Copper selenide; Citric acid; Nanoparticle; Hexagonal, Optical bandgap.

ABSTRACT

INVITED TALK

Prof. Dr. Ong Keat Khim

Universiti Pertahanan Nasional Malaysia

Controlled Release NPK Fertiliser Encapsulated by a Biodegradable Polyester

NABIILAH Faris[1,a], SOLEHA Mohamat Yusuff[2,b], NUR ATHIRAH Zulkifli[3,c], WAN MD ZIN Wan Yunus[1,4,d], KEAT KHIM Ong[3,5,e,*], SITI HASNAWATI Jamal[4,5,f], SYED MOHD SHAFIQ Syed Ahmad[5,g], MOHD JUNAEDY Osman[5,h], CHIN CHUANG Teoh[6,i] and NOR LAILI-AZUA Jamari[5,j]

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Abstract. The commercial NPK granular fertilizer was coated using a biodegradable polyester namely polylactic acid (PLA) in order to prepare controlled release NPK fertilizers (PLA-coated NPK fertilizers). The coatings were prepared from the polymer solution of PLA by immersion method. The effects of PLA concentration and number of coating on nutrients release behaviour in water (in terms of conductivity) of PLA-coated NPK fertilizers were investigated at room temperature for a period of 28 days. The results revealed that the release of NPK nutrients from double PLA-coated NPK fertilizers were slower than that of single PLA-coated NPK fertilizers. Therefore, this study demonstrated that double PLA-coated could acts as controlled release fertilizers (CRFs) which are suitable for sustainable agricultural and horticultural applications.

Keywords: controlled release fertilizer, polylactic acid, coating

ABSTRACT

INVITED TALK

Assoc. Prof. Dr. Mohamad Fariz Bin Mohamad Taib

Universiti Teknologi Mara

Accelerated Innovation Via Modelling of $LiFePO_4$/Graphene Cathode for Li-Ion Battery

M.F.M.Taib[1,2], N.H.M.Zaki[1,2,],A.S.Kamisan[1,2], A.I.Kamisan[1,2], N.S.Samsi[1,2], O.H.Hassan[2,3], A.M.M. Ali[1,2] M.Z.A.Yahya[4]

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Abstract. Lithium-ion batteries (LIBs) are the most popular battery storage option and control more than 90% of the global grid battery storage market. In turn, the electrification of transportation is heavily reliant on advancements in storage technologies, with LIBs being the fastest-growing storage technology in power systems and transport that requires both high-energy and high-power density simultaneously. The olivine structured $LiFePO_4$ material is considered a competitive candidate for cathode material of LIBs due to excellent cycling stability, low cost, and good safety making it stable in nearly all electrolytes typically used in LIBs. However, the low electronic conductivity and low diffusion coefficient of Li^+ have hampered its commercial applications. Doping and conductive layer coating are the most common methods to improve its performance. Due to the availability of better computational resources, the computational analysis and predictions of materials offer a sensible approach before the practical synthesis of material. The density functional theory (DFT) calculations can emerge various properties of structural and stability, conduction behavior, and Li-ion diffusion, which can provide an atomic understanding of the capacity, reaction mechanism, rate capacity, and cycling ability. The DFT results help reveal the properties of the modified $LiFePO_4$, hence supporting the design of novel electrode materials.

Keywords: Density functional theory, Lithium-ion batteries, $LiFePO_4$, cathode, Li-ion diffusion

ABSTRACT

INVITED TALK

Prof. Dr. Abdul Halim Bin Shaari

Universiti Putra Malaysia

Some aspect of Materials characterization using electron spin resonance (ESR) spectroscopy

S.A. Halim,

H. Baqiah, S. K. Chen, K. P. Lim, Z.A.Talib and M. M. Awang Kechik

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Abstract

Electron spin resonance (ESR) spectroscopy is a method used for studying materials with unpaired electrons. In this presentation; some recent ESR results of K-substituted YBa2Cu3O7 (Y123) superconductors, BiFeO3 nanoparticles, BiFeO3/Fe2O3 composites, La0.7Sr0.3MnO3 nanoparticles and Cd0.3Zn0.7Se nanocrystals are discussed. It was reported that the ESR line clearly split into two components and shifted to lower magnetic field in K-substituted Y123. This was explained as due to the changes in the oxygen ordering in under-doped region of Y123. In BiFeO3 nanoparticles obtained by calcination solid solution containing bismuth nitrate and iron nitrate as starting materials, polyvinyl pyrrolidone (PVP), the values of g-factor and ΔHpp increased with the increase of calcination temperatures whilst the Hr decreased with the increase of calcination temperatures (450 – 550 °C). On the other hand, four spin centers related to cycloidal structure of BiFeO3, α-Fe2O3 phases, defect and Fe isolated ions has been identified in ESR spectra of (BiFeO3)1-x(α-Fe2O3)x. The ESR signals obtained at 30 – 110 °C have been used to estimate the temperature Curie temperature (Tc) of La0.7Sr0.3MnO3 nanoparticles. ESR has been used to investigate defects.

ABSTRACT

INVITED TALK

Ts. Dr. Sarizam bin Mamat

Universiti Malaysia Kelantan

Development of TIG/MIG Hybrid Welding Process

Sarizam Mamat[1], Rose Alifah Ellyana Roslan[1], Srinath Gudur[2], Yuji Toshifumi[3], Shinichi Tashiro[4], Manabu Tanaka[4]

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Abstract The influence of TIG current variation on arc stability of TIG/MIG hybrid welding were studied by comparing it with conventional MIG welding process. The welding current-voltage waveform was analysed to characterise the arc stability of MIG arc. From the observation, the introduction of TIG arc at as low as 60 A of current brought a significant change to the MIG arc stability in TIG/MIG hybrid welding. The length of MIG arc in TIG/MIG welding increased with the introduction of TIG arc compared with the one in conventional MIG welding. The increase of arc length is believed to be related to the arc interaction between TIG arc and MIG arc, which then affected the wire melting rate. At the optimum TIG current, the diameter of the molten droplet decreased with the increment of droplet transfer frequency.

Keyword : TIG/MIG hybrid welding, arc stability, arc interaction

ABSTRACT

INVITED TALK

Prof. Dr. Md Rahim Sahar

Universiti Teknologi Malaysia

Tailoring the optical and magnetic properties of cobalt oxide nanoparticles in boro-tellurite glass in the presence of erbium

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Abstract. This paper reports the cobalt oxide (Co_3O_4) NPs concentration dependent on erbium (Er^{3+}) doped sodium magnesium borotellurite glass prepared using melt quenching method and the influence of Co_3O_4 NPs as incorporated in Er^{3+} doped glass are examined. Samples are characterized using X–ray diffraction (XRD) which reveals the amorphous nature of the glass without the existence of any sharp peak. The typical absorption bands of Er^{3+} that are attained possess a broader absorption due to the overlap of Er^{3+} with Co^{2+} and Co^{3+} ions. The emission spectra revealed two prominent peaks centered at 653 nm and 822 nm, assigned to the transition $^4F_{9/2} \rightarrow {}^4I_{15/2}$ (red) and $^4I_{9/2} \rightarrow {}^4I_{15/2}$ (NIR) respectively with significant drop in the luminescence intensity due to the principal role played by the NP ions. The EPR spectra revealed three prominent value of g factor at ranges of 4.07–4.22, 2.97–3.02, 2.11–2.41 attributed to Co^{2+} ions in tetrahedral and octahedral sites.

Keywords: Boro-tellurite glass, Co_3O_4 nanoparticles, Luminescence quenching, EPR

ABSTRACT

INVITED TALK

Dr. Nurul Akidah Binti Baharuddin

Universiti Kebangsaan Malaysia

Dual Electrode Functioning Lithiated Nickel Based for Solid Oxide Fuel Cell

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Abstract. Durability concerns encountered by electrode materials have been a growing focus of research in developing electrode materials. A brand-new emerging configuration in the expanding SOFC application has emerged. This novel form, known as symmetrical SOFC (S-SOFC), is a major topic in fuel cell development. By incorporating lithiated nickel oxide-based materials, which are primarily employed in lithium-ion battery applications and making them viable for S-SOFC applications. Thus, these investigations will concentrate on preliminary research, specifically the characterization and chemical performance of lithiated nickel doped ruthenium, abbreviated as $LN_{1-x}R_xO_2$ (x=0.1,0.2, and 0.3) with various dopant compositions. To simulate the working environment of a dual-functioning electrode, the LNRO-based powder was exposed to analysis in both oxidising and reducing environments. The symmetrical cell with a configuration of LNRO/SDC/LNRO was fabricated via the screen-printing method and heat treated at 800 °C for 2 hours. The samples were further analysed for the electrical conductivity of the electrode and, lastly, for the EIS analysis. The activation energies obtained for LNR1, LNR2 and LNR3 are 0.22, 0.13 and 0.18 eV while in a reduced environment (mixture gas of H2:N2) are 0.04, 0.03 and 0.09 eV. Meanwhile, the ASR value of the best sample LNR2 was obtained from the EIS analysis measured in air and reduced environment at 800 °C are 6.123 Ω cm^2 and 0.281 Ω cm^2, respectively. The finding demonstrated that the dopant utilised in LNR2 had a high potential as an electrode for the S-SOFC application, which is more than just a way to improve SOFC performance.

Keywords: Electrical Conductivity; Electrode; Lithium; Morphology; Resistance; SOFC

ABSTRACT

INVITED TALK

Prof Madya Dr. Muhammad Azwadi Sulaiman

Universiti Malaysia Kelantan

Synthesis of Advanced Ceramic Using Microwave Sintering Method

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Abstract. Advanced ceramic materials synthesis involved a very high sintering temperature (>1000°C) and a long soaking time (>5h). The high temperature and time-consuming process caused the conventional technique to be inefficient and costly. In this study, the microwave sintering approach was carried out using an enhanced method to solve this problem and the dielectric properties and other properties were investigated. An enhanced silicon carbide (SiC)-based susceptor was utilized to optimize the microwave radiation temperature to produce a type of advanced ceramics, the $CaCuTi_4O_{12}$ (CCTO). The calcination process was conducted at 500℃ with different calcination times using a microwave furnace operated at the frequency of 2.45 GHz and assisted with an enhanced silicon carbide (SiC)-based susceptor. XRD pattern revealed that cubic perovskite CCTO was obtained partially after calcination at 500℃ for more than 5 hours, but the single-phase CCTO was not completely formed at this temperature. The SEM microstructure showed grain growth and reduced porosity and grain boundaries of the pellets with increased calcination time. Dielectric properties also increase with the increase of calcination time. The dielectric constants for the CCTO pellets were to vary from 200 to 2900 in the frequency range of 1 MHz to 10 GHz. The investigations were conducted more on the sintering effect using the microwave. The calcination process of CCTO powder was completed conventionally in a furnace at 900°C for 12 hours to produce a controlled sample. The CCTO cylindrical pellets were sintered using a commercial microwave at 2.45GHz and 800W power. The sintering process was tested at five different irradiation times: 1 hour, 2 hours, 3 hours, 4 hours, and 5 hours. The electrochemical impedance spectroscopy conducted at 2.5V and 3V with 1Hz to 10 MHz frequency shows the dielectric behaviour performance of the sample concerning sintering time. The result reveals that the dielectric constant was best produced for 5 hours of sintering time. However, the CCTO sample can melt beyond the duration because the high heat generated in the sample's interior deteriorates the sample shape. The dielectric loss is also reasonably low during this time. It is then proven that completing the microwave sintering process in 5 hours is sufficient to improve the dielectric properties of the CCTO.

Keywords: Microwave sintering; calcination, solid-state reaction, CCTO, dielectric materials

ABSTRACT

INVITED TALK

Associate Professor Dr. Norli Binti Abdullah

Universiti Pertahanan Nasional Malaysia

Effect of Acid Treatments and Surfactant on MWCNTs Nanofluids: Structural, Morphological and Thermal Conductivity

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Abstract: This study discussed the effect of using three acid treatment methods (Method A, Method B and Method C) to introduce the surface oxygen functional group (SOFG) on multi-walled carbon nanotubes (MWCNTs) for structural, morphological and thermal Conductivity performance. The SOFG on the MWCNTs has been characterized by Fourier Transform Infrared (FTIR) spectroscopy, Raman spectroscopy and Field Emission Scanning Electron Microscopy (FESEM). The result shows that the modification with acid treatment significantly affects the degree of defects and surface group functionality of surface oxidized MWCNTs from method B. The preparation of nanofluids using MWCNTs in water-based fluids produced from method B (MWCNT-MB) was prepared using two different parameters: with and without polyvinylpyrrolidone (PVP) as surfactant with setting variable of carbon particle concentration from 0.1 wt.% to 1.0 wt.%, and the amount of PVP is 10% of carbon particles at different temperatures (6°C, 25°C, 40°C). The thermal conductivity performance of nanofluids proved that the surface oxidized MWCNTs with PVP enhanced thermal conductivity compared to the nanofluid containing MWCNTs without PVP due to the stability and homogenization of nanoparticles. These promising properties of MWCNTs in water-based fluids would enable the nanofluids to be utilized in heat transfer fluid and cooling applications.

Keywords: CNT; MWCNTs; nanofluids; polyvinylpyrrolidone; PVP; thermal conductivity

ABSTRACT

INVITED TALK

Prof. Dato' Dr. Roslan Abd. Shukor

Universiti Kebangsaan Malaysia

Metal Sulfide Effects on AC Susceptibility and Electrical Properties of $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8$ Superconductor

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Abstract. Many works on the effect of metal oxides on Bi-based superconductors have been reported. Metal sulfides offer another interesting and rich avenue to improve the superconducting properties of the Bi-based materials. Moreover, oxygen and sulfur belong to the same group (VI) in the periodic table. In the paper we report the effects of metal sulfides (MS where M = Cd, Pb, Zn, Fe and Mo) addition on the superconducting properties of $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8$ (Bi-2212) superconductor. The samples were prepared through the conventional solid state reaction method. The amount of metal sulfide addition was between 0.1 and 10 wt. %. The structure, microstructure, electrical resistance, AC susceptibility and intergrain critical current density were investigated. X-ray diffraction patterns showed that the Bi-2212 phase were dominant with volume fraction of over 80 % in all samples. Our result showed that the onset transition temperature, $T_{c\text{-onset}}$ was 83 K and zero-resistance temperature, $T_{c\text{-zero}}$ was 72 K for non-added sample. Metal sulfides suppressed the critical temperature except for CdS addition samples. The highest onset transition temperature $T_{c\text{-onset}}$ for the $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8(CdS)_x$ series was 90 K. All metal sulfide added samples showed metallic normal state behavior except for sample with x = 5 wt.% of the $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8(FeS)_x$ series which showed semiconductor behavior. AC susceptibility transition temperature, $T_{c\chi'}$ was around 52 K to 97 K. The addition of metal sulfides strengthened the flux pinning in some samples. The critical current density, J_c at the peak temperature of the imaginary part of the susceptibility, T_p was between 15 and 25 A cm^2 for all samples. This work showed that among the metal sulfides, CdS showed great improvements in the critical temperature and current transport properties.

Keywords: Critical Current Density; microstructure; X-ray diffraction

ABTRACTS

OTRS007

Synthesis of Precipitated Calcium Carbonate (PCC) as the Function of Carbon Dioxide Gas Flow Rate

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Abstract. The synthesis of precipitated calcium carbonate (PCC) starting from carbide lime waste and carbon dioxide gas (CO_2) was investigated under different gas flow rates. The reaction started with dissolution of calcium ions in the sucrose solution and followed by carbonation of CO_2 gas. The carbonation process is carried out with variations of the CO_2 gas flow rate of 0.2, 0.5, 1.0, 2.0, 3.0 and 4.0 *l*/*min* at 40 °C temperature. The PCC particles were formed through precipitation and crystallization. The synthesized PCC was filtered and dried to obtain solid PCC. The effect of various gas flow rate on the synthesized PCC were further investigated using X-ray diffraction (XRD) and field-emission scanning electron microscope (FESEM). Variations in CO_2 gas flow rate affect the carbonation time. Shorten carbonation time was recorded at higher CO_2 gas flow rate. The finding discovered no significant outcome of different CO_2 gas flow rates on the phase formation was observed. The identified particles were calcite polymorphs with mixed morphologies of scalenohedral and asparagus-like shapes.

Keywords: precipitated calcium carbonate, waste, carbon dioxide, carbonation, precipitation, calcite

OTRS009

Synthesis of Pure Zeolite-X In A Flowsynth Circulating Batch Microwave Reactor From Clear Solution Extracted From Coal Fly Ash

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Abstract. The present work shows that pure phase of Na-X zeolite can be successfully synthesized via a microwave-assisted system in a flow process from a clear solution extracted from alkaline treated coal fly ash (CFA). The FlowSynth microwave reactor supplies continuous microwave irradiation for the circulating batch manufacturing of nanomaterials. The effect of crystallization time and temperature of circulating batch microwave on the yield and crystallinity of the produced zeolite was investigated. The synthesized crystalline zeolite Na-X was thoroughly characterized by XRF, XRD, SEM, EDX, and BET. The maximum crystallinity (99.13%) was achieved at an operating temperature of 85 ºC, 124-W, and 4-h. Circulating batch flow microwave reactor enhances and accelerates the crystal growth of zeolite. The produced crystalline zeolite had a high purity.

Keywords: Coal fly ash, Synthesis, Microwave irradiation, Bench scale, Zeolite X, Extracted solution.

UKM012

Optimization of Substrate Orientation for Homogeneous Deposition of MoS_2 Thin Film by Computational Fluid Dynamics

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Abstract. Obtaining a homogeneous and large area deposition of two-dimensional (2D) transition metal dichalcogenides (TMDs) thin film is challenging in solid source chemical vapor deposition (CVD). Here, we report the effect of substrate orientations on the uniformity of MoS_2 deposition by carrying out computational fluid dynamics using Ansys Fluent. The simulation replicated our CVD system which consists of a 1 inch quartz tube and a single zone furnace. The S (~300 ºC) was located upstream followed by MoO_3 (~840 ºC) and a SiO_2/Si substrate (850 ºC). The mass flow rate of the S, MoO_3 and Ar carrier gas was set at 1.14×10^{-8}, 1.65×10^{-9}, and 2.70×10^{-6} kg/s, respectively. Based on our calculation, the Reynolds number for this simulation is ~9 which means that the flow in the tube is laminar. Substrates placed horizontally (face-up and face-down) had the poorest uniformity with surface deposition rate (SDR) changes from 4.50×10^{-4} to 1.10×10^{-5} kg/m^{2}s across the substrate. For substrates placed at an inclined position (20 and 45º) the uniformity showed a slight improvement. However, when the substrate is at 90º (perpendicular to the furnace wall), a uniform deposition was obtained across the substrate with SDR of 3.10×10^{-5} kg/m^{2}s. This is attributed to a more uniform velocity distribution right above the reaction zone on the substrate. Our results highlight the importance of computational fluid dynamics in CVD optimization and its potential to reduce cost and time to obtain homogeneous and large area 2D TMDs thin films.

Keywords: chemical vapor deposition, transition metal dichalcogenides, computational fluid dynamics, MoS_2, Ansys Fluent

UKM017

Synthesis of Metallic Niobium Disulfide (NbS_2) via Halide Assisted-Chemical Vapor Deposition

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Abstract. Metallic two-dimensional (2D) transition metal dichalcogenides particularly niobium disulfide (NbS_2) has huge potential for next generation metal contact for electronic devices and efficient catalyst for hydrogen generation. In this work, NbS_2 flakes were prepared at atmospheric pressure via halide assisted-chemical vapor deposition (CVD). The precursors used were sulfur and a mixture of metal oxide (Nb_2O_5) and salt (NaCl) with a ratio of 8:2. Growth was carried out at carrier gas (Ar/H_2) flow rates of 20, 60 and 100 sccm. NbS_2 flakes were obtained for the sample grown at the lowest carrier gas flow rate. Most of the flakes have a triangular shape with a dimension of less than 8 μm. However, a rainbow-like feature was also observed on the surface of the substrate which was attributed to a molten Na_xNbO_y intermediate which facilitate the nucleation and formation of NbS_2 flakes. This observation indicates that the growth underwent a vapor-liquid-solid mechanism (VLS). Almost no deposition was observed for samples grown at higher gas flow rates (60 and 100 sccm). As the growth time is reduced from 10 to 1 minute, thinner flakes were obtained. The Raman spectrum obtained from the grown flakes showed peaks at 290, 339 and 380 cm^{-1} which indicate that the flakes are 3R-NbS_2.

Keywords: 2D materials, Chemical Vapor Deposition, Niobium disulfide.

UM002

Synthesis of Highly Metallic MnSi and Mn_4Si_7 Nanowires by Thermal Chemical Vapor Deposition and Their Controllable Ferromagnetic and Electrochemical Properties

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Abstract. Manganese silicides are narrow bandgap semiconductors and have been attracted great attention lately, owing to their unique physical, electrical, and magnetic properties in applications of electronics, spintronics, solar energy harvesting, thermoelectrics, and energy storage devices. The direct vapor transport mechanism in a thermal chemical vapor deposition (TCVD) reactor enables to growth various morphologies of one-dimensional (1D) manganese silicide nanowires at low reaction temperature around 850°C, such as nanowires, nanorods, nanoleaves, nano-branches, and other alloy nanostructures. In this study, we grown MnSi, Mn_5Si_3, and Mn_4Si_7 in 1D structure and their phases vary from highly metallic to semiconducting greatly depending on growth condition. These nanostructured alloys were grown directly on c-Si and SiO_2 substrate surfaces at the reaction temperature around 850°C. It is worth mentioning that these 1D nanowires exhibiting ferromagnetic behavior at room temperature and the ferromagnetic property was greatly improved at low temperature of 4 K. Moreover, the band structure calculations using the density functional theory revealed that these 1D ultra-thin MnSi and Mn_4Si_7 nanowires possess a highly metallic characteristic.

Keywords: Thermal chemical vapor deposition; MnSi; Mn_4Si_7; nanowires; highly metallic, ferromagnetic

UMK007

Effect of pH values on the structures and energy bandgap of ZnO prepared by a hydrothermal method

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Abstract. In this paper, zinc oxide nanoparticles at different particle size were successfully synthesized via simple hydrothermal method by controlling the parameter of pH values. The zinc chloride and sodium hydroxide were used as precursor to synthesize the ZnO and was heated at 180°C for 24 hours. The pH of the precursor was varied from 8, 9, 10, 11 and 12 by controlling the amount of sodium hydroxide. The morphological variation and the optical band gap of zinc oxide (ZnO) nanostructures varied by the pH of precursor were studied. The samples were characterized using X-ray diffraction (XRD), Scanning electron microscope (SEM) and Ultraviolet-Visible (UV-Vis) spectroscopy. XRD pattern shows that the ZnO nanostructured exhibit the hexagonal wurtzite structure with the average crystallite size is calculated. The morphology images by SEM revealed the nanorod (1D), spherical granule (2D) and nanoflower (3D) structure for all samples. UV-Vis spectroscopy shows the absorption or reflectance peaks of zinc oxide was around 300 to 400 nm indicates the presence of blueshift. The energy bandgap was found to be increasing with the pH value increased. Thus, pH values play a crucial role to the structure control and tuning of band gap.

Keywords: Zinc Oxide, Hydrothermal method, Hexagonal Wurtize.

UMK016

Enthalpy and Heat Capacity Changes in CCTO Phase Transformation Up to 1000 °C Using Simultaneous TGA/DSC

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Abstract. Two sets of bulk powders with the chemical formula of $CaCu_{3+x}Ti_4O_{12+x}$ and $CaCu_{3-x}Ti_4O_{12-x}$ for x = 0.0, 0.02, 0.04, 0.06, 0.08 and 0.10 was prepared and characterized using simultaneous TGA/DSC instrument. The measurements were carried out at a heating rate of 10 °C·/min under 60 ml/min of flowing nitrogen from room temperature to 1000 °C. Then, it isothermal at 1000 °C using oxygen gas at a rate of 20 ml/min for 1 hour. The samples were then characterized using XRD for their structural phase analysis. The TGA mass analysis at isothermal oxidation are decreased for $CaCu_{3+x}Ti_4O_{12+x}$ and increased in curves pattern for $CaCu_{3-x}Ti_4O_{12-x}$. The DSC curves from 30 to 1000 C° are divided into 3 parts of the thermodynamic events. The first parts are huge endothermic reaction due to the decomposition of the carbonate group. The second parts involve two small peaks of endothermic cause by reduction reactions of CCTO precursor. Then the third part is composed of endothermic and exothermic peaks relate to fusion and crystallization of CCTO oxides. The enthalpies of fusion (ΔH_f) and crystallization (ΔH_{cry}) change significantly with the increased and decreased the Cu element in the CCTO oxides system. The heat capacities (C_p) at the crystallization peaks are be influenced by the heat capacity at fusion reaction since the thermal solubility depends on the total molar mass of oxides. The XRD patterns indicated that the secondary phases are formed by non-stoichiometric samples compared with the x = 0 sample analyzed using the standard diffraction pattern of JCPDS number 01-075-1149.

Keywords: CCTO; TGA/DSC; enthalphy, heat capacity; XRD

UMK028

Zn-Doped Calcium Copper Titanate Synthesis via Microwave-Assisted Technique

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Abstract. Electroceramic material has become important-significantly in the recent development of electronic parts such as capacitors, resonators and sensors. The previous study on calcium copper titanate ($CaCu_3Ti_4O_{12}$, CCTO) showed that CCTO exhibit a colossal dielectric constant, up to 10^4 for bulk materials using a conventional synthesis route (calcine and sinter at 900-1040℃ for 9-12 hours). The high firing temperature and longer reaction time were undesirable because they would increase production costs and be time-consuming. Alternately, doping was proven an effective technique to improve the dielectric properties. Thus, the Zn-doping (Zn= 0, 1 and 3 mol%) method was utilized to increase the dielectric constant in CCTO. The study successfully synthesized Zn-doped CCTO at 700ºC with a soaking time of 40 minutes using a microwave-assisted technique (calcined and sintered). Then, the samples were characterized using XRD and an impedance analyzer. The CCTO crystal formation was examined through an XRD pattern, and 1 mol% of Zn-doped recorded optimum formation reaction for calcining (56.5 wt%) and sinter (70.3 wt%). However, despite the low formation of CCTO crystal structure in 3 mol% of Zn-doped (34.9 wt%), it has the highest dielectric constant and the dielectric loss was reduced at high frequency.

Keywords: Zn-doping, CCTO, Microwave-assisted technique, Dielectric properties

UMS002

Imine-based Covalent Organic Framework for Copper(II) Removal in Water

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Abstract. The imine-based covalent organic framework (Imine-based COF) were synthesized using melamine and terephthalaldehyde as monomers under the solvothermal method at 180 °C for 10 hours and were used as an efficient porous adsorbent for Cu(II) removal from an aqueous solution. Elemental analysis, FTIR spectra and PXRD confirmed the formation of Imine-based COF. Batch adsorption experiments were conducted with highest adsorption capacity up to 80% of Cu(II) removal at pH 6 for 180 mins reaction at room temperature. The kinetic studies showed that the adsorption reaction fitted well with Freundlich isotherm and pseudo-second order model. Furthermore, the reusability of the synthesized adsorbent showed high stability up to five cycles.

Keywords: Covalent organic framework; Imine-based COF; Adsorbent; Metal adsorption.

UNMP002

Thermal Decomposition, Phase Formation and Microstructure Analysis of Carbon Nanotubes Assisted Sol-Gel Derived $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ Material

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Abstract. A single-phase of perovskite-type oxide ceramic nanomaterial can be produced at a lower processing temperature than 1000 °C via a wet chemical method, namely sol-gel method. However, it is influenced by the nature of chemical agents added during the synthesis process such as chelating agent, surfactant, and dispersant. Among the chemical agents, dispersant is considered as an important chemical agent as it can hinder hard agglomerated particles formation which is the main drawback of sol-gel method. In the present work, sol-gel derived lanthanum strontium cobaltite, $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ (LSC64) material is prepared with the aid of carbon nanotubes (CNTs) as dispersant. The prepared LSC material is characterized by thermal gravimetric analyzer (TGA), X-ray diffractometer (XRD) and scanning electron microscope (SEM) equipped with energy dispersive X-ray (EDX) spectrometer for its thermal decomposition, phase formation and microstructure properties. Thermal decomposition of the as-synthesized material and phase formation of the calcined LSC material are completed and formed at temperature below than 1000 °C, respectively. The calcined powder consists of homogeneous and almost identical shape of particles as shown in SEM image.

Keywords: LSCO material; Calcination; Perovskite; Ceramic; Nanomaterial

USM002

Growth of aluminum nitride layer on sapphire substrate with different miscut-angles and effect of nitridation.

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Abstract. Aluminum gallium nitride based ultra-violet light emitting diodes (AlGaN based UV LEDs) have recently become a subject of interested due to their potential for surfaces, air and water disinfections, including 'eliminating' coronaviruses. However, current UV LEDs are only few percent efficient. This makes them are not compatible for large-scale environments at present, whereby high energy and cost consumption are required. Hence, efforts of preventing the spread of coronaviruses widely using the LEDs are still hindered. Of key issues to improve the LEDs efficiency is to grow an aluminum nitride (AlN) layer which acts as the base layer for the LEDs, with low threading dislocations (TDs). An ideal route to achieve the target is by growing the layer on native AlN substrates. However, such substrates are currently expensive and available in limited sizes. To date, most of AlN layers and AlGaN based UV LEDs are grown on sapphire substrates. Our recent work proposes that miscut-angles of sapphire substrate influences the growth of 1 μm thick AlN layers. In particular, the TDs density of the layers. The results suggest that higher miscut-angles lead to reduction of TDs but at the expense of increasing the surface roughness. The surface roughness can be reduced by introducing nitridation prior to the AlN growth on sapphire. Interestingly, the nitridation also reduces the TDs further. The optimized AlN layer obtained from this work exhibits a TDs density of around 5×10^{9} cm^{-2} by growing the layer on 0.5° miscut sapphire with 20 min of nitridation.

Keywords: AlN, sapphire miscut-angle, nitridation, threading dislocations and surface roughness.

UKM009

The Effect of Sodium Alginate on Properties of Sodium Carboxymethyl cellulose(NaCMC)/ Hydroxyethyl cellulose (HEC) Membrane As a Bio-Based Plastic Mulch For Agriculture Application

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Abstract. Due to the agronomic advantages, agricultural plastic mulch films are commonly utilized in specialized crop production systems. On the basis of natural renewable resources, sodium carboxymethyl cellulose (NaCMC) and hydroxyethyl cellulose (HEC), a unique biopolymer film has been produced that has potential as an alternative to plastic mulching materials. By incorporating sodium alginate (SA), a natural thickening agent. NaCMC/HEC/SA solution was produced, then immersed in a crosslinking agent solution, calcium chloride ($CaCl_2$), and oven-dried at 60°C regenerating NaCMC/HEC/SA membrane. Hence, NaCMC/HEC/SA membrane with variation in SA weight percentages (0,0.5,1.0,1.5,2.0 wt%) was characterized, especially their chemical changes through Fourier transform infrared spectroscopy (FT-IR). Significant changes in the position which the band approximately 1034cm^{-1} correspond to C-O stretching in the acetyl groups present on the SA backbone that observed in the FT-IR spectrum of NaCMC/HEC/SA to compare with NaCMC/HEC. In addition, it was found that by increasing the weight percentage of SA, the NaCMC/HEC/SA membrane had the highest moisture content. Also, adding SA to the matrix membrane increases the UV-blocking ability of the membrane. Improvement in tensile property was also observed, with the membrane containing 0.5 wt% of SA resulting highest tensile strength and elongation at break of 7.92 MPa and 114.90%, respectively. The produced NaCMC/HEC/SA membrane assured a vast potential, especially for agriculture applications.

Keywords: Agronomic, biopolymer, tensile strength, UV-blocking

UMK020

Pyrolysis Kinetics of Chicken Manure using Thermogravimetric Analysis via Kissinger Method

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Abstract. Chicken manure comprises of a mixture of feather, bedding, spilled food and urine. In this study, the kinetics of chicken manure was investigated using thermogravimetric analysis (TGA) equipment. The pyrolysis was conducted at two different heating rates of 10 °C/min and 20 °C/min, and was heated from room temperature to 900 °C under an inert nitrogen environment with a flow of 20 ml/min. Pyrolysis kinetics such as activation energy (E_a) and the pre-exponential factor (A) of chicken manure was analyzed using Kissinger method which assumed to be constant during the whole pyrolysis process. Results showed that E_a and A for pyrolysis were 131.7 kJ/mol and 2.10×10^{11} s^{-1}, respectively. The kinetics results were compared with other manures that used Kissinger method and were found in good agreement. This study proved that the kinetics from chicken manure was comparable to those found in other studies and can be used for designing pyrolysis reactor.

Keywords: Chicken manure; Pyrolysis; Thermogravimetric Analysis; Kinetics; Kissinger Method

UMK014

Extraction of Phenolic and Flavonoids Compounds from Kenaf (*Hibiscus Cannabinus L.*) using Ultrasound Assisted Extraction (UAE)

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Abstract. *Hibiscus cannabinus L.* or kenaf for the past few years have been studied as medicinal properties due to the presence of phytochemical compounds such as phenolic, flavonoids and alkaloids. The purpose of this study is to screen the presence of phenolics and flavonoids compounds after the extraction using ultrasound assisted extraction (UAE) with different times and solvents from kenaf bast fibres and leaves. In this study, the extraction time using UAE are 10 minutes, 20 minutes, 30 minutes, 40 minutes and 50 minutes. Type of solvents that were used are water and ethanol. The change of colours were observed which indicate the presence of phenolic and flavonoid compounds in bast fibres and leaves. For the results, it shows that each sample for different solvent shows different colours to be observed meanwhile the time differents did not shows significant colour changes. For the phenolic compound test, bast fibres shown the orange colour for ethanol solvents while for water shows dark orange with precipitate. Meanwhile, leaves give dark green colours for water and for ethanol the dark green colour was more intense. In flavonoid test, both water and ethanol solvent for bast fibres samples shows pale yellow while leaves shows yellow for water and yellow greenish for ethanol. Overall, the presence of bioactive compounds especially for phenolic and flavonoid compounds was confirmed in *Hibiscus Cannabinus L*. Further analysis using High Performance Liquid Chromatography (HPLC) to determine the concentration of bioactive compounds in each sample.

Keywords: Ultrasound Assisted Extraction, *Hibiscus Cannabinus L*., phenolic compounds, flavonoid compounds.

UMK019

Fabrication of Ultrafiltration Mixed Matrix Membrane of Polyethersulfone (PES) Incorporated Aliquat 336 and Graphene Oxide for Humic Acid Removal

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Abstract. In this study, ultrafiltration membranes of Polyethersulfone (PES) incorporating Aliquat 336 and Graphene Oxide (GO) were fabricated to remove Humic Acid (HA). The fabricated membranes were characterized using thermogravimetric analysis (TGA) for thermal stability, contact angle (CA) for hydrophilicity and scanning electron microscopy (SEM) for membrane morphology. Based on experimental results, it was shown that the different composition of Aliquat 336 and GO has different effect on the membrane characteristic, performance and fouling. Membrane C1 which was incorporated with both ionic liquid (20 wt.%) and GO (0.5 wt.%) successfully achieved 99.93% rejection towards HA. It also showed good antifouling properties where it managed to achieved reversible flux ratio (RFR) (30%) and flux recovery ratio (FRR) (83%), respectively.

Keywords: Ultrafiltration, Humic Acid, Aliquat 336, Graphene Oxide, Polyethersulfone.

UMK027

Recovery of Gold from Low-Grade Ore of Gua Musang, Kelantan using Chemical and Biological Methods

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Abstract. Gua Musang, Kelantan has become a well-known site in gold mining history. However, conventional gold mining activities using chemicals had contributed to environmental damages and gave impacted the ecosystem worldwide such as water and land pollution because of the chemical that is being used. Therefore, this study has been carried out to determine the efficiency of the biological methods for gold recovery in low- grade ore of Gua Musang, Kelantan as a potential method for future approach in mining industry. In this study, we used *Shewanella oneidensis* MR-1 as an anaerobic metal reducing bacteria to reduce Iron (III) reduction and noble metal ions. Ferrozine assay was used to determine the concentration of ferrous iron with an optical density 562 nm. The highest amount of the deposited ore, 0.5 g/mL with MR-1 showed a significant result in a concentration of Ferrous Iron, 1.243 ± 0.329 mM while the highest utilization of electron shuttle, 100 mg/L showed the result reached 1.611 ± 0.099 mM. In addition, the Aurum were extracted by using chemical method with a mixture of nitric acid and hydrochloric acid (1:3; v/v) and analysed by using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). For the results, the biological method showed recovery for Aurum in ore samples with the average recovery value 72 ± 17.35 %. As conclusions, this study showed the biological methods has the potential to be used for gold extraction compared to chemical method.

Keywords: Minerals, Metal-Reducing Bacteria, XRD, ICP-MS

UMK036

Characterization of phosphate solubilizing *Methylorubrum sp* isolated from paddy (*Oryza sativa*) leaves

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Abstract. *Methylorubrum sp* (formerly known as *Methylobacterium sp*) are gram-negative, rod-shaped and strictly aerobic, facultative methylotrophic bacteria with the ability to grow solely on organic one-carbon compounds like formate, formaldehyde, methanol and methylamine. Members of *Methylorubrum* were reported to promote seed germination and plant development particularly due to the production of phytohormones such as auxins and cytokinins making them a potential candidate for biofertilizer. Five endophytic and epiphytic *Methylorubrum sp* isolated in this study were shown to have phosphate solubilization activity commonly associated with bacteria found in plant rhizosphere or rhizosphere microbiome. Phosphate solubilization activity of the five isolates namely *Methylorubrum sp* ENPD1, *Methylorubrum sp* ENPD2, *Methylorubrum sp* ENPD3, *Methylorubrum sp* EPPD1 and *Methylorubrum sp* EPPD4 were evaluated by phosphate solubilisation index (SI), phosphate solubilization assay and phytase assay. The highest phosphate solubilization index (SI) was shown by *Methylorubrum sp* EPPD1 while the highest value for phosphate solubilization assay and phytase assay were recorded by *Methylorubrum sp* ENPD3. Other than the production of phytohormones, phosphate solubilizing activity is also a key characteristic of the development of biofertilizer. Thus, the potential of these *Methylorubrum sp* isolates in promoting plant growth will be further investigated.

Keywords: *Methylorubrum sp*, phosphate solubilization, phosphate solubilization index, phytase, biofertilizer.

UITM043

Structural and Morphological Properties of Graphene Oxide from Regenerated Carbon Black (rCB) of Waste Tyre

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Graphene oxide (GO) has attracted attention in the study of the creation novel material and mainly synthesized from exfoliation of graphite. However, the expensive market price of graphite lead to the high-cost production of GO beside the resource exhaustion due to rising demands from research and industry worsen the situation. Consequently, a cheaper and recycle alternative to graphite as possible raw material for producing GO is from carbon of waste tyre through modified Hummers method. The obtained GO was confirmed by using Raman spectroscopy, XRD, FTIR, and SEM-EDX. The Raman spectroscopy obtained for I_D of ~$1375cm^{-1}$ and I_G of ~$1602cm^{-1}$ with I_D/I_G ratio of 0.85 with 2D multi layers. The XRD spectroscopy showed the diffraction peak at (2θ = 26.38°) with interlayer spacing of 0.338 nm and FTIR spectra revealed the functional groups of hydroxyl (-OH), carboxyl (-COOH), alcohol (C-OH), and epoxy (C-O) at 3392 cm^{-1}, 1706 cm^{-1}, 1615 cm^{-1}, and 1108 cm^{-1} respectively that resembles the FTIR result of GO from graphite by previous study. SEM results revealed the morphology of agglomerates and coarse surface with the elemental composition consist of carbon (77.26%) and oxygen (22.74%). The establishment of GO from carbon waste tyre was successfully supported by all the above characterizations thus indicate that it can be suitable alternative of graphite for the synthesis of GO.

Keywords: Graphene oxide, Carbon black, Modified Hummers method, Waste tyre,

UKM021

Three-Dimensional Free-standing Graphene: Influence of Etching Solution and Etching Time on CVD Graphene/Nickel Foam

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Abstract. Three-dimensional (3D) structures made of graphene sheets have been developed recently, resulting in the development of a new class of graphene materials known as 3D graphene materials. High-quality free-standing 3D graphene foam has been synthesized by chemical vapor deposition (CVD) on nickel foam followed by a chemical etching process to remove the nickel foam as a template. FESEM, XRD and Raman measurements were performed to investigate the morphologies, crystal phase and the structure of nickel foam (NF), graphene/nickel foam (Gr/NF) and 3D graphene (3D Gr). In this study, we investigated the influence of etching solution and etching time on Gr/NF to produce free-standing 3D Gr. XRD analysis showed that the mix solution of 1M FeCl3:1M HCl at 80 ℃ for 3 hours can significantly remove the NF which no peaks of NF are observed, indicating a high crystal quality of 3D Gr was obtained. In addition, XRD analysis of etching times revealed that increasing the etching time after 3 hours decreases the intensity of diffraction peaks and degrades graphene quality. This research emphasizes the significance of etching solution and etching time selections for removing the NF to maintain the characteristic, quality and surface morphology of 3D Gr after the etching process.

Keywords: 3D graphene; chemical vapor deposition; etching solution; etching time

UPNM001

Effect of Acid Treatments and Surfactant on MWCNTs Nanofluids: Structural, Morphological and Thermal Conductivity

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Abstract: This study discussed the effect of using three acid treatment methods (Method A, Method B and Method C) to introduce the surface oxygen functional group (SOFG) on multi-walled carbon nanotubes (MWCNTs) for structural, morphological and thermal Conductivity performance. The SOFG on the MWCNTs has been characterized by Fourier Transform Infrared (FTIR) spectroscopy, Raman spectroscopy and Field Emission Scanning Electron Microscopy (FESEM). The result shows that the modification with acid treatment significantly affects the degree of defects and surface group functionality of surface oxidized MWCNTs from method B. The preparation of nanofluids using MWCNTs in water-based fluids produced from method B (MWCNT-MB) was prepared using two different parameters: with and without polyvinylpyrrolidone (PVP) as surfactant with setting variable of carbon particle concentration from 0.1 wt.% to 1.0 wt.%, and the amount of PVP is 10% of carbon particles at different temperatures (6°C, 25°C, 40°C). The thermal conductivity performance of nanofluids proved that the surface oxidized MWCNTs with PVP enhanced thermal conductivity compared to the nanofluid containing MWCNTs without PVP due to the stability and homogenization of nanoparticles. These promising properties of MWCNTs in water-based fluids would enable the nanofluids to be utilized in heat transfer fluid and cooling applications.

Keywords: CNT; MWCNTs; nanofluids; polyvinylpyrrolidone; PVP; thermal conductivity

UPNM004

Optical Limiting Studies of Organic Semiconductor Molecule with Carbon Nanotube Addition

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Abstract. Thiophene semiconductor molecules has the advantages of easy solution processability and optical modulation. There has been interest in thiophene-based molecules for its nonlinear optical (NLO) studies and optical limiter for several lasers. One way to improve stability of an optical limiter is by adding a second material into the solution or film. In this paper, multi-walled carbon nanotubes (CNT) were introduced into the thiophene solution as non-covalent intermolecular formation in order to investigate the role of CNT addition in third-order NLO characteristics at 532 nm cw laser. CNT are well-known NLO material owing to their unique electronic and molecular structures. Also, CNT's thermal stability makes them desirable in laser application. In the z-scan measurement at 532 nm cw laser, the nonlinear refraction (n_2) and absorption (β) had been measured in open and closed apertures constructions, respectively. The result shows these values increased after CNT addition and a much stable optical limiting behavior was observed for the composite. In our interest, there are many interesting and broad areas in material, optoelectronics and photonics studies can be explored with 532 nm laser applications.

Keywords: thiophene, carbon nanotubes, dispersion, 532 nm cw, third-order NLO

OTRS003

NIR emissions from Nd^{3+}-activated phosphate-based glass system for cost-effective, tunable, and miniaturised laser devices

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Abstract. This work represents a phosphate-based glass system of composition (40-*x*) P_2O_5 - 30 B_2O_3 - 30 $ZnSO_4$ - *x* Nd_2O_3, (*x* =0.5, 1.0, 1.5, 2.0 and 2.5 mol%) to determine the optical absorption and emission spectral characteristics. Moreover, Judd-Ofelt (J-O) intensity and radiative parameters were computed. Samples were prepared using melt-quenching method and characterized using Archimedes measurement, Ultraviolet-Visible-Near Infrared Spectroscopy and Photoluminescence Spectroscopy. The density values of these samples were reduced as the Nd_2O_3 concentration increased. The absorption spectra revealed 11 peaks corresponded to Nd^{3+} transitions from the lowest electronic energy level ($^4I_{9/2}$) to various excited levels. The optical energy band gap was found to be reduced with Nd^{3+} doping. The refractive indices (n) increased as the Nd^{3+} increase. The observed increasing trend of n was interpreted in terms of the enhancing tendency of samples molar volume (obtained from density), indicating a structural-optical correlation in the system under study. The obtained values of Urbach energy (Eu) have an increasing tendency in the range of ~ 0.318–0.711 eV. Tow significant NIR emission peaks were assigned to the $^4F_{5/2} \rightarrow {}^4I_{9/2}$ and $^4F_{3/2} \rightarrow {}^4I_{9/2}$ transitions of Nd^{3+}. Values of J-O intensity parameters Ω_2, Ω_4 and Ω_6 were found in the range of $(1.63–2.25)\times10^{-19}$ cm^2, $(2.57–2.94)\times10^{-19}$ cm^2 and $(1.53–1.82)\times10^{-19}$ cm^2, respectively. The obtained stimulated emission cross-section for the NIR transitions from Nd^{3+} ($(23.83–26.64)\times10^{-20}$ cm^2 for $^4F_{5/2} \rightarrow {}^4I_{9/2}$, and $(10.93–17.91)\times10^{-20}$ cm^2 for $^4F_{3/2} \rightarrow {}^4I_{9/2}$ obviously indicated the lasing effectiveness of the titled glass system.

Keywords: Phosphate glass; Neodymium ions; absorbance; NIR emission; Judd–Ofelt parameters; Radiative properties.

UITM049

Synthesis and Characterization of Cr/Zn Co-Doped Al_2O_3 Prepared Using Solution Combustion Method

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Abstract. Cr-doped Al_2O_3 was applied in biomaging application due to its sharp and high photoluminescence (PL) emission. In order improve its sensitivity, it is important to obtain sample with high PL intensity. Zinc was added to enhance PL of the sample as it reported can improve the energy and reduce the host matrix band. In this research, Cr/Zn doped and co-doped Al_2O_3 were prepared using solution combustion method. Structural and PL properties were investigated using X-ray diffraction (XRD), scanning electron microscope (SEM), energy dispersive X-ray (EDX) spectroscopy, and photoluminescence spectroscopy. The XRD results show that both samples have well-defined diffraction peaks corresponding to the α-Al_2O_3 structure, which remains unchanged with Zn substitution. The increase in crystallite size following Zn co-doping demonstrates that Zn influences both crystal growth and crystallization of Al_2O_3. PL decay curves of Cr/Zn-doped Al_2O_3 was estimated around 3.27 ms. The energy band gap was reduced from 4.31 eV to 4.23 eV after zinc addition. This reduction results in a 34% increase in PL intensity. Furthermore, the enhancement is thought to be the result of Zn^{2+} ion modification of the crystal field environment. Thus, it is shown that adding zinc elements can increase the PL intensity of Cr-doped Al_2O_3.

Keywords: Photoluminescence, Chromium doped Alumina, Solution Combustion

UMK012

Characterization of Wood Saw Dust: The Potential Pore Forming Agent for Green Porous Ceramic Production

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Abstract. Porous ceramic materials can be made in a variety of ways. Using a pore agent approach is definitely important. The size, shape, and distribution of the pores are affected by the pore-forming agent. The physical characteristics of these materials, including their heat conductivity, are greatly influenced by porosity. In order to fully utilize the potential of wood sawdust as a pore-forming agent in porous ceramic, this research is being conducted to examine how the physical and mechanical properties of porous ceramic thermal insulators are affected by the weight percentage (wt.%) and firing temperature of wood sawdust content. The chemical composition, microstructural change, phase transformation, and reaction bonding were carried out using XRF, SEM, XRD and FTIR respectively. Then, kaolin clay and wood sawdust were combined to create a porous ceramic material, with the amount of wood sawdust varying from 0 wt.% to 50 wt.%. Compressive strength, scanning electron microscopy (SEM), and X-ray diffraction (XRD) are then used to describe the porous ceramic sample. Additionally, the burnt clay seems to have a higher porous microstructure as a result of such mixed compounds. It has been demonstrated that porous ceramics' mechanical strength is impacted by water absorption. The compression test is performed to evaluate the mechanical strength (compressive strength). The results demonstrate that compressive strength falls as waste wood sawdust content increases and reduced density is caused by ceramic porosity. The mechanical strength falls when the water absorption value rises because it causes the density to drop due to increased porosity

Keywords: Pore forming agent, porosity, wood sawdust, porous ceramic, characterization

UMK025

Effect of Sintering Temperature on Crystallization and Structural Properties of Soda Lime Silica Glass

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Abstract. Glass ceramic is materials made up of crystalline phases embedded in a glass matrix obtained by controlled crystallisation. Since glass ceramics contain crystalline phases, they also contain grain boundaries to change from transparent to opaque. This study focused on glass ceramic by using different ratios of soda lime silica waste glass with kaolin. The effect of adding different amount of kaolin into the soda lime silica composition has revealed the impact positive in the production of glass ceramic. The properties of glass ceramic sample after being sinter at 700 °C and 800 °C was identified according to their physical and structural. The glass ceramic sample properties were investigated using XRD, XRF, FTIR, density test and firing shrinkage. Furthermore, the structure investigated using XRD has indicated the crystalline phase that has a high peak for an increasing amount of kaolin when sintered at 800 °C. The density of the samples shows increasing values by the increasing amount of kaolin and decreasing amount of soda lime silica. Results obtained shows strong evidence that proved the addition of kaolin and reduction of soda lime silica give a significant effect on the physical and structural properties of glass ceramic.

Keywords: Soda lime silica, kaolin, X-Ray diffraction, density, firing shrinkage

UMK039

Characterization of In-Situ Al_2O_3- TiO_2 and Al_2O_3-TiO_2-Graphite Composites Prepared by Powder Metallurgy

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Abstract. Al_2O_3-TiO_2 composite is known as an excellent hardness, corrosion, and wear-resistant material that is able to withstand up to 1000°C. The presence of unstable Al_2O_5Ti synthesized by powder metallurgy and plasma spray deteriorates the performance of these properties. In this study, two approaches are highlighted which are in-situ processing and adding another phase such as graphite into the Al_2O_3-TiO_2 composite could be solutions to the problem. Al_2O_3-TiO_2 and Al_2O_3-TiO_2-graphite and composites were prepared using in situ processing followed by powder metallurgy routes. The effect of milling times (30, 60, 90, and 120 h) and compaction pressures (200, 400, 600, and 800 MPa) on microstructural, structural, compressibility, and density of Al_2O_3-TiO_2 and Al_2O_3-TiO_2-graphite composites were evaluated. XRD analysis for both composites revealed that the Al_2O_5Ti phase did not exist in the composite. Milling up to 120 h resulted in a reduction of crystallite size and increment of internal strain, but only had a slight change in the composite morphology and density. The Al_2O_3-TiO_2-graphite composite exhibited better dispersion of reinforced phase than of Al_2O_3-TiO_2 composite which gave better densification. The densification behavior of both composites depends very much on the compressibility of the composite powder particles.

Keywords: Al_2O_3-TiO_2 composite; in situ processing; powder metallurgy; graphite

UMP006

Tailoring Structural and Optical Properties of Oxychloride Magnesium Tellurite Glass with Addition of Samarium Ions (Sm^{3+})

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Abstract. Addition of different modifier to the glass matrix will lead to change in physical and optical properties of the glass. In this work, Sm^{3+} doped oxychloride magnesium tellurite glasses were prepared by melt quenching method at 900 °C with chemical composition of (79-x)TeO_2-xMgO-20Li_2O-1Sm_2O_3 (Series 1) and (79-x)TeO_2-x$MgCl_2$-20Li_2O-1Sm_2O_3 (Series 2), where $0 \leq x \leq 15$ mol%. It is found that all the glasses are amorphous in nature by observed using X-ray diffraction (XRD). The density is observed to decrease when the MgO or $MgCl_2$ content value is increasing. The average density for Series 1 is (4.45 – 5.18) g/cm^3 while for Series 2 is (4.45 – 4.98) g/cm^3. The molar volume behaves exactly opposite to the increase in MgO or $MgCl_2$ content, which are (30.46 – 22.69) cm^3/mol and (30.46 – 25.29) cm^3/mol, respectively. FTIR spectra revealed modification in network structures evidenced from vibrational wavenumber shift of TeO_4 and TeO_3 structural units. The significant rise in HOH vibration mode detected implies its usefulness in boosting water and light absorption. In addition, UV-Vis-NIR has revealed four absorbance bands and the optical band gap is evaluated using UV-Vis spectroscopy. The indirect optical band gap for Series 1 and Series 2 are in a range of (3.42 – 3.36) eV and (3.42-3.30) eV respectively. The emission spectra revealed four prominent peaks centered at 562.54 nm, 599.14 nm, 645.63 nm and, 708.40 nm which assigned to the transition from $^4G_{5/2} - {}^6H_{J/2}$ (J = 5,7,9,11). The optimum composition of glass is potential for development of optical devices.

Keywords: Tellurite glass, Optical Properties, UV-Vis Spectroscopy, Samarium

UPM002

Effect of TiO_2 Addition on the Structural and Electrical Properties of $La_{0.67}Ca_{0.33}MnO_3$

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Abstract. Numerous studies have been conducted on perovskite manganites to enhance the low field magnetoresistance (LFMR). One of the effective approaches is the addition of an insulating oxide as the artificial boundary layer outside the manganite grain. The objective of this research is to determine the structural and electrical properties of $La_{0.67}Ca_{0.33}MnO_3$ (LCMO) when added with different contents of TiO_2. LCMO powder was prepared via sol-gel route before appended with TiO_2 nanoparticle to form (1-*x*) LCMO: *x* TiO_2, *x* = 0.00, 0.005, 0.01, 0.03 and 0.05. The structural analysis by X-ray diffraction (XRD) revealed that no significant changes on the lattice parameter, crystallite size, bond length and angle as the concentration of TiO_2 increases. The TiO_2 in LCMO caused an increase in resistivity and a decrease in metal-insulator transition (T_{MI}). This indicates the double exchange (DE) has been suppressed by the TiO_2 addition. The electrical resistivity of the samples in the metallic region was fitted with theoretical models, and the conduction mechanism can be explained by the grain/domain boundary, electron-electron and electron-magnon scattering process.

Keywords: CMR, LCMO, Fitting, Conduction, Boundary

UPM004

Mechanical Properties of Bioactive Glass with Various CaF_2/P_2O_5 Ratios

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Abstract. Biomaterials such as bioglasses gain significant interest due to their ability to form a bond with new tissues. However, there is some limitation of the human tooth, which is unprotected and easy to fracture due to loss in mechanical strength over time. The challenge is to replace the fractured area with a material that can bond with new tissue and perform the same properties as the host material before degrading. Hence, this study highlighted the fabrication of bioglass with various CaF_2/P_2O_5 ratios via the conventional melt-quenching technique. The eggshells waste is chosen as a source of calcium in this work. The mechanical properties such as the compressive strength test and Vickers microhardness test on bioglass with various ratios were analyzed. It was found that the mechanical properties of the bioglass are improved with the appropriate CaF_2/P_2O_5. From the results, the CaF_2/P_2O_5 ratio bioglass of 6/4 showed better compressive strength, which is 48.98 Mpa, and Vickers microhardness, which is 3.09 GPa, among the bioglasses. Therefore, the findings point toward low-cost bioglass systems derived from waste eggshells as candidates used in dental materials.

Keywords: bioglass, melt-quenching, mechanical properties, compressive strength, Vickers microhardness

UPM005

Optical Properties of Sm^{3+} Doped Zinc-borosilicate Glass

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Abstract. Glasses made of zinc-borosilicate are noteworthy for their thermal shock resistance, strong elastic modulus, chemical resistance, and piezoelectric characteristics. Nevertheless, zinc-borosilicate glass's low energy absorption rates have restricted its applicability. The introduction of rare-earth ions into the host glass is one method for resolving this issue. Therefore, in this work, a series of zinc-borosilicate glass ($ZnO–B_2O_3–SLS$) with various samarium (Sm^{3+}) concentrations were fabricated via the melt-quenching method. The waste soda-lime-silica (SLS) glass bottle was used as the source of SiO_2 in this work. The influence of the Sm^{3+} concentration on the optical properties was investigated. The optical absorption intensity enhanced as the dopant increased. In the meantime, the optical band gap for direct and indirect allowed transition reduced from 5.152 eV to 5.023 eV and 4.133 eV to 3.832 eV, respectively, as the concentration of Sm^{3+} increased. The result of the indirect bandgap values is comparable to the semiconductor's broad bandgap. Therefore, the $ZnO–B_2O_3–SLS$ doped Sm^{3+} ions are potentially applied in optoelectronic devices such as LEDs.

Keywords: Sm^{3+} doped glass, SLS glass, melt-quenching, optical properties, optical band gap

UPM012

Effect of Sm^{3+} dopant on structural and elastic properties of magnesium-boro-tellurite glass system

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Abstract. A series of samarium doped magnesium borotellurite glass with empirical formula (60-*x*)TeO_2−$30B_2O_3$−10MgO−*x*(Sm_2O_3) was produced via melt and quenching technique, with *x* is varied to 0.0, 0.5, 1.0, 2.0 and 3.0 mol%. The bulk density of the Sm-doped MBT glass was increased with addition of samarium oxide from 4.105 g/cm^3 to 4.403 g/cm^3. Besides, the molar volume illustrated contrary trend with the decreasing range from 29.39 cm^3/mol to 28.69 cm^3/mol. In XRD analysis, it is observed two broad humps with different intensity appeared in the region 20−80°, proving the amorphous state of glasses. All elastic moduli demonstrated a linear increase with the increment of Sm_2O_3. The longitudinal modulus, *L*, varies between 60.57 and 73.24 GPa, whereas the Young modulus, *E*, changes from 50.83 and 61.92 GPa. In addition, the bulk modulus, *K*, varies within 33.37 and 40.00 GPa, and the shear modulus, *G*, ranges between 20.39 and 24.93 GPa. The Poisson's ratio values were noted to be between 0.236 and 0.246. Furthermore, the microhardness in the range of 5.35 to 6.61 GPa is picking up steam, which is accompanied by an increase in Sm_2O_3. The glasses are potentially be use as a host for the glass laser applications.

Keywords: Samarium; Magnesium Borotellurite Glass; Elastic properties; Microhardness

USZA002

Plasmonic Effects of Dual-Metal Nanoparticles (Au /Ag) in Er doped Lasing Glass

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Abstract. Bimetallic plasmonic nanoparticles as one of the ingenious strategies towards the development of high-performance lasing glass. A series of Er^{3+} doped tellurite glasses are prepared using the melt quenching method and the influences of gold (Au) and silver (Ag) nanoparticles (NPs) on the optical behaviors are examined. XRD analysis confirms the amorphous nature of the samples. Coupling of Au and Ag NPs promotes wider SPR absorption in the range from 450 nm to 800 nm. Meanwhile, the optical properties such as UV-vis absorption and photoluminescence (PL) emisson has been determined in a usual manner. PL analysis reveals that the coupling of Au and Ag NPs into the erbium ions doped tellurite glass brings significant enhancement in the luminescence intensity. This enhancement is expectedly due to the plasmonic wave (referring to the coherent coupling of photons to free electron oscillations called plasmon) occurs at the interface between a conductor and a dielectric. This paper briefly discussed the phenomena of interaction of light with rare earth doped glasses embedded with bimetallic NPs that greatly influenced the performance of the lasing glass.

Keywords: Tellurite; glass; rare-earth; nanoparticle; gold; silver

USZA003

Silver nanoparticle enhanced luminescence of samarium in magnesium tellurite glass: Energy transfer effect

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Abstract. Improving the optical properties of rare earth doped inorganic glasses embedded with metallic nanoparticles (NPs) is a constant challenge in photonics. The main issue being addressed is optimizing NPs concentration in order to meet the requirements for lasing glasses. Glasses sample composition of $88.6TeO_2$-$10MgO$-xSm_2O_3-(1.4-x) AgCl where $x = 0.2 \leq x \leq 1.0$ in mol% have been prepared by using melt quenching technique. X-Ray Diffraction pattern demonstrate a broad hump pattern as a verification to the amorphous nature of glasses sample. Transmission Electron Microscope image shows the existence of silver nanoparticles (Ag NPs) in spherical shape. A down conversion emission spectra was carried out under an excitation wavelength of 554 nm, exhibit a single emission band located in the range of 703 nm – 724 nm depending on composition and corresponds to $^4G_{5/2} \rightarrow {}^6H_{11/2}$ transition. The observed enhancement in PL intensity is reflected to the energy transfer from Ag NPs to Sm^{3+} and local field enhancement around Sm^{3+} ions. The mechanism of enhancement is further correlated to Q-factor calculation in order to investigate heat dissipated during non-radiative emission. Result of Q-factor was supported the decrement and enhancement in intensity of PL emission. The praiseworthy characteristics of our findings are extremely beneficial for the fabrication of solid-state lasers, optical and photonic devices.

Keywords: Samarium; Silver Nanoparticles; Amorphous; PL emission; Q-Factor

UTM002

Silver nanoparticle enhanced luminescence of samarium in magnesium tellurite glass: Energy transfer effect

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Abstract. Improving the optical properties of rare earth doped inorganic glasses embedded with metallic nanoparticles (NPs) is a constant challenge in photonics. The main issue being addressed is optimizing NPs concentration in order to meet the requirements for lasing glasses. Glasses sample composition of $88.6TeO_2$-$10MgO$-xSm_2O_3-$(1.4-x)$ AgCl where $x = 0.2 \leq x \leq 1.0$ in mol% have been prepared by using melt quenching technique. X-Ray Diffraction pattern demonstrate a broad hump pattern as a verification to the amorphous nature of glasses sample. Transmission Electron Microscope image shows the existence of silver nanoparticles (Ag NPs) in spherical shape. A down conversion emission spectra was carried out under an excitation wavelength of 554 nm, exhibit a single emission band located in the range of 703 nm – 724 nm depending on composition and corresponds to $^4G_{5/2} \rightarrow {}^6H_{11/2}$ transition. The observed enhancement in PL intensity is reflected to the energy transfer from Ag NPs to Sm^{3+} and local field enhancement around Sm^{3+} ions. The mechanism of enhancement is further correlated to Q-factor calculation in order to investigate heat dissipated during non-radiative emission. Result of Q-factor was supported the decrement and enhancement in intensity of PL emission. The praiseworthy characteristics of our findings are extremely beneficial for the fabrication of solid-state lasers, optical and photonic devices.

Keywords: Samarium; Silver Nanoparticles; Amorphous; PL emission; Q-Factor

UTM007

Modification Strontium Oxide Concentration Stimulated Optical Properties of Er3+/Gd3+/Yb3+ Tri-doped Phosphate Glass

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Abstract. Phosphate glasses have been extensively studied in many fields such photonic applications, solid state laser, optical fiber, biomedical and many more due to their promising properties in several aspects. In particular, phosphate glasses properties such as low melting temperature, prominent transparency for visible light, low refractive index and dispersion, high luminous for ion doped concentration, and large emission and absorption cross sections are advantageous for white light emitting diodes (W-LEDs). But, conventional pure phosphate glasses relatively poor electric and thermal stability, which limits their applications. Glass composition can be optimized by adding other oxides such as Li2O, ZnO and SrO to achieve stable network glass structure. Recently, various type of dopant is being added to achieved desires luminescence and energy transfer properties. In this work, Er3+, Gd3+ and Yb3+ doped to glass system and the concentration decided so that it is compatible with and can improve its function in an application. In order to understand the influence of dopant concentration to properties, determination of the right amount of SrO as modifier in the glass system is also needed. A series of Er3+, Gd3+ and Yb3+ tri-doped phosphate glasses with composition (48.5-x)P2O5 –30Li2O – 20ZnO – (x)SrO, where $0 \leq x \leq 5$ were prepared by melt quenching technique and their spectroscopic characterizations were made. The XRD spectra shows abroad hale which means the nature of the glass is amorphous. Glass samples are characterized via FTIR to examine the SrO concentration dependent structural properties. FTIR spectra revealed broad absorption bands (weak and strong) in wavenumber range of 1400 to 400 cm−1. Thermal properties, including glass transition temperature (Tg), crystallization temperature (Tc), and crystal melting temperature (Tm) were obtained using DTA. The UV-Vis-NIR absorption spectra are recorded in the range of 200-800 nm. Using the UV absorption edge, the values of optical band gap energy (Eopt) and the Urbach energy (ΔE) are evaluated. It is demonstrated that SrO plays the role as an intermediate of glass formation and transforms the role to network-former or glass modifier depending on composition. The role of SrO in influencing the optical responses are analyzed and discussed. It is suggested that SrO contents assisted modification in the structure and absorption behavior is attributed to the relaxing selection rules for forbidden transitions as well as reduction in the multi-phonon relaxation rate. Meanwhile, the observed optical improvements suggest that these glass compositions are potential for development of phosphate glass based efficient solid state laser.

Keywords: Phosphate glass, strontium oxide, erbium, gadolinium, ytterbium, tri-dopant

UKM004

SNR Relaxivity and Uniformity of Agarose Gel Phantom with Gadolinium (III) Oxide and Iron (III) Oxide Solution as Relaxation Modifier

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Abstract. In recent years, novel materials were studied to develop an ideal MRI phantom. In this study, twenty-two agarose gel phantoms with different volume of gadolinium (III) oxide (Gd_2O_3) and iron (III) oxide (Fe_2O_3) were prepared. The aim of this study was to evaluate the signal-to-noise ratio (SNR) relaxivity and uniformity of agarose gel phantoms added with Gd_2O_3 and Fe_2O_3 solutions as relaxation modifier. These relaxation modifiers were used to manipulate the T1 and T2 relaxations of the agarose gel phantoms. The Gd_2O_3 and Fe_2O_3 nanoparticles were diluted with hydrochloric acid (HCl) before being added in systematic proportion to the agarose gel. These phantoms were scanned using a 3-T Siemens Magnetom Skyra MRI machine using Turbo Spin Echo (TSE) puse sequences to produce T1 and T2 measurement images. T1 measurement images were acquired in a range of TRs at a fixed TE, while the T2 measurement images were acquired in a range of TEs at a fixed TR. The SNR of the images were recorded using Image-J software from 1, 3 and 25 regions-of-interest (ROIs). With the inclusion of relaxation modifier, the T1 relaxation of the agarose changed to a much lower time constant while T2 relaxation reveals negative values. The results also show that the SNR of all agarose gel phantoms were uniform for all ROIs. It can be concluded that nanoparticle Gd_2O_3 and Fe_2O_3 dissolved in HCL can be used as effective relaxation modifier to reduce the T1 and T2 relaxation time when it is introduced into the phantoms.

Keywords: Agarose gel, relaxivity, signal uniformity, signal-to-noise ratio, nanoparticle

USM008

Effect of Cerrobend Thickness on Electron Transmission in Megaelectronvolt (MeV) Produced by Clinical Linear Accelerator

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Abstract. Electron therapy requires a highly precision dose to the tumour volume. Hence, beam reshaping during the treatment course is deemed as crucial and very important in order to provide a highly accurate, reliable, and precise beam delivery. This study aimed to investigate the cerrobend material used for attenuating electron beam transmission and its required thickness for various level of megaelectronvolt (MeV) energies. The study was also conducted to determine the appropriate depth of measurement for electron beam transmission. Six different thickness of cerrobend was created ranging from 0.2 cm to 1.8 cm for attenuating four different electron energy, mainly 8, 10, 12 and 18 MeV. A transmission value less than 5% than its controlled value is acceptable for clinical usage. A thickness of 0.4 cm was seen adequate enough to attenuate the electron beam for 8 and 10 MeV to less than 5% from its original values, whereas 0.8 cm and 1.2 cm was seen able to attenuate both 12 and 18 MeV respectively. Since 1.2 cm of cerrobend thickness managed to attenuate up to 18 MeV of electron energy, it was then concluded that a 1.2 cm cerrobend thickness should be the standard 'single thickness for all' in order to avert human error. The study also confirms that the depth of measurement for electron transmission after cerrobend shielding should be measured at 0.0 cm to 0.5 cm to avoid the underestimation of required shielding.

Keywords: Cerrobend Shielding, Electron Transmission, Radiation Shielding.

UITM024

DC Conductivity of $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ Heterogeneous Composite Cathode Prepared by Sol-gel Templating Approach

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Abstract. The $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF) heterogenous composite cathode of nanotubes (NTs) and nanopowders (NPs) are synthesized using the sol-gel templating technique and applied as cathode material to improve the electrochemical properties. The template material used in this work is nanoporous anodic aluminium oxide (NAAO). Firstly, the NAAO templates are fabricated via two-step electrochemical anodization of aluminium at 80 V, 1 minute for the first anodization and 80 V, 2 hours for the second anodization. The sol-gel method is then applied to form the BSCF sol and nanopowders by dissolving Ba^{2+} : Sr^{2+} : Co^{2+} : Fe^{3+} with a ratio of 0.5 : 0.5 : 0.8 : 0.2. The BSCF NTs are synthesized using a combination of sol-gel template and spin-coating techniques and the heterogeneous composite cathode is prepared by mixing 10 wt% BSCF NTs and 90 wt% BSCF NPs. The DC conductivity of BSCF heterogeneous composite cathode material is measured by using the 4-Probe DC technique, which shows that the electrical conductivity of the prepared cathode increases with the increase of temperature.

Keywords: DC Conductivity; SOFC; 4-Probe DC; NAAO template; nanotubes; nanopowders

UPNM008

Aptamer-conjugated gold nanoparticles/ reduced graphene oxide for electrochemical detection of malathion

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Abstract. The widespread use of organophosphorous (OP) compounds in environment has raised serious human health and environmental concerns. The OPs are commonly used as pesticides and insecticides, but also display potential to be employed as chemical warfare agents (CWAs) by terrorist. Thus, the development of chemical sensor with high sensitivity and selectivity towards OPs is of vital importance. Electrochemical sensor is one of the most useful techniques that has been reported for the detection of OPs due to its stability, potential to be miniaturized for on-site detection, and simple measurement procedure. Herein, we have developed an electrochemical sensor for detection of malathion that employs gold nanoparticles (AuNPs) decorated reduced graphene oxide (rGO) modified on screen printed carbon electrode (SPCE) as the sensing platform. Graphene oxide was electrochemically reduced on SPCE and further modified with AuNPs to produce AuNPs/rGO-modified SPCE which was then utilized for the immobilization of thiolated DNA aptamer by self-assembly method. Cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), scanning electron micrograph (SEM) and Fourier-Transform Infrared (FTIR) spectroscopy were utilized to show the successful surface modification of SPCE. The detection was carried out by using EIS and the result shows that the value of charge transfer resistance increased upon binding of malathion to the aptamer-modified electrode indicating the successful formation of malathion-aptamer complex that blocks the electron transfer. This proposed electrochemical sensor provides a sensitive and selective detection of malathion which can be potentially used for application in real samples.

Keywords: chemical sensor, electrochemical, organophosphorous compound

UPNM008

Supercontinuum Generation from Erbium Gallium co-doped Mode-Locked Fiber Laser

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Abstract. We proposed a supercontinuum mode-locked fiber laser using a gain medium which is called Erbium Gallium co-doped fiber (EGDF). The EGDF has an absorption rate of 24.5 dB/m at 981 nm. With a 3-meter-long EGDF utilized as the primary gain medium in the laser system, the proposed laser can generate mode-locked solitons, with a central wavelength of 1560 nm, a 3 dB bandwidth of 3.20 nm, and an average output power of 18.23 mW. The generated pulse yields a repetition rate of 12.25 MHz with pulse duration and pulse energy of 860 fs and 1.49 nJ respectively. A different length of HNLF (200 m and 400 m) as the nonlinear media have been used for comparison purposes. A broader spectral bandwidth has been obtained by the insertion of 400 m HNLF which has a span range from 1530 nm to 2050 nm with a total span of 750 nm. The proposed work is the first time, to the knowledge of the authors, that the application of EGDF as an active gain medium in the development of supercontinuum mode-locked fiber laser.

Keywords: Supercontiuum Generation, Mode-Locked fiber laser, repetition rate, pulse duration, pulse energy.

USIM003

Graphene Oxide Coated Plastic Optical Fiber for Low concentration of Ethanol Detection

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Abstract. Halal food is an Islamic dietary code refers to food that permissible to consume by Muslim. Therefore, the ability to sense low concentration of ethanol rise an urge, especially in food industry. This paper reported the fabrication of ethanol sensor based on unclad plastic optical fiber coated with ZnO and GO. ZnO and GO were synthesized by using simple and low-temperature Hydrothermal method and Modified Hummers' method respectively. Characterization of ZnO coated on glass substrate results in the presence of hexagonal wurtzite structure based on XRD spectra, meanwhile nanorods shape observed by FESEM and high transmittance optical properties is determined by UV-Vis spectrometer. This sensor operates based on evanescent wave absorbance principle. The fabrication of unclad POF comprises of removing POF's cladding by chemical etching process using diluted DI water and sandpaper. The performance of ZnO and GO coated POF towards 0.5% to 3.5% of ethanol were analyzed and compared with unclad POF. It is found that GO coated POF exhibit the highest sensitivity which is 0.2349 a.u/% compared to fiber coated with ZnO 0.0697 a.u/% and without coating 0.0581 a.u/%.

Keywords: Polymer optical fiber; ethanol concentration, zinc oxide, graphene oxide

UITM012

Insight Into Chemical, Optical, Structural And Electrical Properties Of Lead Bromide $PbBr_4^{2-}$ Frameworks Synthesized With Three Different Amino(methyl)pyridines Cations In Acidic Solution

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Abstract. Low-dimensional hybrid perovskites have evolved into an interesting materials platform for optoelectronic applications like solar cells. Despite their widespread use in devices, there is little knowledge of their structure-property correlations. In this study, we investigate the chemical, optical, structural, and electrical properties of various dimensional bromoplumbates frameworks ranging from zero-dimension to two-dimension hybrid perovskite compounds. Three different monosubstituted pyridinium cations of (2-AMP), (3-AMP) and (4-AMP) were synthesized in 90°C-reflux with lead bromide in hydrobromic acid solution. The precipitate crystals were grown via solution-cooling process and their chemical, optical and structural properties were determined. FTIR (cm^{-1} KBr) analysis confirmed the presence of NH_3^+, pyridinium, and Ar-H ions in the produced samples. The characteristic exciton peaks in the UV-Vis absorption spectra of the [(2-AMP)(3-AMP)(4-AMP])$PbBr_4$ series are located at 432 nm, 429 nm and 357 nm. Meanwhile, the optical band gap energy was determined using an extrapolated line from the Tauc plot, yielding values of 2.87, 2.89, and 3.47 eV, respectively. Besides the (4-AMP)-based sample, both [(2-AMP)(3-AMP)]$PbBr_4$ samples emit at 467 nm and 468 nm in photoluminescence spectra under emission mode. In the x-ray diffraction profile, high order diffraction peaks were observed, indicating the formation of a hybrid crystal with layered perovskite structure. Preliminary half-fabricated solar cell devices made as potential light-harvester layers show promising results, with the highest recorded power conversion efficiency of 0.69 percent for the (2-AMP)$PbBr_4$ cell.

Keywords: Amino(methyl)pyridine, hybrid perovskite, low-dimensional, solar cell material.

UITM018

Lithium Triflate Concentration Effect on Electrical and Dielectric Properties of Solid Polymer Electrolytes based Poly (lactic acid) for Electric Double Layer Supercapacitor

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Abstract. Solid polymer electrolytes (SPEs) based on polylactic acid (PLA) with lithium triflate ($LiCF_3SO_3$) were prepared via a solution casting technique. The PLA host was complexed with various concentrations of x% $LiCF_3SO_3$ salt (x = 10, 20, 30, 40, 50). Electrochemical Impedance Spectroscopy (EIS) was used to characterize SPEs, which produced unique results based on varying ionic conductivity levels and dielectric characteristics. The highest ionic conductivity (7.12×10^{-4} S/cm) was obtained by SPEs. The dielectric permittivity has a large magnitude at low frequencies due to the electrode polarization (EP) effect and gradually decreases as the frequency is increased to higher frequencies. SPEs with 50 wt % $LiCF_3SO_3$ salt concentration of PLA showed the highest dielectric constant value due to the dissociation of the highest ions, which participate in polarization. The tangent loss analysis reveals that increasing the amount of $LiCF_3SO_3$ salt in the SPEs results in greater peak values at higher frequencies, higher charge carriers in polymer chains, and lower relaxation time. The increase in the electric modulus, M′ and M′with increasing frequency indicates an increase in charge carrier force in depletion and accumulation region at room temperature.

Keywords: polylactic acid (PLA), lithium triflate ($LiCF_3SO_3$), ionic conductivity, dielectric properties, electrochemically stability

UITM028

Hubbard U Approach on Structural, Electronic and Optical Properties of Kesterite and Stannite Cu_2MnSnS_4 from First-Principles Study

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Abstract. In recent years, the energy harvesting copper-based chalcogenides have been extensively studied as a promising material for thin film solar cell application. In this work, the structural, electronic and optical properties in kesterite and stannite phases of Cu_2MnSnS_4 (CMTS) were investigated via density functional theory (DFT) framework. The Hubbard U term in Cu 3*d*, Mn 3*d*, Sn 5*p* and S 3*p* electrons of both kesterite and stannite CMTS were proposed to analyze the structural, electronic and optical behaviors with the effect of U parameter within Perdew-Burke-Ernzerhof (PBE) functional. The *d*-orbital of Cu and Mn were fixed at 16 eV while the *p* and *d* orbital states of Sn and S were alternately filled with Hubbard U in the range of 5 eV to 10 eV for both kesterite and stannite structures, respectively. The results suggest that the implementation of Hubbard U yields band gap closes to the experimental data. The optical properties such as dielectric function and absorption coefficient were also calculated since it is very crucial finding in solar cell application.

Keywords: Absorption coefficient, Density functional theory, Electronic properties, Hubbard U, Stannite, Thin Film

UITM030

Effect of Stabilization Time on the Electrochemical Performance of a $LaSrCoFeO_3$ Symmetrical Cell

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Abstract. Lanthanum Strontium Cobalt Ferrite Oxide ($LaSrCoFeO_3$) has been commonly employed as a cathode material for the intermediate-temperature solid oxide fuel cells. Many investigations on their electrochemical performance in increasing the ion-conducting behavior at intermediate temperatures have been published in the literature. The common practice before performing the electrochemical impedance spectroscopy (EIS) measurement is to allow a sufficient period of time before the applied sinusoidal signal begins. This study aims to investigate the influence of stabilization time on the electrochemical behavior of a 25-mm diameter symmetrical cell with the configuration of LSCF|BCZY|LSCF (LSCF= LaSrCoFeO and BCZY= Y^{3+} doped $Ba(Ce,Zr)O_3$). The LSCF and BCZY powders are successfully obtained by a sol-gel method and the symmetrical half-cell is fabricated using dry pressing and spin-coating techniques. The EIS results show that at 750°C, the area specific resistance (ASR) of LaSrCoFeO symmetrical cell stabilized in the atmosphere containing air for 24-hrs is 0.57 Ωcm^2, which is significantly lower than the 17-hrs ASR (0.68 Ωcm^2). As a result, it can be stated that there are various variations before performing the EIS, one of which is to ensure that the impedance is evaluated when the system has reached its stationary state by preserving stabilization time at a specific temperature.

Keywords: Proton Ceramic Fuel Cell, LSCF, Polarization resistance, Area Specific Resistance, $Ba(Ce,Zr)O_3$

UITM039

Effect of Fe Dopant in $LiCo_{0.6}Ni_{0.4}O_2$ Cathode Material on Structural Stability and Electrochemical Performances for Li-ion Battery

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Abstract. The mass demand for the usage of rechargeable lithium-ion batteries (LIBs) in various electronic devices has attracted more researchers to search for a new cathode material with better electrochemical performance. $LiNi_{1-x}Co_xO_2$ is one of the most potential cathode materials to be explored as it possesses the advantages of $LiCoO_2$ (LCO) and $LiNiO_2$ (LNO) cathode materials. However, several issues such as fast voltage fading, poor cycle life and poor rate capability of these cathodes need to be resolved before being used for commercial applications. To improve the stability in the $LiCo_{0.6}Ni_{0.4}O_2$ battery system, 5% Fe doping was implemented into the Co site to give $LiCo_{0.55}Ni_{0.4}Fe_{0.05}O_2$ (LCNF) cathode material by combustion method. The synthesized LCNF precursor was further annealed at different temperatures of 700 ºC, 800 ºC, 900 ºC and denoted as LCNF7, LCNF8 and LCNF9 respectively. Based on the XRD results, all Fe-doped materials showed pure and single-phase layered structures. LCNF8 sample exhibits the highest Reference Intensity Ratio (RIR) value of 1.69 which indicates a lower degree of cation mixing and cation ordering compared to others. The higher FWHM of LCNF8 also is evidence of the smaller crystallite sizes upon Fe^{3+} substitution and is supported by FESEM morphology. All materials have a polyhedral-irregular shape with a close stoichiometry of elemental composition with the theoretical stoichiometry. In terms of electrochemical performances, LCNF8 material shows remarkable performances of 126 $mAhg^{-1}$ with 1.5% capacity fading after the 40^{th} cycle. Lower cation mixing and good cation ordering in the LCNF8 material might be the vital factor contributing to the excellent performance of the material. These findings prove that LCN8 material has the potential to be used as cathode materials for lithium-ion batteries.

Keywords: Cathode material; Layered; Fe doped; Li-ion battery

UITM044

$LiNi_{0.3}Mn_{0.3}Co_{0.3}O_2$ (NMC 111) Cathode Material Synthesize *Via* Combustion Method: Effect Of Combustion Fuel On Structure And Morphology

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Abstract. Using different fuels during the synthesis process will affect the phase, morphology, and crystallinity as well as electrochemical performance of the cathode materials. In this work, the synthesis of $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$ (NMC 111) was done using the combustion method. Different fuels such as citric acid, urea, and glycine were used to study the effect on the materials' phase, morphology, and performance. The final products of NMC 111 synthesized using citric acid, glycine and urea were denoted as LC, LG, and LU, respectively. Based on the XRD results, all materials showed a pure, single phase and isostructural with hexagonal α-$NaFeO_2$. LC material shows good cation ordering with a Reference Intensity Ratio (RIR) value of 1.25. Meanwhile, FESEM results revealed that all materials have a morphology of polyhedral-like shape and well-crystallized particles with smooth surfaces. LC material displays a smaller crystallite size compared to the LG and LU materials. From the XRD and FESEM results, LC material has the potential as cathode material that has good cation ordering and a smaller surface area that provided a larger surface area. LC anneal at 800 ˚C for 24 hours shows the highest initial discharge capacity of 130.80 $mAhg^{-1}$ compared with LC anneal at 700 ˚C and 900 ˚C.

Keywords: Cathode, Doped, Combustion, NMC 111, Crystal Structure

UKM008

Dual Electrode Functioning Lithiated Nickel Based for Solid Oxide Fuel Cell

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Abstract. Durability concerns encountered by electrode materials have been a growing focus of research in developing electrode materials. A brand-new emerging configuration in the expanding SOFC application has emerged. This novel form, known as symmetrical SOFC (S-SOFC), is a major topic in fuel cell development. By incorporating lithiated nickel oxide-based materials, which are primarily employed in lithium-ion battery applications and making them viable for S-SOFC applications. Thus, these investigations will concentrate on preliminary research, specifically the characterization and chemical performance of lithiated nickel doped ruthenium, abbreviated as $LN_{1-x}R_xO_2$ (x=0.1,0.2, and 0.3) with various dopant compositions. To simulate the working environment of a dual-functioning electrode, the LNRO-based powder was exposed to analysis in both oxidising and reducing environments. The symmetrical cell with a configuration of LNRO/SDC/LNRO was fabricated via the screen-printing method and heat treated at 800 °C for 2 hours. The samples were further analysed for the electrical conductivity of the electrode and, lastly, for the EIS analysis. The activation energies obtained for LNR1, LNR2 and LNR3 are 0.22, 0.13 and 0.18 eV while in a reduced environment (mixture gas of H2:N2) are 0.04, 0.03 and 0.09 eV. Meanwhile, the ASR value of the best sample LNR2 was obtained from the EIS analysis measured in air and reduced environment at 800 °C are 6.123 Ω cm^2 and 0.281 Ω cm^2, respectively. The finding demonstrated that the dopant utilised in LNR2 had a high potential as an electrode for the S-SOFC application, which is more than just a way to improve SOFC performance.

Keywords: Electrical Conductivity; Electrode; Lithium; Morphology; Resistance; SOFC

UKM016

Effect of Molarity on Structural Properties of Cobalt Oxide Catalyst for Oxygen Reduction Reactions

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Abstract. The design of non-precious metal catalyst with good oxygen reduction (ORR) activity is of great significance for the development and commercialization of fuel cells. However, the sluggish and strong irreversible nature of the oxygen electrochemical kinetics makes it difficult to manufacture this catalyst material. In this study, catalyst based on cobalt oxide-based materials (Co_3O_4) with different structural properties was prepared through a one-pot hydrothermal method and followed by study of the dependence of the electrocatalytic performance of the catalyst on the structural properties of Co_3O_4. From the rotating disk electrode measurement using linear sweep voltammetry (LSV) and Koutechy-Levich analysis, the overall electron number transferred for ORR catalyzed by the optimum catalyst $Co_1$is determined to be 3.8, suggesting that the ORR is dominated by a two-electron transfer process. The defect and catalytic of the catalysts are explored by Raman Spectrometer and X-ray diffraction (XRD).

Keywords: Co_3O_4; molarity; porosity; defect; ORR

UKM018

A Coral-like Mo_2C/TiO_2 composite heterojunction photoelectrode for Photoelectrochemical Water Splitting Application.

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Abstract. The development of photocatalyst nanostructures with effective charge transfer and separation is a notable problem in the development of photoelectrochemical hydrogen (H_2) generation. Titanium dioxide (TiO_2) as the most researched photocatalyst material, has a wide bandgap of ~3.2 eV that limits its absorption energy to UV light, and the photoexcitation products, i.e., electron and hole recombine fast. Thus, band structure modification needs to do, such as by adding other material as co-catalyst. 2D Molybdenum carbide (Mo_2C) has been reported as an effective non-noble cocatalyst is intensively researched in the photocatalytic H_2-evolution field owing to its Pt-like H^+ adsorption ability and good conductivity. In this study, composites of TiO_2 and Mo_2C were prepared and its photocatalytic activities for water splitting evaluated. The composites were prepared by sol gel technique with four compositions variation, and the gel spin-coated onto FTO conducting glass. Observation through Field Emission Scanning Electron Microscope (FESEM) revealed that TiO_2 nanoparticles are highly dispersed over Mo_2C as coral-like structures, while X-ray diffraction (XRD) analysis confirms the presence of composite heterojunction peaks of TiO_2 and Mo_2C. Sample with 3% Mo_2C contain showing highest improvement of photocurrent density about ~1.5 mA cm^{-2} at potential 1.0 V vs Ag/AgCl, which is five times higher than bare TiO_2. Besides that, the onset potential of the composite also shifted to lower potential. This study proves that presence of Mo_2C improve overall photocatalytic performance of TiO_2 photoelectrode.

Keywords: Titanium Dioxide (TiO_2), Molybdenum Carbide (Mo_2C), Photocatalyst, and Mo_2C/TiO_2

UKM019

Photoelectrochemical Activity of Direct and Pulse Electrodeposition Method of Copper Metal on FTO

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Abstract. Electrodeposition is one of the ways that is utilized in a wide variety of applications since it is one of the most easy-to-use and cost-effective approaches. This method's rising popularity can be attributed to its ability to control the morphology and chemical composition of the materials of interest. Copper (Cu) is one of the metals that can be discovered in the greatest abundance on earth, and it has been used as an alternative to noble metals to improve the photocatalytic generation of hydrogen. In this study, copper metal was electrodeposited onto FTO glass substrates by direct and pulse electrodeposition in an electrolyte solution consisting of $CuSO_4 \cdot 5H_2O$ and Na_2SO_4 as the inorganic additive. A thin layer of copper films was electrodeposited effectively onto the FTO glass. In order to investigate the plasmonic photoelectrochemical response of metallic copper, a PEC analysis was carried out on the fabricated thin films. The effects of different electrodeposition methods, applied voltages, electrodeposition times, and pulse cycles on the photocatalytic performance of FTO/Cu samples were analysed in a systematic manner. According to the findings, the FTO/Cu samples that were fabricated using the pulse electrodeposition approach display the most favourable photoelectrochemical performance. It is also shown that their PEC performance can be affected by both the amount of time and the number of pulse cycles used for electrodeposition.

Keywords: Copper, FTO Glass, direct electrodeposition, pulse electrodeposition

UMK017

Improved Sinterability of Lead-Free Potassium Sodium Niobate by Two-Step Sintering Techniques for Green Energy Application

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Abstract. Green energy applications such as piezoelectric energy harvester (PEH) reported an exponential increase due to their unique ability to harness small mechanical energy from the environment into practically used electricity. For some of the criteria of intended PEH, the material should have a small grain size and of near-full theoretical density. In this work, the effect of varying parameters of different temperatures and different soaking times in the two-step sintering (TSS) techniques on the dielectric properties and piezoelectric properties of the undoped Potassium Sodium Niobate was determined systematically and compared with conventional sintering. The samples sintered through TSS possess higher density than conventionally sintered samples, increasing from 90 % to 94 % of theoretical density and reduce the evaporation of alkali metal of host compound. For piezoelectric performance, it's have been improved from d_{33}: ~80 pC/N to ~150 pC/N, k_p ~ 30 % and Q_m ~ 70. This can be translating a better sinterability in the two-step sintering to prepare KNN piezoelectric ceramic.

Keywords: Dielectric Properties, Two-Step Sintering, Lead-Free Potassium Sodium Niobate, Piezoelectric Ceramic.

UNMP001

Effect of Sm and Fe Co-Doping on Structural and Electrical Properties of Ceo_2 for Solid Electrolyte Application

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Abstract. High efficiency and environmental-benign characteristics of solid oxide fuel cell (SOFC) as an energy source have been receiving enormous attention to overcome global warming, pollution and fuel availability issues. Intensive research in SOFC focuses on developing cells that have high electrochemical performances and durability. The solid electrolyte that commonly used in SOFC is samarium doped ceria (SDC) because it has more high oxygen ionic conduction compare to yttria stabilize zirconia (YSZ). In this project, compositional modification of cerium oxide (CeO_2) by double substitution of samarium oxide (Sm_2O_3) and iron oxide (Fe_2O_3) with composition of $Ce_{0.8}Sm_{0.1}Fe_{0.1}O_{1.9}$ was studied. Sample was synthesis via solid state reaction method by mixing the raw materials which is cerium oxide (CeO_2), samarium oxide (Sm_2O_3) and iron oxide (Fe_2O_3), then pressed into pellet, and finally sintered at 1450 °C. Sample was undergo x-ray diffraction (XRD) analysis for phase confirmation, scanning electron microscopy (SEM) analysis for microstructure observation, and impedance measurement for electrical conductivity in order to investigate the influences of the double dopant on the crystal structure, microstructure, and electrical properties. The correlation between the structural properties and electrical properties of $Ce_{0.8}Sm_{0.1}Fe_{0.1}O_{1.9}$ is discussed.

Keywords: solid oxide fuel cell, double dopant, samarium doped ceria (SDC), solid electrolyte, conductivity

UOP001

Microstructural Property and Conductivity Investigation of Bulk NiO-YSZ Electrode with Varying Precursor Particle Size for Solid Oxide Electrochemical Cells

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Abstract. The electrodes in solid oxide electrochemical cell (SOC) applications play an important role in the performance of the electrochemical cell. Desirable properties of the electrode comprise of but are not limited to homogenous microstructure, high electron and ionic conductivity, and high electrochemical active sites. In this study, in order to investigate the effect of precursor particle size to the electrode microstructure and properties, nickel oxide and yttria stabilized zirconia (NiO-YSZ) electrode was synthesized by mixing first NiO and 8 mol% YSZ powders in a planetary ball mill with varying milling speed (400 rpm and 600 rpm) and milling time (10h and 20h) prior to sintering. Structure, morphology, and conductivity properties of the sintered electrodes were investigated. The milling time and speed showed a different obtained particle size of NiO-YSZ precursor composite powders. As revealed from particle size analysis (PSA), higher milling speed and milling time promoted increase in particle size due to agglomeration. SEM-EDX mapping revealed a porous and homogeneous elemental distribution of the composites. In addition, X-ray diffraction (XRD) peaks of the sintered samples showed the successful synthesis of the NiO-YSZ electrode which can both be indexed to a cubic structure. Electrochemical properties such as conductivity will be reported.

Keywords: solid oxide electrochemical cells, NiO-YSZ electrode, planetary ball milling, particle size

USZA001

Tailoring Activity on Effect of Loadings over Praseodymium Oxide Catalyst in Methanation

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Abstract. A series of praseodymium oxide has been prepared using wet impregnation method. The potential Ru/Mn/Pr (5:30:65)/Al_2O_3 catalyst calcined at 800ºC using one series reactor, achieved 96% of CO_2 conversion. This catalyst has been further studied by various based loading from 60 wt% to 85 wt%. When Pr loading was increased up to 85 wt%, the CO_2 conversion was slightly decreased. When using two series furnace reactors, the potential catalysts showed an increasing of CO_2 conversion and CH_4 formation. X-ray diffraction analysis showed that the catalysts exist in an amorphous phase and the active species in the catalyst were MnO_2, and Pr_2O_3. While, Field Emission Scanning Electron Microscopy analysis illustrated the catalyst surface was covered with small and dispersed particles with undefined shape. Electron dispersive X-ray analysis revealed that all the element of active species presence on the catalyst surface. Nitrogen gas adsorption showed that the catalysts were mesoporous with type H3 hysteresis loop and Type IV isotherm.

Keywords: methanation, praseodymium, catalyst, active species

UTEM002

Surface Engineering of ZnO Thin Film for the Growth of $MAPbI_3$ Perovskite Layer

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Abstract. Organometal halide perovskite solar cells (PSCs) produce low-cost photovoltaic systems that have led to power conversion efficiencies of over 21%. Electron transport layer (ETL) is essential in the fabrication of PSCs that are generally composed of zinc oxide (ZnO), which is often regarded as a possible replacement material for titanium dioxide (TiO_2) because of its equivalent bandgap and electron injection efficiency. The growth of the perovskite layer is crucial in developing planar structure PSCs due to the heat instability of perovskite coatings on top of ZnO and a large concentration of –OH agents by ZnO, which decompose into methylamine and lead iodide. In this work, the influence of different preparation of ETL layer using ZnO (dry and wet) and graphite polymer as an interfacial layer spin-coated on the growth of perovskite layer ($MAPbI_3$) was investigated. The samples were characterized using X-ray powder diffraction (XRD), UV-Vis spectroscopy, and Scanning electron microscopy (SEM) to examine their morphological, structural and optical properties. The XRD and SEM results demonstrated that wet ZnO and graphite polymer had reduced the PbI_2 peak, indicating enhanced stability compared to dried ZnO. Furthermore, UV-Vis results revealed that in the visible region, the wet ZnO showed a broad bandgap of 1.30eV. These findings are helpful for the deposition of the perovskite layer on ZnO and attractive contenders for various other perovskite materials.

Keywords: Perovskite solar cells; zinc oxide; graphite polymer; electron transport layer

UTM008

Optimization Study By Box-Behnken Design (BBD) Of Biodiesel Production From Waste Cooking Oil Using Modified Alumina-Supported Potassium Oxide Catalyst

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Abstract. Optimization study for the heterogeneous catalysts in biodiesel production are vital to enhance productivity. However, one-factor optimization with more experimental trials requires longer experiment time and high cost of chemical reagents used. Therefore, this research focused on optimization of modified alumina-supported potassium oxide catalyst using the Box-Behnken design of the Response Surface Method. Catalysts were synthesized by using the modified wetness impregnation method by incorporating palm oil leaves extract to the catalyst solution and various preparation parameters such as calcination temperature, potassium nitrate loadings and dosage of palm oil leaves were optimized. Catalytic activity of the catalyst was measured using gas chromatography-flame ionization detector (GC-FID). ANOVA analysis showed good agreement between predicted and experimental yield with $R^2 = 0.9733$. 30 wt.% of KNO_3 loadings, 1.0 g of palm oil leaves catalyst calcined at 700℃, produced the highest biodiesel yield of 89.0% from waste cooking oil. The optimum condition suggested by this model was at 35 wt.% of KNO_3 loadings, 1.0 g dosage of palm oil leaves and calcined at 754℃ with prediction of 96.79% of biodiesel yield. 93.0% of biodiesel yield was obtained with a percent error difference of 3.90% compared with model prediction.

Keywords: Biodiesel, catalyst, potassium, transesterification reaction, waste cooking oil

OTRS008

Effects of Air Gap Size to Static Properties of Laser Welded Ultra-High-Strength Steel Lap Joints

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Abstract. Laser welding of ultra-high-strength (UHS) abrasion resistant steel involves challenges that need to be solved before laser welded structures made from UHS steels can be utilized effectively. This paper investigates effects of air gap size to static properties of laser welded UHS steel lap joints. Test material was abrasion resistant steel (AR600) with a tensile strength (Rm) > 2 GPa. Three different energy inputs were used in the welding experiments (60, 160 and 320 J/mm). The effect of the air gap size on the morphology of the joints was examined with a microscope. The static properties of the lap joints were evaluated by hardness measurements and shear strength tests. The results showed that energy input markedly affects the width of the weld at the interface of the sheets. The width of the weld with energy input of 60 J/mm increased by 137% as the air gap increased from 0 mm to 0.4 mm. Increasing the air gap increased the shear strength of the joints with all energy inputs. The shear strength of the joint increased by 55% with energy input of 160 J/mm when the air gap increased from 0 to 0.4 mm. A maximum joint strength of 681 MPa was achieved with energy input of 320 J/mm and 0.3 mm air gap. Overall, we conclude that by using an air gap in laser welded lap joints, the properties of the joint can be significantly improved, but when the air gap is too large, the properties of the joint deteriorate.

Keywords: Laser welding; ultra-high-strength steel; abrasion resistant steel; lap joint; shear strength

UMK026

Effect of *Shewanella oneidensis* MR-1 on Microbial Influenced Corrosion

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Abstract. Iron-reducing bacteria (IRB) play important roles in geochemical cycling of iron. Under anaerobic conditions, IRB are capable of reducing iron (III) to iron (II). Despite its direct involvement in iron redox reactions, the role of IRB in Microbial Influenced Corrosion (MIC) remains unclear. There were contradicted report on whether IRB inhibit or enhance corrosion during MIC. In this study, the effect of the IRB model strain, *Shewanella oneidensis* MR-1 on MIC of iron nail will be investigated. Iron nail was incubated into two different media consisting rich media, Luria-Bertani (LB) and minimal M1 media amended with hydrous ferric oxide (HFO) as the sole electron acceptor culturing IRB strain anaerobically. The corrosive assessment involved incubation at room temperature for 30 days and measurement of Fe (II) concentrations for abiotic control and biotic conditions by Ferrozine assay. The results suggested *S. oneidensis* MR-1 cultured in LB rich media enhance corrosion with the increasing of iron (III) reduction activity by approximately 2-folds compared to minimal M1 media. Observations on surface morphology of the iron nail via Scanning electron microscopy (SEM) confirmed formation of excessive crack structures indicating iron oxides as product of corrosion after 30 days. Results from this study provide insight on how IRB affect corrosion acceleration behavior in different growth media.

Keywords: *Shewanella oneidensis* MR-1, Iron-reducing bacteria (IRB), Microbial Influenced Corrosion (MIC), Fe (II) concentration, Scanning Electron Microscopy (SEM)

UTEM001

The Influence of Gas Pressure on the Bonding Mechanism of Cold Sprayed Titanium Dioxide Coatings on Pure Metals

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Abstract. It is widely accepted that the cold spraying of ceramic materials can be challenging because cold spraying requires plastic deformation of the feedstock particles for adhesion to the substrate. The problem lies in the difficulty of plastically deforming hard and brittle ceramic materials such as TiO_2. On top of that, the primary bonding mechanism of TiO_2 particle and pure metals is metallurgical bonding which required free oxide surface. Different gas pressure will influence particle velocity and kinetic energy. This kinetic energy is required to remove remaining oxide layer on substrate surface in order for metallurgical bonding to perform. The results showed increasing trend in the adhesion strength of the coating 1.52 to 3.46 MPa for C1020 and 0.45 to 4.15 MPa for AA1050, with an increase in the process gas pressure from 0.7 to 3.0 MPa. Higher gas pressure during the cold spray process may remove surface oxidation and promote intimate contact between TiO_2 and the pure metals substrate surface through metallurgical bonding and contributing to the increasing trend of coating adhesion strength.

Keywords: Cold spray, Aluminum, oxide thickness, bonding mechanism, titanium dioxide.

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UMK034

Physical Properties of Clay River areas in Kelantan Districts (Tanah Merah, Kota Bharu, Lojing and Pasir Puteh)

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Abstract. The clay areas in Kelantan involved in this research are Kampung Gual Ipoh in Tanah Merah, Kampung Bukit Gedombak in Pasir Puteh, Kampung Kor in Kota Bharu and Kampung Pos Handdrop in Lojing. All clay samples were taken from rivers located in four districts in Kelantan. This study is to determine and compare the properties of clay present in the area because Kelantan still lacks quality clay data for reference by entrepreneurs and the community. In this study, clay samples were prepared by the casting method and baked at 1200°C for 8 hours. The physical properties tests conducted were shrinkage, density, porosity, and SEM. The shrinkage percentage of clay samples in Kota Bharu was the highest, compared to other districts. The results from this study found that the clay from Kota Bharu has the highest density and lowest porosity compared to samples from other districts. From the SEM observation, it was found that the particle size distribution in Tanah Merah district sample was highest, followed by Lojing district, Kota Bharu and Pasir Puteh. Although all the clay samples were taken from rivers, the experimental results showed that the physical properties of clay were different.

Keywords: Clay; Kelantan; properties of clay

UITM029

Effect of in-situ thermal annealing on the structural and optical properties of In_2O_3 nanowire

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Abstract. Indium oxide (In_2O_3) nanowires and In_2O_3 composite nanowires were deposited onto crystalline Silicon (c-Si) substrate by plasma assisted reactive thermal evaporation (PARTE) and nitrogen plasma assisted in-situ thermal annealing, respectively. The nitrogen plasma assisted in-situ thermal annealing demonstrated a morphological evolution from tapered nanowires to widened nanowires due to formation of tungsten nitride (W_2N) layer as a composite nanowire. The X-ray Diffraction (XRD) patterns were used to determine the crystallinities of the nanowires which reveal the formation of cubic structure for both In_2O_3 and W_2N. The optical bandgap of the studied nanowires decreases from 2.49 to 2.40 eV attributed to the incorporation of W_2N in the nanowire.

Keywords: Indium oxide, Nanowire, In-situ thermal annealing

UKM015

Achieving Stable Room-Temperature Ferromagnetism and p-Type Conductivity in Li:ZnO Nanowires

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Abstract. Over the past decades, wide bandgap diluted magnetic semiconductor nanomaterials characteristics has been more significant in spintronic technology. Material scientists are working on synthesizing high-quality magnetic semiconductors at room temperature. The stable p-type ZnO is an essential challenge that might be accomplished by partially substituting Zn^{2+} in the ZnO lattice with certain magnetic or non-magnetic ions. Consequently, it is necessary to understand the effect of dopant incorporation into ZnO in detail. Hydrothermal approach was used to produce Li-doped ZnO NWs. The XRD results revealed that the nanowires (NWs) had wurtzite crystal structure and high intensity at the (002) peak, indicating that the hexagonal face of the NWs is responsible for the majority of the reflection. The TEM results are found to be consistent with XRD results. The FESEM results revealed that the grown NWs had a preferential orientation along the c-axis in the (001) direction owing to its anisotropic nature. The XPS analyses confirmed the presence of Li in all of the doped samples. UV-Vis investigation revealed a reduction in optical bandgap after doping, which is most likely owing to the sp-d exchange interaction between dopant localized d-electrons and band electrons. According to the Raman data, the ZnO NWs included crystallization with few defects following Li-doping. The overall magnetization is enhanced at low Li acceptor concentrations, but the ferromagnetism is decreased at higher Li concentrations due to induced magnetic moments on the oxygens. Our findings ae are likely to play a key role in the development of spintronic devices.

Keywords: room-temperature ferromagnetism, doped ZnO, nanowires, p-type conductivity, hydrothermal process

UKM020

Microplasma Assisted Synthesis of Nickel Oxide Nanostructures for Photodegradation of Organic Dye

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Abstract. In the current study, nickel oxide (NiO) nanostructures were synthesized via the microplasma technique to photodegrade organic dye. This is environmentally safe, fast, and non-toxic. The cubic structure with size 36.7nm of synthesized sample is observed by X-ray diffraction (XRD) analysis and spherical like morphology is obtained by scanning electron microscope (SEM). The energy band gap of synthesized nanomaterials, as determined by ultraviolet-visible spectroscopy (UV-Vis spectroscopy), is approximately 3.8eV, while the vibrational mode of the NiO phase, as determined by fourier transforms infrared spectroscopy (FTIR) spectroscopy, is obtained at 682.94 cm^{-1}. Finally, the synthesized NiO nanostructures have been used to degrade the methyl orange dye in the presence of sunlight, and it has been observed that the degradation efficiency is increasing with the passing of irradiation time. The results showed that 80 % of the methyl orange dye was successfully removed by the synthesized nickel oxide photo-catalyst.

Keywords: Nickel Oxide, Microplasma, Photodegradation

UM005

Electrical Properties of ZnO Nanoparticles-based Interdigitated ITO Devices

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Abstract. In this work, zinc oxide (ZnO) nanoparticles thin film was synthesized using the sol-gel method, prior deposited on top of interdigitated indium tin oxide (ITO) using the spin-coating technique. The electrical properties of the ZnO nanofilm were characterized and analyzed using a source measure unit system. It was found that the ZnO device exhibited a prominent hysteresis current-voltage behavior in both positive and negative voltage regions, known as the bipolar effect. The device showed a reduction in current when the UV light was irradiated due to an increase in the photoluminescence mechanism when voltage was applied to the device. The device demonstrates high responsivity towards humidity from human breathing.

Keywords: ZnO nanoparticles, interdigitated ITO electrodes, electrical properties, UV response, humidity response.

UMT005

Closing the loop: synthesized silica nanoparticles foliar from rice husk for paddy plants

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Abstract

Rice production is widespread as a staple food crop that makes up the dominant part of a population's diet. This is reflected in massive by-product generation from the rice milling industry, primarily in rice husk ash. Approximately 108 tons of rice husks worldwide are disposed of annually. However, rice husks are either recycled only for low-value products or burned. To close the recycling loop, we extract silica nanoparticles from rice husk (MR219 rice variety) and convert them into foliar to enhance paddy yield. Taking the advantages of interconnected porous silica (ca. 15-28 wt %) and lignocellulose (ca. 72-85 wt%) structures that existed naturally in rice husk, spherical silica nanoparticles (SiNP) ranging from 50 nm - 70 nm were synthesised via facile hydrothermal synthesis with a prior low temperature heat treatment at 500 °C. X-ray diffraction (XRD) analysis showed that the obtained SiNP exhibited an amorphous phase. These SiNP were dispersed in distilled water, forming silica nanofoliar (liquid fertilizer). The dispersibility and pH stability of the silica nanofoliar were evaluated across 30 days. Silica nanofoliar with 600 ppm showed the optimum results with no sedimentation and unchanged particle size. Subsequently, the silica nanofoliar was applied through spraying to Uputra paddy seeds. Responses in seed germination, plant height, root and shoot lengths, root volume and paddy leaves' chlorophyll content were also evaluated. This work demonstrated that paddy seed germination and plant growth significantly improved under silica nanofoliar 600 ppm application. Hence, SiNP originated from rice husk and synergistically acted as a fertilizer to enhance rice cultivation, leading to a close-loop recycling.

Keywords: Rice husk, Silica nanoparticles, Foliar spray

UPM006

Hydroxyapatite/Montmorillonite Nanocomposite as a Bone Tissue Engineering and Anti-Cancer Drug Delivery Agent for Cloxacillin

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Abstract. A nanocomposite was prepared by mixing hydroxyapatite (HA) and montmorillonite (MMT) powder for the formation of HA/MMT nanocomposite by the sintering technique, and subsequently loaded with a bone anti-cancer drug, cloxacillin (CLX) as a delivery agent for the drug and at the same time mimicking the human bones for bone rejuvenation treatment. Powder sintering of the green body was accomplished at various HA/MMT ratios and it was found that the addition of 20 w/w% of montmorillonite into the hydroxyapatite with the sintering temperature of 800 °C significantly increased the compressive strength of the nanocomposite by 5 folds, from 85 MPa to 422 MPa with the optimum value of the BET specific surface area of 15 m^2/g. This shows the sintering process resulted in the development of pores of the samples and the pore volume was found to be reduced when the sintering temperature was increased. The pore development was found to be useful to host the bone anticancer drug, cloxacillin as well as prolong the release of the drug. This paves the new way for a simple up-conversion of HA using MMT via the sintering process for bifunctional purposes; bone tissue engineering and drug delivery agent.

Keywords: Porous ceramic, montmorillonite clay, conventional sintering technique, controlled release

UPNM005

Optical and Morphology of Self Assembled Polyhexylthiophene (P3HT) Nanowires

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Abstract. Poly (3-hexylthiophene-2, 5-diyl) (P3HT) is a well-known p-type semiconductor for optoelectronic application with bandgap ~ 1.9 eV. It is believed that the nanowires form of the polymer offers better structure, stability and carrier pathways as electronic device. In this study, P3HT nanowires formed by aggregation under dark for 72h in partial solvent, toluene. In order to investigate the change in polymer chain entanglement, UV-Vis absorption, FTIR and Raman spectra of both P3HT nanowires film and P3HT amorphous film were analysed. The result show that the absorption peak of P3HT nanowires blue shifted to higher energy implying widening bandgap. This electronic change is supported by FTIR and Raman result that implied increasing of P3HT conjugation length with nanowire formation. It is estimated that the diameter size of P3HT nanowires were around 10 – 20 nm. Increase in conjugation length drive by π-π stacking interaction implied better performance in application such as charge carrier layer and photon absorber.

Keywords: P3HT, Nanowires, UV-Vis absorption, Morphology, Raman

UPNM009

Quantitative Determination of Malathion by Application of Colorimetric and Image Processing Techniques

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Abstract. A simple, rapid and sensitive aptamer-gold nanoparticle-based colorimetric assay coupled with an image analysis technique was developed for the quantitative determination of malathion (MLT) insecticide. The effect of different variables including concentrations of cit-AuNPs and DNA aptamers on the sensing were investigated and optimised. The detection of MLT was based on color change (red wine to blue-purple) due to aggregation of citrate-capped gold nanoparticles (cit-AuNPs). Color images of the solutions were analyzed to obtain red, green, and blue (RGB) values, where the response of the sensor was reported as ΔRGB. The good linear relationship between the response and concentration of MLT proves that the developed aptasensor can be applied for the quantitative determination of MLT.

Keywords: aptasensor, colorimetric, gold nanoparticles, image processing, malathion

UPSI002

Judd-Ofelt Intensity Parameters and Luminescence Analysis of Reduced Graphene Oxide-coated Tellurite Glass for Fiber Optics

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Abstract. Reduced graphene oxide-coated tellurite glass doped with erbium nanoparticles denoted as ZBTEr (NPs)-rGO was studied as an approach to enhance the optical properties of glass materials. Herein, a melt-quenched method was used to prepare the ZBTEr (NPs)-rGO glasses meanwhile, a low-cost spray coating method was employed to deposit the rGO onto the glass surfaces directly. The morphological studies of ZBTEr (NPs)-rGO glass were investigated by scanning electron microscopy (SEM), revealing the oxygen functionalized and agglomerated structures on the glass surfaces. TEM micrographs prove the existence of Er (NPs) with average diameters ranging from 20.07 to 23.52 nm, respectively. The presence of structural disorder and amorphous nature of glasses were confirmed by the XRD pattern. Judd-Ofelt analysis was studied to obtain the intensity parameters (Ω_λ), radiative transition (A), branching ratio (β_R), and radiative lifetimes (t_r). The radiative parameter and branching ratio values suggested that the $^2H_{11/2} \rightarrow {}^4I_{15/2}$ transition has a higher stimulated emission radiative than other transitions, which corresponds to the strong green emission. The luminescence spectra exhibited two emission peaks centered at 539 nm and 558 nm which were assigned to $^2H_{11/2} \rightarrow {}^4I_{15/2}$ and $^4S_{3/2} \rightarrow {}^4I_{15/2}$ transitions, respectively. These findings highlight the significant effects of rGO deposited onto tellurite-based glass; hence, this study proposed the potential coating materials for improving the current fiber optics applications.

Keywords: Reduced graphene oxide; Judd-Ofelt; Luminescence

UTHM003

C-V Characteristics of Dilute Nitride p-i-n Diode with Multiple Quantum Wells (MQWs)

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Abstract. We investigated the capacitance-voltage properties of dilute nitride p-i-n diodes with multiple quantum wells (MQWs) using impedance spectroscopy at frequency ranges 1kHz to 1 MHz. Three size variations of MQWs were grown on highly n-doped (100)-oriented GaAs using the VG V80 Molecular Beam Epitaxy (MBE) system. At high current injection, the forward bias displays a strong size-dependent behaviour. Greater current density is measured at the same applied bias voltage for smaller areas. C-V characteristics showed the same size-dependent behaviour of the highest capacitance value for a smaller MQWs device. At higher forward bias, all devices experience extremely low negative capacitance (NC) values, and NC values get smaller as the frequency increases. The C-V analysis of the devices shows that quantum well active area sizes significantly affect the characteristics of the diode devices

Keywords: Multiple quantum wells (MQWs), dilute nitride, C-V

UMK045

Analysis Of Stable Phase Change Material Made Using Rubberwood Biochar for Thermal Energy Storage

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Abstract. This work analyses the stability of phase change materials after being mixed with rubber wood biochar for thermal energy storage. Stable phase change materials are getting much attention from around the globe these days as it provides better functionality specifically to regulate temperature changes during day and night time in building construction elements. These experiment focuses on conducting three main sections, to obtain the optimum impregnation percentage of rubberwood for the phase change material to take place, to evaluate the effect of phase change material on the heat transfer properties of wood composites, and to measure the physical and mechanical properties of wood composites with shape-stabilized palmitic acid/decanoic acid as phase change material. Rubberwood particles were pyrolyzed before mixed with palmitic acid and decanoic acid, respectively. Testing of leakage and thermal conductivity were carried out for both mixtures. Mechanical evaluation on wood composites made with the wood mixtures were also carried out.

Keywords: biochar; phase change material; wood composite; palmitic acid; decanoic acid

UPM013

Sensitivity Enhancement of Surface Plasmon Resonance Optical Sensor for the Detection of Dopamine

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Abstract. Dopamine (DA) is an important neurotransmitter that plays several key functions in human health related to the central nervous, cardiovascular, and hormonal systems. It impacts neural plasticity as well as numerous brain processes as a significant neuromodulator. Some mental and physical disorders, such as Parkinson's disease, schizophrenia, Alzheimer's disease, and depression, may be caused by low DA concentrations. The development of extremely sensitive and selective sensors capable of detecting DA in vivo and in vitro is critical for early clinical diagnosis, therapy efficacy monitoring, and disease prevention. In recent years, massive efforts have been deployed to develop several methods. However, most of them have disadvantages that hinder them from satisfying the rising demands for precise, easy, and efficient sensing. Surface plasmon resonance (SPR) sensor has recently emerged as a potential technique for label-free, real-time monitoring of various biomolecular interactions with high responsiveness and accuracy. However, to monitor normal or extremely low levels of DA using SPR sensor, the sensitivity of the sensor must be enhanced. The modification of the sensor chip with carbon-based nanomaterials and the biopolymer chitosan contributed to improve the sensor sensitivity. Both developed SPR sensors based on graphene quantum dots/chitosan and carbon quantum dots exhibited outstanding performance in the direct and ultrasensitive detection of DA with detection limits of 1 fM and 0.01 pM, respectively. The simple design, high sensitivity, and other sensing capabilities of the developed SPR sensors qualify them to serve as a viable platform for direct measurement of DA.

Keywords: Neurotransmitters, dopamine, surface plasmon resonance, optical sensor, carbon materials, biopolymer, sensitivity enhancement.

USM003

Photonic Crystal Directional Coupler with Cavity Filter for Wavelength Division Multiplexing Applications

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Abstract. Photonic crystals have been considered as building blocks for modern wavelength division multiplexing (WDM) applications. Here a two dimensional (2-D) photonic crystal structure based on a serial directional coupler and resonant cavity filter is simulated, using silicon rods as high index material on silicon dioxide as low index material, of which there are no air gaps. Simulation was performed using plane wave expansion (PWE) and finite-difference time-domain (FDTD) methods utilizing OptiFDTD 32-bit software by Optiwave. Directional coupler demonstrated the demultiplexing of two wavelengths of 1.31μm and 1.55μm and the fine filter region gives series of spectrum over the 1.55 μm bandwidth where filter group distances from one another; cavity rod size, and positioning of point defect filters adjacent to the input bus from the directional coupler output are shown to play important roles. Photonic band gap map for silicon rods on silicon dioxide with no air gaps suggests lower PBG bandwidth than rods on air.

Keywords: plane wave expansion (PWE), finite-difference time-domain (FDTD), wavelength division multiplexing (WDM), photonic band gap (PBG), photonic crystals (PhC), line defects, point defects, directional coupler, cavity filter

UITM015

Preparation of Crosslinked Chitosan/Eggshell/TiO_2 Beads and Their Application in Methyl Orange Adsorption from Aqueous Solution

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Abstract. The use of low-cost and environmentally friendly sorbents has been investigated as a viable alternative to the present high-cost methods of removing dyes from wastewater. This study synthesised chitosan/eggshell/TiO_2 (CS/ES/TiO_2) beads using benzaldehyde, salicylaldehyde, and benzil as the crosslinkers via the hydrothermal method. The CS/ES/TiO_2 composite was then investigated for its properties, including basic characterisations and methyl orange (MO) elimination capability. The obtained beads were characterised using FTIR, FESEM, and XRD analysis. FTIR and FESEM data confirmed the formation of chitosan/eggshell/TiO_2 composites. The adsorption of MO from an aqueous solution was subsequently examined using the synthesised composite beads. CS/ES/TiO_2-benzaldehyde exhibits the highest adsorption performance with an 87.4% removal of MO under the following conditions: pH = 5; initial MO concentration = 10 ppm; adsorbent dose = 0.3 g; contact time = 180 minutes. This work features that CS/ES/TiO_2-benzaldehyde composite can be considered a suitable and effective adsorbent for removing MO from an aqueous solution.

Keywords: Adsorption, Chitosan, Eggshell, Methyl orange, TiO_2

UITM052

The Physical Properties of Polyurethane as Concrete Raising Material

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Abstract. The construction industry in Malaysia uses asphalt and concrete to make pavement. 22% of expressways in Malaysia use concrete pavement because it is highly durable and environmentally friendly. However, they faced a few problems, such as unleveled slabs, surface cracks and holes. Nowadays, polyurethane (PU) derived from petrochemicals acts as adhesive, sealant and grouting material. Petroleum-based polyurethane (PPU) provided by Al-Fazance Sdn. Bhd was synthesized with three different ratios of polyol and isocyanate to study their physical properties. The ratios are 1:1, 0.5:1, and 0.5:1. All the produced samples were tested on their cream time, rise time, gel time and tack free time (characterization time), density, rheology and hardness. The average characterization time for the ratio of 1:1 was 240 seconds, which is 230-280 seconds in range for industrial polyurethane. All other ratios have a lower average density than the 1:1 ratio, which is 56.0 g/cm3. The rheology index shows the viscosity of the material and the ability of the material to expand and flow. PPUs with a 1:1 ratio travel the farthest distance among the other ratios, indicate low viscosity and are suitable as grouting material. The maximum hardness PPU of 1:1 can achieve 25 N/mm2. The hardness of the other ratios cannot be made as it is not suitable for testing. From the outcome, it shows that 1:1 is the best ratio with good physical properties in characterization time, density, rheology and hardness and could be applied in the concrete raising material.

Keywords: Petroleum based polyurethane, Rigid polyurethane, Grouting material, Physical properties, Concrete raising material

UKM006

Zinc Oxide-filled Polyvinyl Alcohol-cellulose Nanofibril Aerogel Nanocomposites for Catalytic Decomposition of Methylene Blue Solution

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Abstract. The preparation of polyvinyl alcohol/cellulose nanofibril (PVA—CNF) aerogel nanocomposites loaded with zinc oxide (ZnO) particles via the freeze-thaw process, followed by subsequent in-situ synthesis of ZnO particles using zinc chloride and ammonium solution. The aerogel samples were characterized using scanning electron microscopy, Fourier transform infrared spectroscopy, thermogravimetric analysis, X-ray diffraction, and Brunauer-Emmet-Teller analysis. The aerogels were used for decoloration of in aqueous methylene blue (MB) solution via simultaneous adsorption and catalytic degradation with sodium borohydride. The adsorption behavior of MB on the aerogel was investigated with the aid of kinetics and isotherm models and found to fit the Langmuir model, which suggested monolayer adsorption of dye with maximum adsorption capacity of 24.5 mg/g. The presence of ZnO particles in the stable and reusable crosslinked PVA-CNF aerogel has improved the removal of MB as high as two folds after ten cycles of treatment.

Keywords: Adsorption isotherm, Catalytic Dye Degradation, Nanocellulose

UMK002

Preparation and Characterization of Polyvinyl Alcohol (PVA) / Cellulose Nanocrystal (CNC) / Zinc Oxide (ZnO) Nanocomposites

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Abstract. In this study, cellulose nanocrystals (CNC) and commercial zinc oxide (ZnO) were prepared as a hybrid filler to reinforce the polyvinyl alcohol (PVA) matrix. Initially, the different concentrations of CNC (1wt%, 2wt%, 3wt% and 4 wt%) were mixed with ZnO and the mixture was characterized for stability and Attenuated Total Reflection- Fourier Transform Infrared (ATR-FTIR). The prepared CNC/ZnO hybrid filler (with different ratio) then was added to 50 mL of 5 wt% PVA and vigorously mixed for 40 minutes at 90°C until the mixture was completely homogeneous and well mixed. The prepared PVA/CNC/ZnO nanocomposites were then characterized using visual inspection, scanning electron microscopy (SEM) and thermogravimetric analysis (TGA). The results found that the CNC/ZnO mixture was homogenous and well dispersed up to 90 days. The FTIR-ATR spectra revealed the presence of the stretching and bending vibrations of the hydroxyl group (1635 cm^{-l}), O-H bending and C-O-C stretching (3318 cm^{-1}). Visual inspection of PVA/CNC/ZnO nanocomposites showed that increasing the weight ratio of CNC/ZnO in nanocomposite thin films leads in opaquer and whiter thin films while the SEM revealed the surface morphology of PVA blend integration with CNC/ZnO became rougher as the ratio increased. TGA analysis showed the highest thermal stability with the higher concentration of CNC/ZnO hybrid filler compared to the rest of thin films. The prepared CNC/ZnO/PVA nanocomposites could be potentially used for biodegradable food packaging application.

Keywords: Cellulose nanocrystals, ZnO, hybrid nanofiller, PVA, biodegradable

UMK015

Kinetic Studies of Zinc (II) ions Removal from Aqueous Solution using Polymer Inclusion membranes (PIMs)

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Abstract. PIM was applied as an extractor to remove zn^{2+} from aqueous solution for its straightforward and effective methods. Researchers also found that the method used is more cost-effective and excellent performance compared to other zn^{2+} extraction methods. The PIM is composed of poly(vinyl) chloride (PVC) as the base polymer, bis-(2-ethylhexyl) phosphate (B2EHP) as an extractanting agent, dioctyl phthalate (DOP) as the plasticizer with the solvent of Tetrahydrofuran (THF). The formulations of component compositions were varied to identify the optimal membrane composition as well as the efficiency of extraction aptitude. Various parameters such as effect of carrier, initial zn^{2+} concentrations and different receiving agent concentrations were investigated. The results revealed that the optimum extraction of zn^{2+} using PIMs were found to be at composition R5, 30 % of B2EHP carrier which performed best on 10 mg/L of initial concentration zn^{2+} at 1.0 M nitric acid of receiving agent concentration. Kinetic modelling of extraction process of zn^{2+} removal mechanism was analysed using the pseudo-first-order and pseudo-second-order on the parameters of different initial zn^{2+} concentrations and different receiver solution concentrations. The kinetic model of pseudo-first-order fits rather well with the kinetic data obtained. The highest percentage removal of zn^{2+} was 97.12%, demonstrating that PIMs have the ability to successfully remove the zn^{2+} concentration.

Keywords: Polymer inclusion membrane, poly(vinyl chloride), dioctyl phthalate, bis-(2-ethylhexyl) phosphate, Zinc (II) ions, Extraction, Back-extraction, Kinetic study

UMP003

Effect of Nanoclay on Mechanical, Thermal and Morphological Properties of Kenaf Recycle Polyethylene Wood Plastic Composites

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Abstract. Recycle wood plastic composites (WrPC) was prepared using kenaf wood flour, recycle polyethylene (rPE) and maleic anhydride polyethylene (MAPE) in the presence of nanoclay filler. Kenaf wood flour, rPE, MAPE and nanoclay were premixed manually and fed into single-screw extruder. Universal Tensile Machine (UTM) and Izod Impact were used to study the mechanical properties. Differential Scanning Calorimeter (DSC) and Thermal Gravimetric Analysis (TGA) were used to study the thermal properties. Scanning Electron Microscope (SEM) was used to observe the morphology. The effect of nanoclay on the mechanical properties, thermal properties and morphology were studied. Tensile strength of WrPC was decreased from 14.67 MPa to 14.07 MPa due to the agglomeration of nanoclay layer. Impact strength was increased from 6.07 kJ/m2 to 8.22 kJ/m2 due to the effectiveness distribution of applied stress to overcome the crack. Only one peak of glass transition temperature, T_g appeared at 133.5 °C as a result of miscible blending. Decomposition of WrPC was slightly affected by the addition of nanoclay. The internal structure of WrPC showed that the addition of nanoclay had filled the voids and lead to smooth morphology.

Keywords: Composites; Recycle PE; Nanoclay; Kenaf; Morphology

UMT008

Effect of Graphene Nanoplatelets (GNP) Composition to the Physical and Conductivity of High-Density Polyethylene (HDPE) Composite

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Abstract. In this study, polymer composite is produced from the melt blending process of polyethylene with filler from graphene nanoplatelets (GNP). Graphene nanoplatelets (GnP) has slowly picking up as one of carbon based materials for polymer composite filler due to its lower processing cost but having nearly the same properties as graphene and CNT. However, the effect of physical properties GnP such as particle's surface area and concentration to the properties of thermoplastic polymer such as polyethylene is not much reported, especially prepared by melt blending and injection moulding process. The interaction between graphene with host polymer during the mixing process and the effect of the filler dispersion is still remaining unclear. In this work, polymer composite of high-density polyethylene (HDPE) was mixed with different particle sizes of GNP with compositions up to 15 wt.%. XRD analysis shows the concentration of GNP within the composite and scanning electron micrograph (SEM) results displayed a distribution GNP in polymer composite. The presence of GNP also enhanced the conductivity of the composite and increased with the composition of GNP in composite.

Keywords: Graphene nano-platelets; high-density polyethylene; polymer composite.

OTRS001

First-principles Study on Structural and Electronic Properties of Pure and Cobalt Doped α-NiS

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Abstract. The crystal structure, average bond length, electronic charge distribution, band structure and density of states (DOS) of pure and cobalt (Co) doped α-NiS were studied using first-principles calculation based on density functional theory with the addition of Hubbard U (DFT+U) with Local Density Approximation with Ceperly Adler Perdew and Zunger (LDA-CAPZ). One of the purposes of selecting cobalt as doping atom is due to its high effective charge on Co atom which can boost up the electrical conductivity and also can enhancing the performance of energy storage devices. The convergence test and *k*-point value also conducted to ensure the accuracy of the calculations. The lattice parameters of pure α-NiS crystal structure are in the hexagonal space group (*P63/mmc*), which display a good agreement compared with the previous studies in experimental work. The average bond length for pure NiS shows an increment with the effect of supercell Co-doped α-NiS crystal structure. For electronic properties, the energy band gap of pure and Co-doped α-NiS shows a good result which contributes higher than the experimental bandgap. These results have been done with the recognition of Hubbard U value after the supercell crystal structure displays lower energy band gap. The electronic charge distribution of both pure and Co-doped α-NiS are also illustrated to identify the bonding characteristics either it is ionic or covalent bonds. The density of states (DOS) illustrates the hybridization state of Co 3*d*, Ni 3*d* and S 3*p* orbitals at the conduction band (CB) and valence band (VB). The bonding populations are referring to the bonding characteristics of pure and Co-doped α-NiS.

Keywords: first-principles; density functional theory; Co-doped α-NiS, Structural Properties; Electronic Properties

OTRS004

Effect of Spin-Orbit Coupling on Electronic and Optical Properties of Au Alloys (with Cu, Ag, and Pt): First Principal Calculations

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Abstract. In recent years, Au alloys have become one of the most vigorously researched topics in condensed matter physics. This interest is driven by the unique nature of Pure Au and the significant structural and optical properties of Au-based alloys. Here we investigate the optical and structural properties of Au alloy when combined with Cu, Ag, and Pt using first principle calculations based on Density Functional Theory (DFT). In this calculation, the PBE-GGA exchange-correlation function for the calculation was employed, along with the spin-orbit coupling effect (SOC). Combining the PBE-GGA potential with SOC led to generally superior results to those obtained far from SOC, especially for the optical results, and provide a good description of the experimental data. The absorption properties for Au-Cu disclosed an important enhancement to pure Cu in contrast to Au-Ag and Au-Pt for the spectrum lying between 1.55 and 2.75 eV, corresponding to wavelengths 800 and 450 nm, respectively. The density of states and band structure showed the splitting of the sp-states on the inclusion of SOC. We show that Au greatly impacts the electronic and structural properties for alloys due to its sensitiveness to the SOC effect, which may be useful for further improvement in the alloy's applications in optoelectronic devices.

Keywords: Au alloys, spin-orbit coupling effect, structural properties, density of states, dielectric function, optical properties.

UITM001

Structural, Electronic and Optical Properties of Cr-doped $SrTiO_3$ using Density Functional Theory

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Abstract. First-principles calculations based on density functional theory (DFT) are performed to investigate the effects of Cr doping on the structural, electronic, and optical properties of $SrTiO_3$ perovskite using the local density approximation (LDA) methods with the Hubbard corrections U_d in Ti 3d states and U_p in O 2p states. The best agreement of the U values to improve the electronic band gap of was found LDA. By combining the two correction terms U_d and U_p, the band gap of $SrTiO_3$ could be enhanced, which is close to the experimental band gap. The incorporation of Cr at the Ti site significantly affects the electronic band structure of $SrTiO_3$ by introducing new states at the G point, converting the indirect band gap into a direct one. The shift of the density of states to lower energies and enhanced interaction between the Cr atom and its neighbouring atoms after Cr doping in $SrTiO_3$ are observed. Moreover, the partial density of states of $SrTiO_3$ changes significantly at the lower end of the conduction band. Thus, the Cr doping affects the electronic band structure of $SrTiO_3$. Cr-doped $SrTiO_3$ offers improved optical properties and its conversion to a direct bandgap makes it an attractive candidate for optoelectronic devices.

Keywords : Hubbard U, Density Functional Theory, $SrTiO_3$, band gap, first-principles calculations

UITM003

First-Principles Hubbard U Approach on Structural and Electronic Properties of Prussian Blue with Potassium Ion Intercalation for Potassium Ion Battery

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Abstract. Prussian blue (PB) is a good candidate as cathode material in potassium ion battery (KIB) due to its high electrochemical performance. Thus, to verify the performance, the structural and electronic properties of PB were performed using first-principles studies based on density functional theory (DFT) method. The properties calculation of PB, KPB and K_2PB were calculated using Cambridge Serial Total Energy Package (CASTEP) computer code. From the geometrical optimization of pure PB, the generalized gradient approximation for Perdew-Burke-Ernzerhof Scheme (GGA-PBE) functional shows the most comparable structural properties to local density approximation by Ceperley and Adler as parameterized by Perdew and Zunger (LDA-CAPZ) and the generalized gradient approximation for Perdew-Burke-Ernzerhof for solids (GGA-PBEsol) functional. Upon the addition, the electronic properties of the pure PB band gap slightly underestimated from the experimental value which is 0.72 eV. Hubbard U was used to broaden the bands crossing the Fermi level. Thus, by using GGA-PBE+U, the band gap produced 1.77 eV with U for Fe^{3+} is 6 eV and Fe^{2+} is 4 eV. The calculations of total and partial density of states (pDOS) present the Fe, C and N orbitals at valence band and conduction band. Other electronic properties such as electron density was also calculated. The intercalation voltage with different numbers of K^+ in PB is calculated to be 4.33 V and 1.40 V for KPB and K_2PB. It is found that the calculated voltage has been improved near to the experimental value. Therefore, the first-principles calculation in this work can give more understanding of the behaviour of pure PB, KPB and K_2PB for its uses as cathode material in KIB.

Keywords: First-principles; Prussian blue; Hubbard U; Density functional theory; Band structures, Intercalation voltage

UITM004

HALF-METALLIC FERROMAGNETS: A LDA+U CALCULATION OF FERROMAGNETIC ORTHORHOMBIC $Pr_{0.75}Na_{0.25}Mn_{1-x}Ni_xO_3$ (x = 0.25 and 0.50) MANGANITES

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Abstract. In this study, the structural, electronic, and half-metallic properties of monovalent-doped $Pr_{0.75}Na_{0.25}MnO_3$(x = 0.25 and 0.50) manganite were investigated via density functional theory (DFT) with local density approximation plus Hubbard U parameter (LDA+U). The Hubbard U parameter for the treatment of strong Coulomb repulsion among electrons in *3d/4f* orbitals was included in LDA + U functional. The U values for Mn *3d*, Pr *4f* and Ni *3d* were set at 6 eV. The results of calculation showed that the structural and electronic properties of $Pr_{0.75}Na_{0.25}Mn_{1-x}Ni_xO_3$ (x = 0.25 and 0.50) were considerably influenced by Ni substitution. Interestingly, density of states (DOS) calculations revealed that ferromagnetic $Pr_{0.75}Na_{0.25}Mn_{1-x}Ni_xO_3$ (x = 0.25 and 0.50) was half-metallic. It found from calculated DOS that the spin down channel exhibited insulating behavior and the spin up channel showed metallic behavior with decreases in calculated energy band gap with Ni substitution. Partial DOS results showed that Mn, Ni and O atoms greatly contributed to the electronic states at Fermi energy for the spin up channel with high degree of hybridization between the Mn *3d* / Ni *3d* and O*2p* electrons.

Keywords: Manganite, Half-Metallic, FM phase, LDA+U, Electronic properties.

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UITM008

Effect of Ti doping on Structural, Electronic and Optical Properties of ZnO: A DFT+U Calculations

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Abstract. This study adopted density functional theory (DFT) with the Hubbard U (U_d + U_p) methods to investigate the structural, electronic and optical properties of pure ZnO and Ti-doped ZnO ($Zn_{1-x}Ti_xO$) with different Ti concentrations (x = 0.0625, 0.125 and 0.1875) in 2 × 2 × 2 supercells. The calculations are based on a generalized gradient approximation for Perdew-Burke-Ernzerhof for solids plus Hubbard U (GGA-PBEsol+U). The effective U values applied in this work are 5 eV for the Zn-3*d* state, 9 eV for the O-2*p* state, and 8 eV for the Ti-3*d* state. The total energy was calculated to forecast the suitable position of the Ti dopant in ZnO. The doping influence on the properties of ZnO can be observed by the changes in the structural parameters, band structure modification, the existence of impurity energy levels (IELs) in the density of states (DOS) and differences in optical properties. The lattice parameters and volume of Ti-doped ZnO clearly increased at a lower concentration of Ti. At higher Ti concentration, the bandgap of pure ZnO significantly decreased from 3.362 eV to 2.630 eV and the conduction band was moved downward due to the presence of impurity energy level. The absorption in visible light is stronger at higher Ti concentrations than pure ZnO due to its lower energy region and longer wavelength spectrum. These research results would provide a theoretical reference for experimental works and also important information for future applications such as photovoltaics and photocatalysts.

Keywords: First-principles; DFT+U; Ti-doped ZnO; Structural properties; Electronic properties; Optical properties

UITM014

First Principles Study of Electronic and Thermoelectric Properties of Surface (001) $ATiO_3$ (A=Pb, Sn) for Thin Film Application using Density Functional Theory

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Abstract. Lead (II) titanate ($PbTiO_3$) has been emerged as promising material for thermoelectric sensor application. In this study, we proposed to use density functional theory and the Boltzmann transport equation approximation to investigate the underlying mechanism for improving the thermoelectric efficiency of $ATiO_3$ (A=Pb, Sn). The surface (001) modification through AO termination layer has increases the electrical conductivity, thus increasing the power factor. We discovered that increasing electrical conductivity, which is aided by a high density of states, improves the power factor of $ATiO_3$ (A=Pb, Sn). On the other hand, increasing the Seebeck coefficient, which is aided by declining thermal conductivity, which is aided by low, improves the figure of merit. It is shown that surface (001) tin (II) titanate ($SnTiO_3$) has higher thermoelectric performance compared to $PbTiO_3$, which is significant as a non-toxic material for benchmarking future improvements in thin film application.

Keywords: Density functional theory, Electronic properties, Thermoelectric properties, Surface (001)

UITM016

Structures, electronic and optical properties of pure BiOCl through DFT calculations

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Abstract. To fully understand the fundamentals and to explain the experimental observations of pure BiOCl for its crystal structure, optical properties, and electronic structure, GGA+U calculation have been done for pure BiOCl. BiOCl matlockite layered crystal structure was drawn using Material Studio visualizer using parameters as close as the experimental data. From the calculation, the band gap of the pure BiOCl was estimated as 3.568 eV, which is close to the experimental band gap around 3.51 eV. The similar band gap was due to the adoption of GGA+U. GGA+U was inspired from the Hubbard model which were known to be the most successful models that describe more accurate correlated electron models compared to generalized gradient approximation (GGA). The band gap that was calculated by GGA is 2.623 eV which are approximately 25% less accurate from the experimental value. This shows that GGA+U are more reliable to fully calculate the electronic structure of pure BiOCl.

Keywords: DFT, Density Functional Theory, First Principle Calculation, BiOCl, Bismuth Oxychloride.

UITM017

Pressure Dependence on Structural, Electronic and Elastic Properties of Rutile, Anatase and Brookite TiO_2: A DFT Investigation

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Abstract. Titanium dioxide (TiO_2) is a semiconductor material that receives a lot of interest for potential applications in many fields due to its excellent physical and chemical properties. In this work, the calculations on the structural, electronic and elastic properties of three different TiO_2 phases in rutile, anatase and brookite structures were performed with the effect of pressure up to 100 GPa. The exchange-correlation functional within local density approximation (LDA) and generalized gradient approximation (GGA) were employed by CASTEP computer code. The calculated band structures of rutile and brookite TiO_2 elucidate that they are direct semiconductor while anatase TiO_2 is indirect semiconductor. The derived elastic constant such as bulk modulus, shear modulus, Young's modulus, Poisson's ratio and Pugh ratio was estimated with the polycrystalline approach, using Voigt-Reuss-Hill theories. The effect of pressure will change the properties of rutile, anatase and brookite TiO_2. The present results were in good agreement with available theoretical and experimental data.

Keywords: First-principles; Density functional theory, TiO_2, elastic properties, pressure

UITM022

Structural, Electronic and Optical Properties of Low Dimensional Hybrid Perovskite $(C_6H_{10}N_2)XI_4$ (X = Pb, Sn) Using Density Functional Theory

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Abstract. Low-dimensional hybrid perovskite has sparked great research attention because of their superior physical performance over 3D structure of perovskite material of $CH_3NH_3PbI_3$. In this study, first-principles calculations on structural, electronic and optical properties of low-dimensional compound $(C_6H_{10}N_2)PbI_4$ were systematically performed. Study on lead-free based halide perovskite material $(C_6H_{10}N_2)SnI_4$ was also been carried out since Pb bring the environmental effects. Perdew-Burke-Ernzerhof (PBE) and generalized gradient approximation (GGA) schemes were used in all calculations. $(C_6H_{10}N_2)XI_4$ (X = Pb and Sn) of isotypic hybrid halide perovskites crystallizing in orthorhombic space group Pbca (no. 61) at room temperature. Both structure comprises layers of corner-sharing BX_6^{4-} octahedra which were separated by monolayers of double protonated (2-aminomethyl)pyridinium cations. A band gap of 1.85 eV yielded for $(C_6H_{10}N_2)SnI_4$ compound, which is smaller compared to $(C_6H_{10}N_2)PbI_4$ (1.96 eV). In addition, it is seen that optical absorption of $(C_6H_{10}N_2)SnI_4$ and $(C_6H_{10}N_2)PbI_4$ is red shifted which directly related to its electronic structure. Based on our theoretical research, $(C_6H_{10}N_2)SnI_4$ appears to be an appropriate choice for use as an active layer in the application of solar cell optoelectronic devices.

Keywords: low dimensional, halide perovskite, lead-free, solar cells, first-principles

UITM033

Influence of Hubbard U on the Structural and Electronic Properties of pure and La-Doped ZnO by using DFT

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Abstract. The lattice parameters, average bond length, electronic charge distribution, band structure and density of states (DOS) of pure ZnO and La-doped ZnO were calculated using density functional theory (DFT) with the addition of Hubbard U (DFT+U) method. Lanthanum, La is a p-type dopant that might be viewed as a practical method for improving a nanogenerator's performance. The lattice parameters of ZnO crystal structure with space group $P6_3mc$ indicates the best agreement compared with experimental data after doping La atom at Zn site in ZnO. The average bond length of pure and La-doped ZnO are also calculated to determine whether it is a strong or weaker bond. For electronic properties, the band gap of pure ZnO and La-doped ZnO shows an increment and close to the experimental band gap with the implementation of Hubbard U at U_d at Zn and La site whereas U_p at O site. The calculated electronic charge distribution of both pure and La-doped ZnO also presented to determine whether it is ionic or covalent bonds. Density of states (DOS) of both pure ZnO and La-doped ZnO were conducted to determine the contribution of *s*, *p* and *d* orbitals that appear in the minimum conduction band and maximum valence band.

Keywords: Density functional theory, Electronic properties, Hubbard U, Structural Properties, ZnO

UKM010

Numerical analysis of the effect of liquid water during switching mode for unitized regenerative proton exchange membrane fuel cell

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Abstract.

The unitized regenerative proton exchange membrane fuel cell (URPEMFC) is a device that generates electrical energy in the fuel cell mode (FCM) and electrolysis in the electrolyzer mode (EM). Promising renewable energy in storing and producing electric current using hydrogen is a single device that can execute two activities. Higher water content during FCM causes flooding, which limits the mass transfer of reactant in the membrane electrode assembly for electrochemical reactions (MEA). During the electrolyzer mode, the flow field, gas diffusion layer (GDL), and catalyst layer are all saturated with liquid water. During the fuel cell mode, reactant diffusion into the GDL and catalyst layer is critical. The performance of the FCM is reduced, and the fuel cell is shut off completely. As a result, thorough purging and liquid water removal during mode switch are critical. The purging process is influenced by the flow field on the bipolar plate. In this study, a 3-dimensional URPEMFC model with flow field optimization is constructed to improve liquid water purging during switching mode. To maximize the liquid water purge and performance of URPEMFC, flow field designs such as parallel, serpentine, and symmetric are examined. The results reveal a substantial improvement in performance by symmetric flow fields. In comparison to the other flow fields, the GDL and catalyst layer contain reduced liquid water. To determine the performance difference, the current density of URPEMFC is also captured on the membrane layer. The symmetric flow field has resulted in a 5% increase in current density generation.

Keywords: flow field; liquid water; URPEMFC; switching mode.

UMK004

Smart Water Quality Monitoring System in Different Location

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Abstract. Water plays an important role in daily life. However, water quality is the most important factor affecting aquatic life and performance in aquaculture production systems. Thus, development of water quality monitoring system (WQMS) able to improve manual monitoring for water inspection. This project was divided into two stages which is prototype development and network development of WQMS. Hence, based from this research, low cost, large coverage and user-friendly water quality monitoring system with multi sensor and multi node using Wi-Fi Technology was presented to improve the monitoring system specifically for fish and prawn pond.

Keywords: Water quality monitoring system, Prototype, Low Cost, Wi-Fi Technology

USM006

Simulation of Combined Metal-Hydrogenous-Composite Materials for Multilayer Shielding of High Energy Proton Radiation Using Monte Carlo Code PHITS

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Abstract. Multilayer shielding scenario for proton radiation with secondary radiation of neutron and gamma have been investigated using Monte Carlo simulation method through Particle Heavy Ion Transport System (PHITS). This research is aims to evaluate shielding effectiveness with variation of layer structure from combination of metal, hydrogenous, and composite materials and determine the optimum thickness of shielding which follow the radiation protection standard. The simulation is carried out using 230 MeV proton source, 1 nA beam current, and water target as the tissue equivalent. The shielding consists of three layers of beam dump from iron (Fe), Portland concrete, and Borated Polyethylene (BPE) materials. The parameters measured in this study are flux distribution, effective dose in shielding depth, ambient dose equivalent H*(10) rate, and long-term induced radioactivity assessment. The simulation result show that the configuration of Fe-Concrete-BPE gives lowest ambient dose equivalent H*(10) rate of 2.44 mSv/h, slightly different from the Fe-BPE-concrete layer structure with an H*(10) value of 2.56 mSv/h. While, the highest ambient dose equivalent rate H*(10) are obtained from BPE-concrete-FE and Concrete-BPE-Fe with H*(10) value around 10.9 mSv/h and 9.24 mSv/h, respectively. The flux distribution illustrates that the iron material on the first layer can attenuate high energy of proton and neutron radiation and reduce energy effectively. However, it produces a high dose build-up effect with higher gamma radiation exposure. The estimation of induced radioactivity in the multilayer shielding along 50 years was performed. The optimum thickness of Fe-concrete-BPE shielding is 90-90-20 cm for 1 m distance from target.

Keywords: multilayer shielding, proton, neutron, Monte Carlo, PHITS

UTM005

Comparison of carboxymethyl cellulose-ammonium sulphate solid biopolymer electrolytes using FTIR spectroscopy with computational model

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Abstract. The solid biopolymer electrolytes (SBEs) based on carboxymethyl cellulose (CMC) doped with ammonium sulphate (AS) was prepared via solution-casting technique. The structural of CMC-AS SBEs was determined in two methods which is FTIR spectroscopy as experimental method and Gaussian 09W software as computational method. These two methods were compared the spectrum of pure CMC, pure AS and CMC-AS by identifying the molecular bonding even so determining the observed vibrational frequencies. For pure CMC, the experimental wavenumber was observed in range of 3200 – 1418 cm^{-1} and compared with computed wavenumber at 2900 – 1310 cm^{-1} for bonding O-H stretching, C=O stretching, C-O stretching, C-H stretching and O-H bending. Besides, the experimental pure AS was appeared at wavenumber 3207 – 1411 cm^{-1} and computational wavenumber was 3400 – 1352 cm^{-1} which represent for N-H stretching, O-H stretching, S=O stretching and N-H bending. Moreover, the wavenumber of CMC-AS SBEs in experimental was determined at range 3373 – 1411 cm^{-1} whereas the computational was observed at 3613 – 1084 cm^{-1} for O-H stretching, C=O stretching, C-O stretching, N-O stretching, O-H bending, N-H stretching and bonding from NH_4 attached to COO^-. Furthermore, the FTIR deconvolution was identified for O-H stretching at range 3800 – 2250 cm^{-1} in order to calculate the transport number of CMC-AS SBEs. This study was proved that AS could be one of the important materials in approach to develop a good SBE.

Keywords: Carboxymethyl cellulose, ammonium sulphate, solid biopolymer electrolytes, FTIR, computational.

IIC001

CHARGE DISTRIBUTION STUDY OF $Ce_{0.8}Sr_{0.2}NiO_2$ BY DENSITY FUNCTIONAL THEORY

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Abstract. Recently, superconductivity was discovered in nickelate $Nd_{0.8}Sr_{0.2}NiO_2$. It is a new family of cuprate-like superconductor. Like the cuprate superconductors with layers of $Cu\text{-}O_2$, superconductivity in nickelate superconductors occurs in the $Ni\text{-}O_2$ layer with Nd and Sr act as charge reservoirs. Ni^{2+} with 8 electrons in the 3d orbital has one electron less than that of Cu^{2+}. Cerium with its natural oxidation states of 3+ and 4+ is expected to be a better electron donor than neodymium. Therefore, the number of electrons in the 3d state of Ni may increase with cerium substitution of Nd. This work investigates the charge distribution and major charge carrier in $Ce_{0.8}Sr_{0.2}NiO_2$. Hole concentration of the compound is calculated and the relation between the nickelate and cuprate superconductor is discussed.

Keywords: YBCO, Charge distribution, hole concentration, Density of State, Density functional theory

UITM019

Electronic and Superconducting Properties of Y-247 Ceramic via Computational Method

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Abstract. $Y_2Ba_4Cu_7O_x$ (Y-247) is one of the phases that came from the YBCO superconductor family. The superconductor has been researched through the computational method by applying the Density Functional Theory (DFT) via the first principles study. The structural of the Y-247 have been constructed in the Material Studios software and the electronic properties of the material were calculated and optimized using Generalized Gradient Approximation Perdrew Burke Ernzerhof (GGA PBE) exchanged correlation with Ultrasoft. From the band structure analysis, the pure Y-247 band gap observe at 0.93 eV between the conduction band (CB) and the valence band (VB). It is also shown that the conduction band and valence band overlapped each other, showing the conducting properties of the structure. For density of states, copper *3d* orbital state and oxygen *2p* state shows important role to maintaining the superconducting properties with electron-hole migration concept.

Keywords: Superconductor, Computational and Simulation, DFT, First Principle Theory, YBCO.

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UITM042

The Fundamental of $Bi_{1.6}PB_{0.4}Sr_2Ca_2Cu_{2.97}Fe_{0.03}O_y$ Crystal Structure by X-Ray Diffraction And Computational Analysis

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Abstract. The effect of Fe doping on BSCCO-2223 phase prepared due to solid state reaction method has been studied via XRD and computational simulation to determine the crystalline structure, energy bandgaps and density of states. Generally, both porous and non-porous sample were orthorhombic crystal structure. Orthorombicity for non-porous was 0.003039 which was dominant compared to porous sample. The c-parameter for porous sample was higher compared to non-porous sample. The porous sample has smaller crystalline size by 0.31358 Å compared to non-porous sample at 0.36070 Å. The volume fraction of Bi-2223 phase for porous sample and non-porous sample were 56.73 % and 76.24 % respectively. The optimized crystal structure has been developed through the simulation of Density Functional Theory due to Material Studio CASTEP. The photonic bands structure shows that the sample has no energy bandgaps since the conduction bands and valance bands were overlapped. The density of states graph justified that the electrons were highly concentrated near and above Fermi level which involved the formation of superconducting properties. Based on the previous studies and theory, we suggest that BSCCO-2223 doped Fe probably has low Tc but higher in Jc value. However, porous sample has a smaller Tc compared to non-porous sample due to decreasing in c-parameter. Smaller crystalline size has low Tc value and a sample with higher percentage of 2223 phase was higher in Jc value.

Keywords: BSCCO-2223, Density Functional Theory, optimized crystal structure, XRD, density of states

UITM050

A Study on Structural and Electronic Properties of Ag and Sb-doped in Ba-site of $YBa_2Cu_3O_{7-\delta}$ Superconductor via Computational Method

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Abstract. The structural and electronic properties of YBa2Cu3O7-δ superconductors doped with Ag and Sb have been predicted theoretically. The Ag ionic radius of 126 pm matches the Ba atom, which is 134 pm, promoting electrical conductivity. When an Sb atom with a lower ionic radius of 76 pm is doped into the Ba-site of $YBa_2Cu_3O_{7-\delta}$, it undergoes structural modifications. To further understand its interatomic behaviour, the structural and electronic properties of both elements doped at the Ba-site of $YBa_2Cu_3O_{7-\delta}$ were computationally analysed, over a wide range of dopant percentages. Focuses were made at x = ±0.200, where Ag dopant enhanced electrical conductivity, and Sb dopant provided structural alterations from prior experiments. Based on the computational calculation, the GGA-PBEsol and GGA-PBEsol+U give the best-validated results as compared to the referred experimental and theoretical studies. The lattice parameters of all samples differ by less than 5% from the previous experimental investigation. The electronic band structure, total and partial density of states (DOS), and electron density show that hybridization exists between the Cu 3*d* and O 2*p* atoms, verifying the Van Hove Singularity at the Fermi level. The bandgap of 3.30 eV for pure YBa2Cu3O7-δ shows a 17.50% difference compared to other theoretical work. The calculated electronic bandgap for pure, Ag and Sb-doped samples was increased. Impurity dopants have the highest concentration on O atoms due to their electronegativity, increasing their electron density. As Ag and Sb dopants were added to the Ba-site of YBa2Cu3O7- δ, respectively, the total charge on Cu(2) increased substantially where Cu atoms exhibit the most atomic population on orbitals.

Keywords: Superconductor, YBCO, Computational Method, DFT

UKM013

Metal Sulfide Effects on AC Susceptibility and Electrical Properties of $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8$ Superconductor

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Abstract. Many works on the effect of metal oxides on Bi-based superconductors have been reported. Metal sulfides offer another interesting and rich avenue to improve the superconducting properties of the Bi-based materials. Moreover, oxygen and sulfur belong to the same group (VI) in the periodic table. In the paper we report the effects of metal sulfides (MS where M = Cd, Pb, Zn, Fe and Mo) addition on the superconducting properties of $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8$ (Bi-2212) superconductor. The samples were prepared through the conventional solid state reaction method. The amount of metal sulfide addition was between 0.1 and 10 wt. %. The structure, microstructure, electrical resistance, AC susceptibility and intergrain critical current density were investigated. X-ray diffraction patterns showed that the Bi-2212 phase were dominant with volume fraction of over 80 % in all samples. Our result showed that the onset transition temperature, $T_{c\text{-onset}}$ was 83 K and zero-resistance temperature, $T_{c\text{-zero}}$ was 72 K for non-added sample. Metal sulfides suppressed the critical temperature except for CdS addition samples. The highest onset transition temperature $T_{c\text{-onset}}$ for the $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8(CdS)_x$ series was 90 K. All metal sulfide added samples showed metallic normal state behavior except for sample with x = 5 wt.% of the $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_8(FeS)_x$ series which showed semiconductor behavior. AC susceptibility transition temperature, $T_{c\chi'}$ was around 52 K to 97 K. The addition of metal sulfides strengthened the flux pinning in some samples. The critical current density, J_c at the peak temperature of the imaginary part of the susceptibility, T_p was between 15 and 25 A cm^2 for all samples. This work showed that among the metal sulfides, CdS showed great improvements in the critical temperature and current transport properties.

Keywords: Critical Current Density; microstructure; X-ray diffraction

UMP005

Current Density and Activation Energy of Bi-2223 Superconductors Synthesised Via Electrospinning

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Abstract. The synthesis and characterization of bismuth-based oxide superconductors, known as bismuth strontium calcium copper oxide were characterised in pellet form, and were synthesised via electrospinning subsequently solid state reaction with heat treatment. A sol–gel mixture was prepared consisting of PVP solution, dissolved in propionic acid, as well as Bi, Sr, Ca, and Cu acetates additionally with Pb doping. The sol-gel was then subjected to electrospinning process and collected in film and flake form. Samples were heat treated at 120 °C to remove excess moisture, and then at 450 °C to remove PVP. The samples were ground and pressed at 0.9 GPa into pellets and heat treated again at 850°C. Based on XRD, the samples contain major Bi-2223 phases. Four-point probe measurements were conducted to investigate the critical transition temperature of samples. The T_c for Pb-doped sample was observed at 80 K and un-doped at 68 K. The activation energy showed improvements for doped sample. Precursors added with Pb and un-doped contains similar Bi-2223 phases in pressed pellet form. This highlights the potential of using electrospinning to synthesis functional Bi-2223 superconductors with or without doping with Pb.

Keywords: High temperature superconductors, BSCCO, Electrospinning

UPM014

Improved Superconducting Properties of SiC added $YBa_2Cu_3O_{7-\delta}$ Bulk Superconductor Synthesized by the Method of Thermal Treatment

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Abstract. Structure and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ compound added with SiC nanoparticales were investigated in this work. Samples were fabricated through thermal treatment method of an aqueous solution of polyvinylpyrrolidone (PVP) and metal nitrates with adding different percentages of SiC, x = 0.0, 0.2,0.4, 0.6, 0.8, 1.0 wt.%. Microstructure and morphology were analysed by x-ray diffraction and field-emission scanning electron microscopy. Electrical resistivity and critical temperature were determined using four-point probe method. Phase formation of orthorhombic Y123 was obtained for all samples beside a small amount of secondary phase as revealed by x-ray diffraction analysis. The average grain size decreased up to x = 0.6 wt.%, and then increased for higher concentration. Therefore, the morphological analysis showed a clear sign of partial melting of all added SiC samples. The resistivity was decreased for all samples with inclusion of SiC. However, the onset critical temperature, $T_{c-onset}$ was reduced from 95.2 k for pure sample to 85.1 k for sample with x = 1.0. The samples with x = 0.4 and 0.6 wt.% exhibited the sharpest superconducting transition temperature (ΔT_c), which may be attributable to enhanced crystallinity and homogeneity of the sintered samples. The achieved results confirmed the improvement of the superconducting properties performance with doped SiC. Hence the addition of SiC can be effective to enhance the pinning properties and J_c of Y123 system.

Keywords: Y123 superconductor; SiC nanoparticales addition; thermal treatment technique; structure and electrical properties

UPM015

Synthesizing and Characterising of YBCO Superconductor via Thermal Treatment Method at Different Sintering Temperature

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Abstract. Among the active and extensively distributed elements in physics that are receiving attention all around the globe is a superconductor. It offers zero resistance to electrical current, repelling magnetic fields, and holds enormous potential for the future. Thus, this research seeks to synthesize a high purity Y-123 superconducting system by using the thermal treatment method and comparing the effect of different sintering temperatures on the superconducting properties of Y-123. In the meantime, it also explores the study of the physical properties in microstructure, phase formation and critical temperature, T_c of Y-123. Hence, in this research, $YBa_2Cu_3O_{7-\delta}$ (Y-123) sinter at temperatures of 920 ℃, 950 ℃ and 980 ℃. The microstructure and superconducting properties of Y-123 were investigated by thermogravimetric analyzer (TGA), X-ray diffraction (XRD), fieldemission scanning electron microscope (FESEM), energy dispersive X-ray diffraction (EDX) alternating current susceptibility (ACS) and Four Point Probe (4PP). It was observed the sample Y-123 showed that the primary phases in all the XRD patterns were the orthorhombic crystal structure while Y-211 and BaCuO2 act as secondary phases. The sample Y-123 with sintering temperature 980 ℃ revealed the highest value of $T_{c\text{-onset}}$, T_{cj}, T_p and the sharpest diamagnetic transition in the normalized susceptibility curves. According to the microstructure analysis, the sample with the highest average grain size is 1.285 μm was sintered at 980 ℃. On the other hand, from 4PP analysis, the sample of sintering temperature 980 ℃ exhibits good metallic behavior in the normal state with the increasing value of $T_{c\text{-onset}}$, $T_{c\text{-offset}}$, hole concentration and smallest ΔT for Y-123.

Keywords: Y-123 superconductor; critical temperature, T_c; thermal treatment method.

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UKM005

Deposition of thin films by atmospheric pressure plasma jet

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Abstract. The goal of this research was to create a thin-film coating utilizing the atmospheric pressure plasma polymerization process and limonene essential oil, an organic substance. A self-made, portable, and easy-to-handle atmospheric pressure plasma jet was used to achieve plasma polymerization. Coatings made from natural precursors are more environmentally friendly than synthetic materials. Atomic force microscopy (AFM) and Field Emission Scanning Electron Microscope (FESEM) were used to explore the surface morphology while Fourier transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS) were used to study the chemical characteristics of polymer thin films. The existence of a limonene thin film coating was confirmed by FTIR and XPS analyses. The thin films of limonene were found to be homogeneous, smooth, and nonporous after AFM analysis. We proposed a single-step atmospheric pressure plasma polymerization of limonene to produce a moderately hydrophobic antibacterial coating with a thickness of less than 100 nm and a smooth surface with an average roughness of < 1 nm. These thin films were also tested for antibacterial activities against Escherichia coli (E. coli) germs. The antibacterial activity of limonene thin films against E. coli bacteria was found to be quite strong. In the biofilm experiment, gram-negative bacteria (E. coli) were shown to be reduced. In addition to its bactericidal properties, Plasma polymerized limonene has been shown to rupture bacterial membranes. This study should be looked into by researchers interested in building a bacteria-resistant and biocompatible coating on various substrates in a cost-effective manner.

Keywords: Thin-film coating, Atmospheric pressure plasma polymerization, Limonene, E. coli, antibacterial.

UMS003

Thickness Dependence of Structure and Soft Magnetic Properties of FeCo-based Magnetostrictive Thin Films

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Abstract. Magnetostrictive thin films with soft magnetic properties (low anisotropy field, H_k and high magnetostriction constant, λ_s) are required for magnetic-microelectromechanical sensors (MagMEMs) application. This paper presents the structure and soft magnetic properties of the FeCo doped with Cr. The FeCoCr thin films were fabricated at different thicknesses from 56 nm to 165 nm by radio frequency sputtering technique. The structure of the films which determined by the X-Ray Diffraction (XRD) exhibited an amorphous with broad peaks were observed in all films thickness. The magnetic properties of the films which investigated by Magneto- Magneto-Optical Kerr Effect (MOKE) demonstrated a slightly decreased on the anisotropy field, H_k when thickness increased up to 100 nm. The magnetostriction constant, λ_s was measured by the Villari technique through the film bending. It was determined that the λ_s for FeCoCr ranged from 22ppm to 28ppm. From this study, it is feasible to achieve a soft magnetostrictive properties of the FeCo by doping with Cr which results in a lower anisotropy field with a magnetostriction constant as high as 28 ppm.

Keywords: magnetostriction, magnetic properties, anisotropy field, amorphous, thin films.

UPNM010

Potential of Kappa-carrageenan as Additive in Improving Permeability of Mixed Matrix Membranes

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Abstract. The polymeric polysulfone (PSf) membranes have high mechanical strength and flexibility but it is a challenge to improve the water permeability and removal capability of the membranes due to the hydrophobicity nature of PSf. In order to overcome this problem, Kappa-carrageenan (ƙ-car) has been reported as pore former is introduced in this work. Carrageenaan which is extracted from red seaweed is a highly hydrophilic biopolymer. This study aims to investigate the effect of adding ƙ-car during membrane fabrication and its impacts on the membrane performances in terms of water flux and metallic ions removal. The ƙ-car is dissolved in ethylene carbonate and blended with PSf resin which is dissolved in N-methyl-2-pyrrolidone (NMP) solvent. The casting solution is well mixed and fabricated via wet phase inversion method by adjusting the weight percentage ratio of ƙ-car (0.0 - 0.25 wt%) with PSf polymeric solution. Results showed that at applied pressure of 1-5 bar, the addition of ƙ-car with various ratio has amplified the hydrophilicity and permeability of the fabricated membranes as the pure water flux has improved from 7.86 to 393.7.38 $L.m^{-2}h^{-1}$. The removal of ferrous iron (Fe^{2+}) in synthetic water was found increased to 98.8% especially by adding 0.1 wt% of ƙ-car in the casting solution. The surface morphologies of membranes showed decreasing trend as they are more brittle with the addition of more ƙ-car. In conclusion, small addition of ƙ-car is a promising technique to produce membranes not only exhibited high water flux which is preferable in water industries, but also good separation performance and mechanically strong enough to withstand the operating pressure.

Keywords: Biopolymer; kappa-carrageenan; polysulfone; hydrophilicity; membranes permeability

UPM017

Potential of Kappa-carrageenan as Additive in Improving Permeability of Mixed Matrix Membranes

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Abstract. The polymeric polysulfone (PSf) membranes have high mechanical strength and flexibility but it is a challenge to improve the water permeability and removal capability of the membranes due to the hydrophobicity nature of PSf. In order to overcome this problem, Kappa-carrageenan (ƙ-car) has been reported as pore former is introduced in this work. Carrageenaan which is extracted from red seaweed is a highly hydrophilic biopolymer. This study aims to investigate the effect of adding ƙ-car during membrane fabrication and its impacts on the membrane performances in terms of water flux and metallic ions removal. The ƙ-car is dissolved in ethylene carbonate and blended with PSf resin which is dissolved in N-methyl-2-pyrrolidone (NMP) solvent. The casting solution is well mixed and fabricated via wet phase inversion method by adjusting the weight percentage ratio of ƙ-car (0.0 - 0.25 wt%) with PSf polymeric solution. Results showed that at applied pressure of 1-5 bar, the addition of ƙ-car with various ratio has amplified the hydrophilicity and permeability of the fabricated membranes as the pure water flux has improved from 7.86 to 393.7.38 $L.m^{-2}h^{-1}$. The removal of ferrous iron (Fe^{2+}) in synthetic water was found increased to 98.8% especially by adding 0.1 wt% of ƙ-car in the casting solution. The surface morphologies of membranes showed decreasing trend as they are more brittle with the addition of more ƙ-car. In conclusion, small addition of ƙ-car is a promising technique to produce membranes not only exhibited high water flux which is preferable in water industries, but also good separation performance and mechanically strong enough to withstand the operating pressure.

Keywords: Biopolymer; kappa-carrageenan; polysulfone; hydrophilicity; membranes permeability

UMK001

Synthesis of Advanced Ceramic Using Microwave Sintering Method

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Abstract. Advanced ceramic materials synthesis involved a very high sintering temperature (>1000°C) and a long soaking time (>5h). The high temperature and time-consuming process caused the conventional technique to be inefficient and costly. In this study, the microwave sintering approach was carried out using an enhanced method to solve this problem and the dielectric properties and other properties were investigated. An enhanced silicon carbide (SiC)-based susceptor was utilized to optimize the microwave radiation temperature to produce a type of advanced ceramics, the $CaCuTi_4O_{12}$ (CCTO). The calcination process was conducted at 500℃ with different calcination times using a microwave furnace operated at the frequency of 2.45 GHz and assisted with an enhanced silicon carbide (SiC)-based susceptor. XRD pattern revealed that cubic perovskite CCTO was obtained partially after calcination at 500℃ for more than 5 hours, but the single-phase CCTO was not completely formed at this temperature. The SEM microstructure showed grain growth and reduced porosity and grain boundaries of the pellets with increased calcination time. Dielectric properties also increase with the increase of calcination time. The dielectric constants for the CCTO pellets were to vary from 200 to 2900 in the frequency range of 1 MHz to 10 GHz. The investigations were conducted more on the sintering effect using the microwave. The calcination process of CCTO powder was completed conventionally in a furnace at 900°C for 12 hours to produce a controlled sample. The CCTO cylindrical pellets were sintered using a commercial microwave at 2.45GHz and 800W power. The sintering process was tested at five different irradiation times: 1 hour, 2 hours, 3 hours, 4 hours, and 5 hours. The electrochemical impedance spectroscopy conducted at 2.5V and 3V with 1Hz to 10 MHz frequency shows the dielectric behaviour performance of the sample concerning sintering time. The result reveals that the dielectric constant was best produced for 5 hours of sintering time. However, the CCTO sample can melt beyond the duration because the high heat generated in the sample's interior deteriorates the sample shape. The dielectric loss is also reasonably low during this time. It is then proven that completing the microwave sintering process in 5 hours is sufficient to improve the dielectric properties of the CCTO.

Keywords: Microwave sintering; calcination, solid-state reaction, CCTO, dielectric materials

UMK 003

Spectroscopy and X-Ray Diffraction (XRD) Analysis of Carbon Steel Slag: The Potential Sustainable Raw Material for Geopolymer Ceramic

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Abstract. The analysis of chemical composition, functional groups, and crystalline phases can be done by means of x-ray fluorescence spectroscopy (XRF), Fourier transform infra-red spectroscopy (FTIR), and x-ray diffraction (XRD). From the analysis, it helps in predicting the reaction that might occur during the alkalination, dissolution and polymerization to form geopolymer chain. Therefore, the presence of Si-O-Si, Si-O-Al and Fe-O functional groups in the raw materials will most likely contribute for the reaction to occur. Furthermore, the high amount of Si, Al, Fe and Ca can contribute to the geopolymerization potential. Moreover, the XRD analysis shows that the China clay mainly consist of kaolinite. Carbon steel slag shows phases of larnite, hematite, mullite and gehlenite. This study suggests the opportunities for future research of carbon steel slag incorporated geopolymer ceramic.

Keywords: Spectroscopy, x-ray diffraction, carbon steel slag, geopolymer ceramic

UITM 006

Reflection Loss And Microwave Absorption Of Some Thermoplastic Natural Rubber Filled With Yttrium Iron Garnet And Magnetite Composite

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Abstract. Thermoplastic natural rubber (TPNR)-YIG-ferrite composite were prepared from a melt-blending mixture of polypropylene, natural rubber and liquid natural rubber with addition of variable proportions of yttrium iron garnet ($Y_3Fe_50_{12}$) and magnetite (Fe_3O_4) not more than 30 wt.% to find the reflection loss (R_L) and the microwave absorption (P_a). The microwave relative complex dielectric permittivity (ε_r*) and magnetic permeability (μ_r*) were measured using a microwave vector network analyser by means of coaxial two-port technique in the frequency range of 0.3 – 13.5 GHz. The real and imaginary components of ε_r* (ε_r' and ε_r'') and μ_r* (μ_r' and μ_r'') for the samples show similar trend of frequency dependent. The material under test absorbed the EM wave most when its thickness equals a quarter of the wavelength of the propagating wave. The number of dips on the reflection loss increases with thickness of the toroidal samples. The lowest frequency dip occurs at a lower frequency for a thicker absorber. The composite with 70 wt.% TPNR with 5 wt% YIG and 25 wt.% magnetite revealed total microwave absorption at matching thickness of 12.5 mm at 10.5 GHz. The incorporation of different ferrites into TPNR matrix may produce microwave absorber based on selective band for sample with suitable thickness.

Keywords: Reflection loss, permeability, permittivity, microwave absorption

UMK 041

A comparative study using Open Sun Drying and Commercial Scale Hybrid Solar Dryer of Microbial Performance on Croaker Fish (Ikan Gelama)

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Abstract. In the present work, microbial parameters of raw and open sun drying fish samples are compared with dried fish samples obtained from Commercial Scale Hybrid Solar Dryer (CSHSD). The data analyzed are total viable count of gram-negative bacteria Escherichia coli ATCC 8739 (E.Coli) and gram-positive Staphylococcus aureus (S. aureus) bacterial and colour of the dried fish. It is found that the experimentally dried fish have better microbial quality as compared to open sun drying. This study addresses the issue of poor hygienic sanitary standards, improper handling and the need to adopt use of enhanced dryer based on recently sustainable developed technology.

Keywords: Hygienic; Dried fish; Drying technology; Solar heating

UMK023

Shape stabilized phase change material by pinecone adsorption

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Abstract. Energy efficient building is crucial for sustainability of our earth. Phase change material has gained interest to be used in building materials due to their ability to absorb and release heat from and to the environment. The phase change material transforms between solid and physical phase when temperature changed. When in liquid state, the phase change material cannot stand by itself, thus a shape stabilizing mechanism is needed. Therefore, the objective of this study is to investigate the pinecone particles as a shape stabilizer for capric acid as the phase change material. Leakage test and FT-IR were conducted to evaluate the shape stabilizing ability of pinecone and to confirm the presence of the capric acid in the material mixture.

Keywords: Phase change material; Biomass; Energy; Wood; Fourier Transform Infrared

UITM041

Study on the effect of 65nm NMOS transistor using SILVACO TCAD

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Abstract. This work aims to study the effect of short gate length of 65nm NMOS transistor using SILVACO TCAD. A 65nm NMOS was designed and virtually fabricated and characterized using ATHENA and ATLAS process and device simulators respectively. A shorter gate length is expected to experience short channel effects (SCE) such as channel length modulation and drain induced barrier lowering (DIBL). The SCE is observed from the comparison of the simulation result of the long gate length (0.3 μm) and short gate length (65nm) NMOS transistors. The result observed from I_D-V_D graph showed that the 65nm NMOS experienced the channel length modulation where I_D did not saturate as V_D increases with an increment of 1.45 at V_D=3.3V. Several improvements were done to overcome the SCE which are Halo implantation and retrograde well. A $5x10^{14}$ cm^{-3} Boron of 200keV implant energy and a $5x10^{13}$ cm^{-3} Boron of 100 keV implant energy were implanted for the retrograde well implant which showed to reduce the channel length modulation effect. In addition, from I_D-V_G graph, the drain current for the 65nm NMOS is not zero when V_G=0V which indicated the DIBL effect. Phosphorus of $2x10^{12}$ cm^{-3} and $1x10^{13}$ cm^{-3} concentration were implanted for the Halo implantation. The results showed that the inclusion of Halo implantation has reduced the DIBL effect as the I_D-V_G plot showed that I_D= 0 when V_D=0 with the threshold voltage, V_{TH}= 1.87 V respectively. This showed that the inclusion of Halo implantation and retrograde well implant reduces the channel length modulation as well as DIBL effect of the short gate length NMOS.

Keywords: NMOS, SILVACO TCAD, SCE, channel length modulation, DIBL, Halo implantation, retrograde well

UMK030

PLANT MONITORING SYSTEM USING GMonS APPS

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Abstract. Planting a tree is not just burying a seed ball in the soil, it has many factors to be considered. Some plants need more care for efficient growth. There are some plants which are grown only for showcase purposes and homemade agriculture. The required environment must be provided to the plant and should be watered from time to time to make the photosynthesis happen. The moisture and temperature of the plants are important to make sure the quality of the plants. In this study GMonS Apps which are the automated monitoring system were developed. The main objective of GMonS Apps is to monitor a plant by providing the suitable environment with the help of sensors such as moisture sensor to check the moisture of the soil and temperature sensor to check the temperature around the plant and then the light sensor to check the availability of the light which plays the major role in the process of photosynthesis. With these apps, alert sound will be issued if the moisture content in the soil is less than required. The data are recorded every 10 minutes for the 3 months. From the reading it shows that the growth of the plant can be monitored with this GMonS Apps and also to maintain a suitable environment for plant growth. This application plays a vital role and serves as a very good companion for the plant especially in recent digital world with IR 4.0.

Keywords: GMonS, moisture, temperature,

UMK031

Developing and design the E-Bosy reservation system for ICT equipment

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Abstract. E-bosy booking system was designed for reservation system for information and communications technology (ICT) equipment in Universiti Malaysia Kelantan (UMK). Currently, all the reservation systems were done manually either by filling the form or through email. Using this existing system faces numerous challenges such as the absence of knowledge of available spaces, tediousness, and improper management of reservations, clashes in reservations, communication failures, and missing the submitted reservation form. Thus, the development and design of E-bosy system was intended to bring the efficiency and friendly user of reservation systems both at home and aboard. The basic functions of the system are designed according to the general requirement including user's registration and login, online equipment booking, personal center, message board and database construction. The development of the system used Java programming language, PHP (a Web platform development technology), MySQL database processing technology, JDBC data access model, PaaS development platform, and cloud server. Through e-BoSy system, every reservation that has been made was recorded for the future improvement of the services. The development of this system is to automate the manual system to a web-based system which it has been accelerated by industrial digitization in response to rapidly changing customer needs to adopt the Industrial Revolution 4.0.

Keywords: E-bosy; information and communications technology (ICT) equipment; reservation system.

OTRS006

White Quantum Dot Light Emitting Diodes (QDLED) using high quantum yield of synthesis InP/ZnSe/ZnS nanocrystals

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Abstract. InP/ZnSe/ZnS nanocrystals for Quantum Dot Light-Emitting Diodes (QDLED) application was synthesised using hot injection method in close system via Schlenk technique. The quantum yield (QY) measurement was performed using photon count method by measuring percentage ratio of photon absorb to photon emitted and successfully produce 90% of QY. The synthesis quantum dot (QD) was then used to fabricate Quantum Dot Light Emitting Diodes in multilayer structure. The QDLED device was constructed as pre-pattern ITO/PEDOT: PSS/Poly TPD/QD (InP/ZnSe/ZnS)/SPPO 13/CsF/Al. The same structure was used as the control device, however using commercial InP/ZnS as the emissive material to study the performance of the commercial and the synthesis QD. Current density-voltage-luminance (J-V-L) characteristic was then measured using a CS200 (Konica Minolta) chroma meter powered by a source measure unit (Keithley 2400). It was found that, the synthesis device was successfully emitting white light at CIE (0.320, 0.325) and luminance at 1200 cd/m^2. Meanwhile, the control device emitted white light at CIE (0.321, 0.341) and luminance at 430 cd/m^2 from the commercial QD. The synthesis device was shown to produce higher luminance than that of the commercial QD due to high quantum yield through stable synthesis process.

Keywords: Quantum dot, InP/ZnSe/ZnS nanocrystal, quantum yield, Quantum Dot Light-Emitting Diodes, QDLED.

UMK033

Synthesis Of Graphene Oxide Embedded Gold Nanorods Using Hydrothermal Method for Enhanced Antibacterial Activity

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Abstract. This study reports the preparation of gold nanoparticle (AuNPs) using seed mediated growth and embedded with graphene oxide (GO) using hydrothermal method. In this study an experimental investigation was conducted to observe the formation of AuNPs on GO sheet and its antibacterial properties. The obtained nanocomposite was thoroughly investigated using UV–visible (UV-Vis) and FT-IR spectroscopy (FTIR) and Xray-diffraction (XRD). Meanwhile the antibacterial study of GO, AuNPs and different ratio of GO: AuNPs (1:0.5 , 1:1 and 1:2) was performed against Escherichia coli (E.Coli), and Staphylococcus aureus (S. Aureus) using Kirby Bauer disk diffusion method. The maximum inhibition zone was recorded every 8h for 24h. The results disclosed that the S. Aureus is more susceptible towards the GO-AuNPs compared to E. Coli where the maximum inhibition zone recorded was 10.4 mm meanwhile the inhibition zone for E. Coli is 8.0 mm. This suggests the potential of this nanomaterial in antibacterial applications.

Keywords: Graphene Oxide, Gold nanoparticle, hydrothermal, nanocomposite.

USM 005

Characterisation and larvicidal effects of different Zinc Oxide nanoparticles against Aedes aegypti larvae

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Abstract. This work reports the characterisation and larvicidal effects of two ZnO nanoparticle types towards Aedes aegypti (Ae. aegypti) larvae. The two types of ZnO nanoparticles were ZnO-AG (as-grown ZnO produced by gas-phase synthesis) and ZnO-BM (ball-milled for one week). Both ZnO-AG and ZnO-BM were characterized for structural, optical and morphology properties by XRD, UV-Vis and FESEM, respectively. For the ZnO-BM sample, the colloidal nanoparticles were centrifuged and dried prior to the bioassay procedure that was performed on the third instar Ae. aegypti larvae. Bioassay procedures were done in accordance to WHO standards for both samples. The results revealed that ZnO-BM had a smaller crystallite size (34.88 nm) and higher EDX O:Zn ratio (0.831) compared to that of ZnO-AG (crystallite size 47.4 nm and 0.675 of O:Zn EDX ratio). Moreover, bioassay results showed ZnO-BM have lower LC_{50} (48.6 mg/L) compared to ZnO-AG (73.47 mg/L) which suggested the stronger toxicity of the ball-milled sample toward Ae. aegypti larvae. The higher mortality rate of the ZnO-BM sample can be attributed to its larger surface area-to-volume ratio that led to enhanced ROS (reactive oxygen species) generation and increased zinc dissolution that caused internal organ damage inside the Aedes larvae.

Keywords: zinc oxide, larvicidal, Aedes aegypti

UMK040

Nanoparticles from Cockleshell for Optical Urea Biosensor

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Abstract. Urea in urine is commonly used as an indicator to determine kidney disease in humans. Previously, numerous sensing materials based on chemicals and artificial sources were used to immobilise urease in urea biosensors. In this study, calcium carbonate nanoparticles ($CaCO_3$-NPs) from discarded cockleshells were synthesised via a simple and eco-friendly approach and characterised using field-emission scanning electron microscopy (FESEM), particle size analyser (PSA) and Fourier-transform infrared-attenuated total reflectance (FTIR-ATR) spectroscopy. The surface of the NPs was primarily functionalised with acrylic acid N- hydroxysuccinimide ester (NAS) to provide a succinimide ester group that could covalently bind to the amine group of urease. An optical biosensor for urea based on urease immobilised on functionalised NPs (Urs/F-NPs) was successfully developed. The results showed that the NPs obtained were an aragonite polymorph of $CaCO_3$, with 78.8 ± 10.8 nm in size. Approximately 85.8% of the urease was successfully covalently immobilised on the surface of the NPs that had been proved by the bovine serum albumin (BSA) method and FTIR-ATR. The FTIR-ATR spectra confirmed peaks at 1120 cm^{-1} and 1016.63 cm^{-1}, which were due to the presence of aliphatic amine C-N and amide bonds, revealing the immobilisation of urease on functionalised NPs. The biosensor provided a colourimetric indication of increasing urea concentrations by changing from colourless to pink. The determination of urea concentration using this biosensor yielded a linear response range of 30 to 1000 mM (R^2 = 0.9901), with a detection limit of 17.74 mM.

Keywords: Calcium carbonate nanoparticles; Optical biosensor; Urea; Urease immobilisation.

UTMH002

Study a Technique of Radiographic Film Processing for X-ray and Gamma Ray Films Using Manual Processing

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Abstract. Radiographic testing (RT) is a non- destructive technique (NDT) method which uses either X-rays or Gamma rays to examine the internal structure of manufactured components identifying any flaws or defects. Advantages of RT include it can be used with most materials, provides a permanent image record of the test, reveals internal nature of materials, discloses fabrication errors and often indicates necessary corrective action and reveals structural discontinuities and assembly errors. Both radiation sources have different properties in term of energy level, intensity and wavelength. There are several issues based on the quality of the film such as poor development, film fogging and poor contrast. Due to that, radiographic film processing is an important step to produce visible image. The objective of this study is to process a radiographic film using manual processing. Both X-ray and Gamma- ray film will undergo six steps which are developing, stop bath, fixing, washing, wetting agent and drying. After drying, both films will undergo viewing process using Densitometer. The identification in the radiographic film was identified based on the instruction number, personal number, specimen number and date of testing. The results show a different quality of visible image formed for both X-ray and Gamma- Ray.

Keywords: radiographic film, film processing, X-ray, Gamma-ray, manual processing

UMK041

A comparative study using Open Sun Drying and Commercial Scale Hybrid Solar Dryer of Microbial Performance on Croaker Fish (Ikan Gelama)

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Abstract. In the present work, microbial parameters of raw and open sun drying fish samples are compared with dried fish samples obtained from Commercial Scale Hybrid Solar Dryer (CSHSD). The data analyzed are total viable count of gram-negative bacteria Escherichia coli ATCC 8739 (E.Coli) and gram-positive Staphylococcus aureus (S. aureus) bacterial and colour of the dried fish. It is found that the experimentally dried fish have better microbial quality as compared to open sun drying. This study addresses the issue of poor hygienic sanitary standards, improper handling and the need to adopt use of enhanced dryer based on recently sustainable developed technology.

Keywords: Hygienic; Dried fish; Drying technology; Solar heating

UMK046

Effect of Cellulose Nanocrystal (CNC) / Zinc Oxide (ZnO) as Hybrid Filler on Mechanical and Antimicrobial Properties of PVA/CNC/ZnO Nanocomposites

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Abstract. Utilizing nanoparticles in various applications, such as reinforcement in the polymer matrix, has increased the possibility of creating a novel material. In this study, cellulose nanocrystals (CNC) and zinc oxide (ZnO) were mixed as a hybrid filler reinforcement in polyvinyl alcohol (PVA) matrix. At first, CNC with various concentrations (1wt%, 2wt%, 3wt% and 4 wt%) were blended with ZnO and the mixture with different ratios of CNC: ZnO (1:05, 2:1, 3:1.5, 4:2.0) then was added to 50 mL of 5 wt% PVA and vigorously mixed for 40 minutes at 90°C until the mixture was completely homogeneous. The surface morphology of CNC/ZnO/PVA nanocomposite films was studied using Scanning Electron Microscopy (SEM), while the tensile strength was determined using Universal Testing Machine (UTM). The antimicrobial effect was carried out using a zone of inhibition of bacteria Gram-negative, E. coli and Gram-positive S. aureus. The SEM showed that as the ratio of CNC/ZnO increased, the surface morphology of the CNC/ZnO/PVA became rougher. The tensile strength and modulus of nanocomposite films increased from 1.75 to 16.25 MPa and from 125.266 to 366.304 MPa at CNC/ZnO/PVA (1:0.5) to CNC/ZnO/PVA (3:1.5), respectively and start to decline at CNC/ZnO/PVA (4:2.0). The solution of ZnO nanoparticles had excellent antimicrobial properties, killing both Gram-negative, E. coli and Gram-positive, S. aureus compared to the CNC/ZnO/PVA films, CNC/ZnO mixture and CNC/ZnO/PVA mixture.

Keywords: Cellulose nanocrystals, ZnO, hybrid filler, PVA, tensile, antimicrobial

UMK044

Bioleaching of Iron (III) Impurities from Different Particle Sizes of Ilmenite Ores ($FeTiO_3$) by Shewanella oneidensis MR-1

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Abstract. Ilmenite is the most common reserve of titanium in nature. Iron oxides are the most common impurities contained in ilmenite ore. Separating iron impurities from ilmenite ore remains as a challenging part in titanium extraction process as the conventional methods require usage of hash chemicals and excessive heating, which are not environmentally friendly. In this study, we explored the application of iron-reducing bacterium (IRB), Shewanella oneidensis MR-1 to leach out iron from ilmenite ore through reductive dissolution strategy. Reduction of iron oxides contained in ilmenite ore by respiration activity of S. oneidensis MR-1 transform insoluble iron (III) to soluble iron (II), which can leach out from the ilmenite ore. Different particle sizes (355 µm, 250 µm, 125 µm and 32 µm) of raw ilmenite were incubated with S. oneidensis MR-1 under anaerobic conditions for 30 days. S. oneidensis MR-1 incubated with 32µm ilmenite grains exhibited tangible results. Reductive dissolution activity was highest in 32µm ilmenite grains recording 0.754mM, of iron (II) accumulation, monitored through Ferrozine method every 3-4 days. Scanning Electron Microscope (SEM) and X-Ray diffraction (XRD) further analyzed the transformed 32µm ilmenite grains incubated with S. oneidensis MR-1 based on chemical composition and structural changes, after 30 days. The weight loss of ilmenite grains with incubation were also recorded. The findings of this study show that reductive dissolution of iron (III) by S. oneidensis MR-1 is a promising environmentally friendly and low-cost bioleaching strategy in removing iron impurity from ilmenite.

Keywords: bioleaching, ilmenite , iron reducing bacteria, Shewanella oneidensis,

UMK009

Mechanical Properties of Kenaf Fibre Mat/Cellulose Nano Crystal/Graphene Nano Platelets reinforced Unsaturated Polyester Resin Biocomposites

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Abstract. Kenaf fibre mat (KFM) reinforced unsaturated polyester (UPE) composite have been prepared by using hand lay-up and compression molding techniques. Two kind of nanofillers were used to improve the strength and rigidity of the biocomposites, which is cellulose nano crystals (CNC) and graphene nano platelets (GNP) in the amount of 0-3 wt %. The nanofiller was mixed homogenously with the unsaturated polyester resin before catalyzed with methyl ethyl ketone peroxide (MEKP) initiator and promoted by cobalt naphthenate accelerator and then were poured into the mould that have kenaf fibre mat. The KFM-UPE biocomposites with various GNP/CNC hybrid ratio was then fabricated by hot press moulding at 120 ℃. The mechanical behavior of the composites was characterized by tensile and flexural testing according to ASTM D3039 and ASTM D790, respectively. The obtained results revealed that the presence of both GNP and CNC nanofillers in KFM-UPE composite have demonstrated a significant enhancement in mechanical (strength and modulus) properties.

Keywords: nanofillers hybrid, mechanical properties, cellulose nano crystals, graphene, kenaf fibre, unsaturated polyester resin

UITM002

First-Principles Calculation for Structural, Electronic and Optical Properties of N-doped, V-doped and N/V-codoped Anatase TiO_2

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Abstract. The structural, electronic structures and optical characteristics of nitrogen (N), vanadium (V) and (N/V)-codoped anatase TiO_2 were investigated by the first-principles density functional theory (DFT). Calculations were performed with the GGA+U (generalized gradient approximation plus U) approach, which can accurately estimate the energy of strong correlation semiconductors. The bandgap of N-TiO_2 was 2.719 eV, whereas that of V-TiO_2 was 2.556 eV, which are smaller than the bandgaps of pure TiO_2 (3.202 eV) and N/V-codoped TiO_2 was 2.609 eV. Furthermore, N-TiO_2, V-TiO_2 and N/V-codoped TiO_2 will result in a red-shift of the absorption edge compared with the pure TiO_2. The absorption coefficient of doped TiO_2 was significantly enhanced in the visible light region. These findings demonstrate that doped TiO_2 would have great application potential in photocatalysis.

Keywords: First-principles calculations, anatase TiO_2, N-doped TiO_2, V-doped TiO_2, N/V codoped TiO_2, photocatalyst

UKM001

Effects of Copper Iodide-doped P3HT:PCBM Photoactive Layer Thickness on the Photovoltaic Performance of Inverted Organic Solar Cells

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Abstract. Photoactive layer of poly(3-hexylthiophene) (P3HT):(6,6)-phenyl-C61-butyric acid methyl ester (PCBM) doped with copper iodide (CuI) in inverted type organic solar cell has displayed a good photovoltaic performance under one sun and indoor illumination. In this work, the thickness of CuI-doped P3HT:PCBM photoactive layer was varied by manipulating the solution concentration in order to obtain an optimum photoactive layer thickness in inverted organic solar cell under one sun and indoor white LED illumination. Electron transport layer of ZnO was spin coated on pre-cleaned fluorine-doped tin oxide (FTO) glass substrates. The photoactive layers with different solution concentrations were spin coated on top of ZnO and top electrode silver (Ag) was thermally evaporated for device completion. It is interesting to find that the optimum thickness obtained under one sun illumination is different from that under indoor white LED illumination. The underlying mechanism is discussed in detailed.

Keywords: Copper iodide, organic solar cell, photoactive layer, thickness.

UITM005

Electronic and optical properties of Au and Ag doped $LiNbO_3$ from first- principles study

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Abstract. Using first principles calculation, the structural, electronic and optical properties of Ag and Au doped $LiNbO_3$ are investigated. The first-principles calculation in this work is implemented using CASTEP computer code with GGA-PBE correlation. The calculated fundamental band gap of pure $LiNbO_3$ was observed at 3.547 eV and for doped $LiNbO_3$, the band gap shows a reduction in the band gap value. For Au doped $LiNbO_3$ shows a value of 1.120 eV while Ag doped $LiNbO_3$ give a band gap of 0.704 eV. The density of states are calculated to analyze the effect of doping Au and Ag on the electronic properties and absorption spectra The results show a shift toward visible region in the optical absorption edge of Au and Ag doped $LiNbO_3$ compared to pure $LiNbO_3$. The dielectric constant and refractive index of doped structures are calculated. The enhancement in optical absorption of Ag and Au doped $LiNbO_3$ making it a promising material for photovoltaic and photocatalyst application.

Keywords: first principles study, Ag doped $LiNbO_3$, Au doped $LiNbO_3$, electronic properties, optical properties

UKM002

Shear Strength Of 3d Printed Polymeric Composites

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Abstract. Additive manufacturing (AM), often known as 3D printing, is a relatively recent technology that may be used to replace traditional manufacturing processes by depositing materials layer by layer to create a structure in the required shape. However, there still have a limitation when the strength of the materials was reduced due to poor interfacial adhesion between matrix and reinforcement. Thus, this aim of this work is to study the influence of interfacial adhesion of polyamide reinforced carbon fibre (PACF) composites by using fused deposited modelling method. Here, we investigated the polyamide reinforced carbon fibre as a feedstock of 3D printing in terms of their processibility, thermal, microstructure and mechanical performance. Then, a printed sample was kept in the oven with 5 and 20 hours to performed for further improve the mechanical properties of the composites. The results showed that the fabricated PACF that was printed on horizontal direction exhibited a higher flexural strength and modulus that was reached 52.90 MPa and 1.77 GPa, compared to the vertical direction. Under drying conditions in thin layer of PACF composites with 70°C, the structure of high performance PACF composites can resist the growth of deformation which may lead to increase in mechanical strength.

UPM010

Enhanced Grain Coupling for Increasing Critical Current Density of Ex-Situ MgB_2

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Abstract. Ex-situ MgB_2 has a higher packing factor than that of its in-situ counterpart. However, intergrain connectivity of the former is much weaker resulting in its lower critical current density, J_c. Hence, it is the aim of this work to increase grain coupling of the ex-situ MgB_2 bulks. In this study, commercial MgB_2 was used as precursor (ex-situ MgB_2 bulks). The precursor was mixed with Mg or (Mg+B) with excess Mg. The mixture was then sintered at 600 °C - 1000 °C for 1 h. Magnetization measurement was carried out in order to determine the superconducting critical temperature, T_c and J_c. Phase formation and lattice properties of the samples were checked using powder X-ray diffraction. Field-emission electron microscope was used to image morphology of the samples. It was found that the T_c remained unchanged at around 38 K. With the addition of Mg or (Mg+B), J_c was enhanced pronouncedly. Self-field J_c of up to 10^4 A·cm^2 was obtained at 20 K. The increased J_c is due to the improved intergrain coupling which enhanced further by optimisation of the heat treatment.

Keywords: ex-situ MgB_2, sintering, grain coupling, critical temperature, critical current density

UMT006

Superoleophilic and Hydrophobic Nanoporous Kapok Fibers as Effective Oil Sorbents

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Abstract. Functional sorbent with high oil sorption, dynamic oil/water selectivity and oil retention is essential to remediate offshore oil spills. This work demonstrated facile and energy-efficient carbonization of superoleophilic-hydrophobic nanopores kapok bundles as effective oil sorbent. The kapok bundles' surface roughness and intrinsic graphite phase were tunable by varying the carbonization temperature, enhancing their oil sorption and retention. Lumen preservation and nanopore formation enable the carbonaceous kapok bundles to show tunable oil sorption capacities of 34.0 g/g – 95.5 g/g for 12 oils with different densities and viscosity. The adsorption-desorption isotherms of the nanoporous kapok fibers fall into H3 IUPAC classification with the indication of non-rigid lamellar pores appearing on each fibers. The kapok bundles selectively absorbed oil slick under vigorous water vortex and demonstrated distinctly high oil retention of 100% under gravitation force. Multiple oil sorption-desorption cycles demonstrate a considerable promise of the carbonaceous kapok bundles for high reusability with low environmental impact for oil spill recovery.

Keywords: Rice husk, Silica nanoparticles, Foliar spray

UTM009

Tailoring the optical and magnetic properties of cobalt oxide nanoparticles in boro-tellurite glass in the presence of erbium

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Abstract. This paper reports the cobalt oxide (Co_3O_4) NPs concentration dependent on erbium (Er^{3+}) doped sodium magnesium borotellurite glass prepared using melt quenching method and the influence of Co_3O_4 NPs as incorporated in Er^{3+} doped glass are examined. Samples are characterized using X–ray diffraction (XRD) which reveals the amorphous nature of the glass without the existence of any sharp peak. The typical absorption bands of Er^{3+} that are attained possess a broader absorption due to the overlap of Er^{3+} with Co^{2+} and Co^{3+} ions. The emission spectra revealed two prominent peaks centered at 653 nm and 822 nm, assigned to the transition $^4F_{9/2} \rightarrow {}^4I_{15/2}$ (red) and $^4I_{9/2} \rightarrow {}^4I_{15/2}$ (NIR) respectively with significant drop in the luminescence intensity due to the principal role played by the NP ions. The EPR spectra revealed three prominent value of g factor at ranges of 4.07–4.22, 2.97–3.02, 2.11–2.41 attributed to Co^{2+} ions in tetrahedral and octahedral sites.

Keywords: Boro-tellurite glass, Co_3O_4 nanoparticles, Luminescence quenching, EPR

UITM010

Enhancement of magnetoresistance effect in $La_{0.8-x}Dy_xNa_{0.2}MnO_3$ (x = 0.00 and 0.10) monovalent doped manganites: Next generation spintronic-based devices.

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Abstract. $La_{0.8-x}Dy_xNa_{0.2}MnO_3$ (x=0,0.1) samples were prepared by solid-state method to investigate the effect of Dy substitution at La-site on magnetoresistance behaviour in monovalent doped manganites. An analysis of X-ray diffraction data using Rietveld refinement analysis shows that the cell volume decreased from 404.24 $Å^3$ to 401.73 $Å^3$ indicates enhancement of lattice distortion as a result of Dy substitution. The ρ-T curve shows that sample x=0 exhibit metallic behaviour while sample x=0.1 exhibit metallic behaviour at low temperature region below metal-insulator transition temperature, T_{MI} (T_{MI} ~220 K). Above the temperature, the x =0.1 sample exhibit insulator behaviour. In the presence of 0.8 T of magnetic field, both samples exhibit a reduction in resistivity in temperature range 30 K – 300 K which led to magnetoresistance effect. The observed reduction of resistivity indicates improvement of ferromagnetic interaction between Mn ions thus conduction process of charge carriers increased. Dy substituted sample exhibit larger magnetoresistance (MR) effect with value of 48% compared to sample x=0 with value of 10% at 300 K indicates high sensitivity of the sample to the magnetic field and its potential application as spintronic based devices.

Keywords: Dy substitution, Manganite, Magnetoresistance

UPNM002

Controlled Release NPK Fertiliser Encapsulated by a Biodegradable Polyester

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Abstract. The commercial NPK granular fertilizer was coated using a biodegradable polyester namely polylactic acid (PLA) in order to prepare controlled release NPK fertilizers (PLA-coated NPK fertilizers). The coatings were prepared from the polymer solution of PLA by immersion method. The effects of PLA concentration and number of coating on nutrients release behaviour in water (in terms of conductivity) of PLA-coated NPK fertilizers were investigated at room temperature for a period of 28 days. The results revealed that the release of NPK nutrients from double PLA-coated NPK fertilizers were slower than that of single PLA-coated NPK fertilizers. Therefore, this study demonstrated that double PLA-coated could acts as controlled release fertilizers (CRFs) which are suitable for sustainable agricultural and horticultural applications.

Keywords: controlled release fertilizer, polylactic acid, coating

UPNM003

Design and Development of Aptamer-Gold Nanoparticle for Colorimetric Detection of Methylphosphonic Acid

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Abstract. In this study, a response surface methodology (RSM) based on face-centered central composite design (FCCCD) was applied to optimize determination of methylphosphonic acid (MPA) using DNA aptamer-citrate capped-gold nanoparticles (DNA aptamer-cit-AuNPs). Detection of MPA was based on color change of the solutions by capturing the color images of the solutions. The images were further processed to red (R), green (G) and blue (B) values. The effects of cit-AuNPs concentration (X1), DNA aptamer concentration (X2) and incubation period (X3) on the response (ΔRGB) were investigated. Analysis of variance (ANOVA) has been used to determine the significant factors that affect the detection. A good agreement between the predicted and experimental responses was demonstrated. Therefore, the developed model is suitable to predict the response at 95% confidence level. This simple and rapid detection method could be implemented for detection of MPA on-site.

Keywords: methylphosphonic acid, cit-AuNPs, DNA aptamer

UKM007

Acoustophoresis and dielectrophoresis forces in a single platform for particle manipulation

Dr. Mohd Farhanulhakim Mohd Razip

Abstract. The microfluidic system for chemical and biomedical analysis would require the passive or active manipulation forces for controlling, trapping, separating, sorting, distinguishing particles and cells. In the case of passive manipulation, the consistency and repeatability are the main concern in order to achieve high level of controls with precise trajectories. Meanwhile, the active manipulations allow to control particle displacement in a highly predictable and consistent fashion, by introducing external forces such as hydrodynamic, dielectrophoretic,magnetophoretic,acoustophoretic and optical tweezing, which are much more promising for the development of a small and compact biomedical diagnostic rapid test. Among these external forces, dielectrophoresis(DEP) and acoustophoresis(ACP) have been shown to be promising due to the capability to exert forces on the particles in liquid environment since the majority of biological particles are suspended in various biological fluids such as blood and urine. Furthermore, both methods are also highly selective, label-free, quick and low-cost in fabrication. In this research, we present a novel approach by integrating these two forces in a single chip enabling to improve the separation process based on the intrinsic acoustic and dielectric properties of particles for ACP and DEP respectively. The possibility for these dual forces to co-exist in a single chip is ensured by the usage of piezoelectric substrate in order to excite surface acoustic wave and its high dielectric properties enabling the presence of DEP forces which has never been reported in the previous studies. This study is expected to reveal why certain manipulative forces are more or less dominant under certain conditions.

UITM013

Structural and mechanical properties of Ti-Y alloys (Y=Nb, Mn, Mo and Re) via density functional theory

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Abstract. Titanium (Ti) alloy rich with α-phase composition possesses a higher modulus of elasticity. Alloying with β-stabilizer elements might be able to tune this modulus in favour of specific applications. Herein, we report a theoretical study of the structural and mechanical properties of binary Ti-Y alloys using β-stabilizer, Y (Y=Nb, Mn, Mo and Re). The calculations are carried out using density functional theory (DFT). The generalized gradient approximation (GGA) for Perdew-Burke-Ernzerhof (PBE) is implemented in the CASTEP package. The lattice parameter decreases linearly with increasing concentration of Mn, Mo and Re, and increases slightly with the addition of Nb. The properties of bulk modulus, shear modulus, Young's modulus, and Poisson ratio are calculated. It is shown that the lower Young's modulus of these Ti-alloys stems from the Ti-Y with a negative value of C_{44}. This insight presents a plausible explanation for the observed complexity in novel data on new material β-stabilizer of Ti alloys.

Keywords: Binary Ti alloys, CASTEP, First-principles, Young's modulus, β-stabilizer

UKM011

Bibliometric analysis on the research of yttrium iron garnet film magnetic properties

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Abstract. Yttrium iron garnet (YIG) was found in 1956 by Bertaut and Forrat. Since then, it has played an important role in the research of physics of magnet. Among the reasons are first, its Curie temperature is above room temperature (559K) meaning that experiments can be conducted at room temperature. Second, it is an insulator with energy gap ~ 2.8 eV thus the analysis and interpretation of experiment data would not involve complication due to false charge current. Despite the abundance of research on this material, a study that can comprehensively evaluate the most highly cited articles on YIG has not been carried out. This kind of study is needed in order to provide a thorough understanding of future trends and applications. This study was carried out using the Scopus database search engine to look for filtered keywords in YIG film magnetic properties, published between 2010 and 2021. The analysis revealed that spin waves and YIG film preparation are the most influential topics. The type of study that have been most conducted in this field are theoretical and model development. These findings can aid the researcher in identifying the future direction of this field, thereby guiding future research thus developing discoveries.

UITM020

The effect of acid photoetching on epoxidized natural rubber and polyvinyl chloride in immobilized TiO_2 for photocatalysis enhancement

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Abstract. ENR and PVC were used as polymer binders in immobilizing TiO_2 on glass substrate by using dip coating technique. The acid photo etching process was applied to the immobilized TiO_2/ENR/PVC (TEP) samples to study the reaction and surface transformation with the presence of hydrochloric acid (HCl). The photocatalytic activity of the prepared immobilized TiO_2/ENR/PVC samples was examined on the degradation of reactive red 4 (RR4) under a 65 W compact fluorescent lamp. All immobilized TiO_2/ENR/PVC samples under the acid photoetching process (TEP A) expressed higher photocatalytic activity in comparison with the photoetching process (TEP P). TEP A50 (acid photo etching for 50 h) sample has shown the highest photocatalytic degradation where Pseudo 1st order rate constant (k) value was ca. 0.0694 min^{-1}. However, it is not considered as an optimum sample due to the peel-off effect. The optimum sample for the acid photo etching was TEP A40 (acid photo etching for 40 h) with 0.0553 min^{-1}. The optimum sample is 2 times faster as compared with the photoetched immobilized TiO_2/ENR/PVC, which is primarily due to the surface transformation and formation of C-OH bond from crosslinking reaction of the polymer binder with the HCl as verified from FESEM and FTIR analysis.

Keywords: Immobilized TiO_2, acid photo etching, polymer binder, crosslinking reaction, photocatalytic degradation

MCB001

Antioxidant-Rich Cocoa Face Mask Cosmetic for Dermal Care

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Abstract. Antioxidant-rich cocoa liquor/mass (CL) which is primarily being used in chocolate products, have been reported in many researches regarding its effectiveness against cancer, cardiovascular-related, and neurodegenerative diseases. However, information of this so-called material pertaining to antioxidant capacity (AOC) and anti-ageing activity for dermal care is still limited. Therefore, the objective of this study was to determine the AOC and in vivo skin efficacy of cocoa face mask (CFM) formulated mainly from CL. Assessment of CFM includes total phenolic content (TPC) and total flavonoid content (TFC) assays whereas the AOC involves 1,1-diphenyl-2-picrylhydrazyl (DPPH), Ferric Ion Reducing Power (FRAP), and β-carotene linoleate bleaching (β-CB). Results showed that the TPC and TFC of CFM extract were assayed at 131.97±0.06 mg GAE/g and 4.10±0.0 mg RE/g through Folin-Ciocalteau and aluminum chloride ($AlCl_3$) tests, respectively. DPPH scavenging activity was observed at the highest concentration of 87.99±0.03% with EC_{50} at 30.33±0.0 mg/mL whilst FRAP and β-CB were assayed at 252.31±0.001 mmol Fe^{2+}/g DW and 83.42±0.03% with EC_{50} at 2.92±0.03 mg/mL, respectively. In term of in vivo skin efficacy, transepidermal water loss (TEWL) or emission of water from the skin of volunteers applied with CFM formulation was significantly lower ($p<0.05$) than placebo whereas skin elasticity parameter for CFM formulation has recorded significant ($p<0.05$) increment of ten times compared to the placebo group. To conclude, cocoa liquor can be categorized as a potential material for dermal care due to the encouraging results of TPC, TFC, DPPH, FRAP, β-CB, as well as in vivo skin efficacy.

Keywords: Antioxidant-rich, Cocoa face mask, Dermal care, Skin efficacy

USU001

Superconductivity in $Tl_{2-x}Te_xBa_2CaCu_2O_{8-\delta}$ prepared using different precursor powders

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Abstract. method. A comparison was made on the effectiveness of BaO and $BaCO_3$ as starting components. TeO_2 was used as the source of Te. Appropriate amounts of high-purity (≥99.99 %) BaO or $BaCO_3$, CaO and CuO were mixed and ground. The mixture was calcined at 900◦C for over 24 h with several intermittent grindings to obtain a homogeneous black powder. Appropriate amounts of Tl_2O_3 and TeO_2 were then added to the precursor and pressed into pellets with 12.5 mm diameter and 2 mm thickness. To compensate for thallium loss during the heating process, excess 10 % of Tl_2O_3 was added. The pellets were heated at 900◦C for 1 h in flowing O_2 followed by furnace cooling. The four-point probe method with silver paste contact was used to measure the electrical resistance. The temperature dependent measurement was performed using a CTI Cryogenics Closed Cycle Refrigerator Model 22 and Lake Shore Temperature Controller Model 340 with liquid helium. The resultant phases were determined by using the powder X-ray diffraction (XRD) method (Bruker model D8 Advance diffractometer). Samples with BaO powders produced zero resistance temperature, $T_{c\,zero}$ from 80 K to 110 K, whereas samples prepared with $BaCO_3$ powders produced $T_{c\,zero}$ from 80 K to 98 K. XRD patterns showed that the volume fraction of Tl-2212 based on BaO was better than $BaCO_3$. The peak of the temperature derivative resistivity (dR/dT) graph, T_c^p was between 89 K and 110 K (BaO precursor). Meanwhile, T_c^p was in the range of 92 K to102 K was noted in the samples prepared with $BaCO_3$. For both powder the presence of Te was found to be effective only in a small amount.

UOP002

Structural formation and conductivity of Sc and Y co-doped ZrO_2 via pulsed laser deposition

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Abstract. Sc and Y co-doped ZrO2 thin films were fabricated using pulse laser deposition (PLD). Among different deposition methods, PLD is remarkable in producing high-quality thin films and the microstructure can be tuned by changing the deposition parameters. In this study, the structural property, formation mechanism, and conductivity of scandium and yttrium co-doped zirconia (ScYSZ) thin films prepared using PLD were investigated. As-calcined powders of 4 mol% Sc_2O_3 and 4 mol% Y_2O_3 were prepared with ZrO_2 via a solid-state reaction method. The sintered pellet was used as a target material for pulsed laser deposition of ScYSZ thin films on Si substrate with native SiO_2 oxide using Q-switched Nd^{3+}:YAG laser (λ=266nm). Deposition parameters include substrate temperature and oxygen partial pressure. The effects of different deposition temperatures and pressures on the structure of ScYSZ thin films and the formation mechanism were investigated using XRD, PES, and Raman Spectroscopy. From the XRD spectra, it can be attested that nanocrystalline film growth starts at 200°C and then fully crystallized from 600°C to 800°C. The structure formation of the films was observed to be dependent on the thin film deposition conditions. On the other hand, the temperature-dependent ionic conductivity of the ScYSZ thin films was measured using an AC impedance analyzer with increasing operating temperature. It was observed that the substrate temperature and pressure have a significant effect on the crystal structure of deposited thin films. Significant high total conductivity was measured for ScYSZ thin films using the interdigital microelectrodes.

Keywords: solid electrolyte, solid oxide electrochemical cells, pulsed laser deposition, co-doped zirconia, electrolyte thin films

UITM023

Tuning electronic and magnetic properties of Zn-Ni-Co Ternary Spinel Oxides Based Co_3O_4 For Supercapacitors Electrode

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Abstract. Modifying the spinel Co3O4 via doping with other 3d transition metals provides a rich redox reaction, hence can improve the performance of the electrode. Herein, a theoretical work of the metal (M)-doped Co_3O_4 (M=Ni, Zn) is performed by using density functional theory (DFT) as implemented in the CASTEP to calculate the structural, electronic and magnetic properties. To form the ternary spinel oxide, the doped Zn into $NiCo_2O_4$ with different doping ratios (x=0.25, 0.50 and 0.75) were calculated. The introduction of Zn has provoked atomic bonding and structure due to the unsatisfied antiferromagnetic spin arrangement at the tetrahedral site as the substitution of Co^{2+} with non-magnetic Zn^{2+} ions. The density of states analysis shows that the value near the Fermi level at a higher doping ratio x=0.75, namely $Ni_{1.0}Zn_{0.75}Co_{1.25}O_4$ (16.13electron/eV) has increased from binary oxide, $NiCo_2O_4$ (12.30electron/eV). Such an increase in this value leads to an enhancement of electrical conductivity. The variation of doping concentration enables to adjustment of the suitable content and consequently can tune the properties of the material.

Keywords: Density functional theory, Co_3O_4, ternary spinel oxide, electronic properties, magnetic properties

UTM001

Structural Modelling of Sodium Borogermanate Glass using Low Field ^{11}B MAS NMR and DFT-FTIR

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Abstract. The structure of ternary sodium borogermanate glasses is complicated due to presence of two network- modifying oxide boron and germanium. It is not known whether sodium ion in borogermanate will favour into either boron or germanium network. Hence in this works, systematic experimental and simulation analysis are carried out to model the structural network of sodium borogermanate glass. Glasses with nominal composition of (100-x-y) GeO_2-xB_2O_3-yM_2O where x and y =10 and 20 and 30 mol % are prepared using melt quenching technique. Identification of short- range order (SRO) and intermediate range units (IRO) of boron and germanate network in sodium borogermanate glass are determined by deconvoluting of low field 11B MAS NMR spectra. The vibrational modes account for the specific vibration of germanate and boron are presented and the spectral features of FTIR experimental are compared with the calculation DFT-FTIR.

Keywords: Sodium Borogermanate glass, ^{11}B MAS NMR spectroscopy, FTIR spectroscopy.

UITM025

Electrical Performance of Ni-CeO_2 Catalysts Layer for Anode-Supported Protonic Ceramic Fuel Cells

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Abstract. This study reports the electrical performance of Ni-CeO_2 catalysts layer on NiO-BCZY anode-supported button cells of a protonic ceramic fuel cell (PCFC). The anode catalysts layer was synthesized by incorporating the catalysts onto NiO-BCZY|BCZY|LSCF (BCZY = $BaCe_{0.54}Ce_{0.36}Y_{0.1}O_{2.95}$) (LSCF = $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\alpha}$) button cell. All powder materials were synthesized using the sol-gel method. NiO-BCZY anode was fabricated using a dry-pressing method while the incorporation of BCZY electrolyte thin film was done via a spin-coating method onto the anode. The LSCF cathode and Ni-CeO_2 anode catalyst layers were then spin-coated onto the electrolyte thin film and anode pellet, respectively, to form a fully functional Ni-CeO_2/NiO-BCZY|BCZY|lLSCF button cell. The composition and structure of the button cell were also summarized. Scanning electron microscopy (SEM) and energy dispersive x-ray (EDX) techniques were used to characterize the microstructure of the fabricated button cell. The cell's electrical performance was measured in a hydrogen atmosphere at 800 °C using electrochemical impedance spectroscopy (EIS) technique. The results obtained from the analysis are discussed in the context of Ni-CeO_2 catalysts layer incorporation impacts on the electrical performance of button cells.

Keywords: Ni-CeO_2, Protonic Ceramic Fuel Cell, NiO-BCZY, Electrical Performance, Anode-Supported.

UITM 026

Electrical Conductivity of NiO-Ba(Ce,Zr)O_3 Composite Anode at Intermediate Temperatures

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Abstract. The increasing demand for the energy utilisation through the greater use of primary energy resources such as natural gas, coal and oil causing an environmental effect. The exploitation of the main energy resources will be depleted in the future. Hence, researchers and scientists use their talents to find and develop more clean and effective energy that be utilize in the foreseeable future. Solid oxide fuel cells (SOFCs) proved to be highly effective electrical conversion device. The most suitable type of SOFCs to be utilize as alternative sources are Proton ceramic fuel cell (PCFC) because its grant higher ionic conductivity that operates at intermediate-temperature within the range 400℃ to 800℃. The in-house developed NiO and the $BaC_{0.54}Z_{0.36}Y_{0.1}O_{2.95}$ (BCZY) powders are mixed in a weight ratio of 50:50 by mortar and pestle to produce a NiO-BCZY composite anode. The pellet will be fabricated by using dry pressing method. The electrical conductivity of the NiO-BCZY pellet is characterized using Van der Pauw measurement in the temperature ranging from 400℃ to 800℃. The result shows that the conductivity of the NiO-BCZY anode increases with the increase of the temperature. It is revealed that the intermediate temperature of 500℃ to 700℃ containing atmosphere NiO-BCZY anode exhibit mixed electronic and ionic conduction that is needed for proton ceramic fuel cell (PCFC).

Keywords: Van Der Pauw measurement, electronic and ionic conduction, composite anode

UTM003

Quantum Chemical Calculation of Borate Structures for the Assessment of Borate Glasses.

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Abstract. Borate glasses possess desired critical properties such as density and refractive index suitable for uses in many applications. These properties depend on the structure of the glass. In pure borate glass, the structure is made up of [BO_3] units, with 75% are in boroxol configuration and 25% are in loose [BO_3] configuration. The addition of alkali oxide to borate glass causes (1) the disruption of the boroxol unit and (2) the formation of other superstructural units. In Raman and FTIR spectra of pure borate glass, the boroxol peak gives a strong intense and sharp peak at about 808 cm^{-1}. The intensity and sharpness of the peak associated with the Raman activity and structural uniformness in the glass network. In this study, we employ quantum chemical calculations, complemented with experimental data, to investigate the overall structure of borate glass within the short and intermediate ranges. From the quantum chemical calculation employing GS/DFT/B3LYP/6-311G^{++}(2d,2p) model chemistry, it was found out that general boroxol vibration dominating the low frequency region, producing three broad peaks spanning from 400 to 1000 cm^{-1}, and one intense peak at 808 cm^{-1}, boron atoms in boroxol units vibrate at four different frequencies spanning from 600 to 1300 cm^{-1}, [BO_3] units in non-ring configuration gives two major peaks at ~700 and ~1100 cm^{-1}, and general boron atom vibrations at higher frequencies (1200 to 1500 cm^{-1}).

Keywords: Quantum Chemical Calculations, DFT, Pure Borate Glasses, Vibrational Frequency, Boroxol.

USM004

Comparison of radiation shielding ability between brown clay and cement with added ostrich eggshell as physical barrier for x ray radiation

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Abstract. Concrete which is the common physical barrier for ionizing radiation is also widely known as a contributor to extreme production of carbon dioxide and greenhouse gasses into atmosphere despite being an effective protection against radiation to human. Thus, this study is aimed to decrease usage of concrete as x-ray room building material and find applicable material that poses radiation properties comparable to concrete and optimizing recycling materials. Ostrich eggshell waste is chosen as filler in sample with brown clay as binder and its attenuation ability is compared with cement mixed with same filler. The percentage of filler in sample are varied from 0%, 25% 50% and 75% before exposed to 60kVp, 80 kVp, 100kVp and 120 kVp of x-ray energy. It is found that Radiation Attenuation Percentage (RAP) of sample brown clay increase with amount of eggshell added opposing to cement. Brown clay with 75% of ostrich is chosen to be an optimum portion due to application of natural material and maximum usage of recycle material. The sample also shown comparable attenuation ability to cement as radiation protection barrier.

Keywords: Radiation Attenuation, Clay, Cement, Ostrich Eggshell

UITM027

Magnesium Titanium Phosphate Ceramic Electrolytes: Structural, Electrical and Electrochemical Properties

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Abstract. Magnesium-Ion Batteries with the Nasicon structured $Mg_{0.5}Ti_2(PO_4)_3$ was synthesized using sol gel method to study the structural, electrical and electrochemical properties of the sample. The structures of the samples were measured using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy measurements. XRD measurement with its Rietveld refinement analysis confirmed the formation of rhombohedral structured of R-3c space group with the minor traces of TiP_2O_7 impurity at temperature 700, 750, 800, 850, 900 and 950 ºC for 24 hours. While, Fourier transform infrared spectroscopy measurement shows the existed of the bands belong to the inorganic compound in the sample. Compound sintered at temperature 850 ºC has been selected as the best sintering temperature by Rietveld refinement analysis and Scanning electron microscopy, EDX analysis. EDX analysis shows the closest chemical composition of prepared sample at temperature 850 ºC. Hence, sample at sintering temperature 850 ºC was conducted for measuring electrical properties of the sample. Impedance spectroscopy indicated the increasing of total conductivity as the temperature increased range 30 to 500 ºC for conductivity-temperature dependence. The total conductivity of the compound at temperature 500 ºC is 2.63×10^{-7} S cm^{-1} which is higher than total conductivity at room temperature. The activation energy require for ion conduction is E_a = 0.70 eV. The highest conducting sample was taken for linear sweep voltammetry analysis and the sample was electrochemically stable up to 1.5 V. Lastly, the ionic transference number value of the sample was 0.97.

Keywords: NASICON; ceramic electrolyte; rietveld refinement; impedance analysis

UPNM007

Structural and Electrical Characterization of Conductive Home-Grown Bacterial Cellulose Composite

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Abstract. Carbon-based polymer composite is an attractive as electrode and conductive coating material due to its flexibility and some of them can be obtained from bioresources. The novelty of our design is the "two-in-one" processing step where the carbon nanotube (10-30 μm in length and 10-30 nm in diameter) is incorporated into bacterial cellulose in a simple dissolution steps using water. The water friendly enviroment enhanced the dispersion of carbon nanotubes and at the same time, created temporary dissolution of bacterial cellulose that allows the carbon nanotube to be inserted among the cellulose fibers. The composites were characterized using XRD, FTIR and FESEM techniques, where it was observed that the carbon nanotubes become tightly bound as a sheet by the bacterial cellulose. Electrical conductivity was studied using LSV method and stability test was also conducted using acetone, methanol, ethanol and isoproponol.The modified bacterial cellulose is produced in two design forms; first is the sheet form where the thickness is measured around 0.052 mm (BC is 0.024mm). This design is best used as electronic sheet, displays, fuel cell electrodes, transistors and some photonic applications that commonly associated with carbon nanotubes. The second design is known as conductive coating where the wet sample is coated homogenously around a small spherical object to illustrate its use as small chemisensor/biosensor device that requires swabbing detection. In both designs, the modified bacterial cellulose based electrode can be explored as an anchoring substrate toward functional materials as third composition due to existing porosity in bacterial cellulose structure.

Keywords: structural, conductive composite, bacterial cellulose, MWCNT, flexible electrode

UTM004

Preparation of Stable Amorphous Paracetamol by Adding Ascorbic Acid

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Abstract. Paracetamol is known for its ability to treat aches, pain and relieve fever. Over the years, research have been done to improve the quality of paracetamol, especially in terms of its stability and solubility. Converting poorly soluble medications from crystalline to amorphous form is one method of increasing their solubility (P. Zhang et al., 2014). Amorphous medicines offer better thermodynamic qualities than crystalline pharmaceuticals in terms of enthalpy, entropy, and energy. (Gupta et al., 2004). Because amorphous medicines are in a non-stable condition, they have a larger internal energy or chemical potential, making them more active and simpler to dissolve than crystalline pharmaceuticals (Kim et al., 2008). Crystalline medications are chemically stable and take more energy to interact with the surrounding molecules, they have a low bioavailability (Taylor et al., 2021). To overcome this, certain amorphous medications are manufactured by adding second component to improve their stability as it has been established that promoting inter- or intramolecular interactions by adding a second component, either in molar fractions or traces, can prevent crystallization (Martínez et al., 2014). In this research, we aim to prepare amorphous paracetamol by adding ascorbic acid as the second component to stabilize the paracetamol. Different mol fractions of paracetamol and ascorbic acid will be used and the structure of amorphous paracetamol will be analyzed by using X-Ray Diffraction (XRD) and Raman Spectroscopy. Each sample will be ground and compressed onto a palette for Raman analysis. For Raman, a 532 nm laser source will be employed. The goal of analyzing the vibrational spectra of is to look at molecule structural disorder in samples made at various temperatures.

Keywords: Paracetamol, ascorbic acid, amorphous paracetamol, stability, solubility, intermolecular interaction, intramolecular interaction, binary component, second component.

IIC001

Charge Distribution Study Of $CE_{0.8}SR_{0.2}NIO_2$ By Density Functional Theory

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Abstract. Recently, superconductivity was discovered in nickelate $Nd_{0.8}Sr_{0.2}NiO_2$. It is a new family of cuprate-like superconductor. Like the cuprate superconductors with layers of $Cu\text{-}O_2$, superconductivity in nickelate superconductors occurs in the $Ni\text{-}O_2$ layer with Nd and Sr act as charge reservoirs. Ni^{2+} with 8 electrons in the 3d orbital has one electron less than that of Cu^{2+}. Cerium with its natural oxidation states of 3+ and 4+ is expected to be a better electron donor than neodymium. Therefore, the number of electrons in the 3d state of Ni may increase with cerium substitution of Nd. This work investigates the charge distribution and major charge carrier in $Ce_{0.8}Sr_{0.2}NiO_2$. Hole concentration of the compound is calculated and the relation between the nickelate and cuprate superconductor is discussed.

Keywords: YBCO, Charge distribution, hole concentration, Density of State, Density functional theory
Conference Scope: Superconductors

OTRS002

Biodegradable Polyvinyl Alcohol (PVA) Reinforced Copper Selenide (CuSe) Nanocomposite Fabrication and Characterization for Electromagnetic Interference Shielding Application

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Abstract. The fast growth of high-powered smart and electronics and telecommunication devices over the last two decades has resulted in accidental electromagnetic wave noises coupled with significant heat emissions, which has become a great concern, which has resulted in electronic pollution that has an adverse effect on the environment. In this work, the CuSe/PVA nanocomposite was successfully fabricated via a solution casting method. The effect of CuSe nanofiller on dielectric properties and electromagnetic interference shielding effeteness (EMI SE) of CuSe/PVA nanocomposite was successfully investigated. The nanocomposite was characterized using various analytical techniques. The results obtained demonstrate an increase in dielectric constant (ε'), loss factor (ε'') and total EMI shielding effectiveness with an increase in nanofiller loading. The highest value of SE_T was found to be 23.95 dB for the highest nanofiller loading (18.92 wt %). Therefore, the obtained results demonstrate that CuSe NPs have proven to be a promising candidate for the EMI application.

Keywords: CuSe; Nanocomposites; Polyvinyl alcohol (PVA), nanofiller; Loss factor; EMI shielding.

UPM006

Hydroxyapatite/Montmorillonite Nanocomposite as a Bone Tissue Engineering and Anti-Cancer Drug Delivery Agent for Cloxacillin

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Abstract. A nanocomposite was prepared by mixing hydroxyapatite (HA) and montmorillonite (MMT) powder for the formation of HA/MMT nanocomposite by the sintering technique, and subsequently loaded with a bone anti-cancer drug, cloxacillin (CLX) as a delivery agent for the drug and at the same time mimicking the human bones for bone rejuvenation treatment. Powder sintering of the green body was accomplished at various HA/MMT ratios and it was found that the addition of 20 w/w% of montmorillonite into the hydroxyapatite with the sintering temperature of 800 °C significantly increased the compressive strength of the nanocomposite by 5 folds, from 85 MPa to 422 MPa with the optimum value of the BET specific surface area of 15 m^2/g. This shows the sintering process resulted in the development of pores of the samples and the pore volume was found to be reduced when the sintering temperature was increased. The pore development was found to be useful to host the bone anticancer drug, cloxacillin as well as prolong the release of the drug. This paves the new way for a simple up-conversion of HA using MMT via the sintering process for bifunctional purposes; bone tissue engineering and drug delivery agent.

Keywords: Porous ceramic, montmorillonite clay, conventional sintering technique, controlled release

UPM007

Nitrogen/Phosphorus-Doped Carbon Quantum Dots Synthesized using Chitosan/Hydrothermal Method for Plant Protection

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Abstract. Carbon quantum dots (CQdot) and their nitrogen/phosphorus-doped counterparts (NPCQdot) were prepared using the chitosan/hydrothermal method with and without the presence of sodium tripolyphosphate (TPP). TPP was used as a size controlling agent of the NPCQdot, where the mean size can be tuned at around 3-7 nm by the addition of 0.5 to 2 % (w/w) of TPP compared to 13 nm for the CQdot prepared without the presence of TPP. In addition, a narrower pore size distribution was obtained at a higher percentage of TPP for NPCQdot. This indicates that the size of the NPCQdots can be controlled by adjusting the amount of TPP used in the synthesis of the NPCQdot. A preliminary study indicates that the resulting NPCQdots were useful to treat the heart rot disease of pineapple due to Erwinia chrysanthemi. This paves a new generation of agronanobacteriacide that can be synthesized using a green, environmentally-friendly method.

Keywords: Carbon quantum dots, nitrogen/phosphorus-doped carbon quantum dots, chitosan, hydrothermal, plant protection, agronanobacteriacide.

UMP004

Study on Coupling Adsorption-Photocatalytic Degradation of Crystal Violet on Corn Cob-Titanium Dioxide Suspension

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Abstract. Coupling of adsorption and photocatalytic degradation processes is well-known for dye wastewater treatment as it induces high removal efficiency of dyes from aqueous solution. The performance of dye removal is anticipated to improve thanks to the high adsorption capacity of adsorbent materials such as corn cob and titanium dioxide catalyst's ability to photodegrade dyes. The current study highlights the application of titanium dioxide catalyst suspension with the help of corn cob for degradation of targeted Crystal Violet (CV) dye from an aqueous solution under UV light irradiation. The effect of initial pH solution (2,4,6,8,10), initial CV concentration (10,20,30,40,50 ppm) and contact time (20,40,60,120,180 min), corn cob-TiO_2 dosages (0.2,0.4,0.6,0.8,1.0 g), and the influence of other dyes (mixture of Crystal Violet and Reactive Blue 4) and subsequently, the optimum conditions were studied as factors influencing degradation of Crystal Violet. The structure and morphology of prepared material before and after degradation were characterized by Fourier Transform Infrared (FTIR) and Scanning Electron Microscopy (SEM). The optimum operational parameters were found to be pH of 10, CV concentration of 100 ppm, 3 hours of contact time and 0.5 g of corn cob-TiO_2 dosages. The optimal overall removal efficiency of CV achieved 92.49 %. In short, coupling of adsorptions using corn cob and photocatalytic degradation method enhance the removal performance of Crystal Violet from aqueous solution.

Keywords: adsorption, photocatalytic, titanium dioxide, corn cob, crystal violet

UITM032

Structural and Electrochemical Study of ZnO Composited with AC Derived by Eggshell

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Abstract. This paper reported the structural and electrochemical properties of ZnO composited with eggshell activated carbon (AC). ZnO composited with AC at three different composition ratio (ACZnO) 50:50, 70:30, and 90:10. Then the samples were analyze using x-ray diffraction (XRD), scanning electron microscopy (SEM) and cyclic voltammetry (CV). XRD pattern showed the existing of ZnO peak at orientation (0 0 2), (1 0 1), (1 0 2), (2 0 0), (2 0 1), (0 0 4), (2 0 2), and (1 0 4) while for AC peak appear at orientation (1 0 0), (1 1 0), (1 0 3) and (1 1 2). The average crystallite sizes corresponding to AC peak orientation (1 0 0), (1 1 0), (1 0 3) and (1 1 2) for ACZnO at ratio of 50:50, 70:30 and 90:10 were 1.19, 1.44 and 1.56 nm, respectively. SEM results for ACZnO composite at ratio 70:30 showed well uniform structure. The capacitance values from the cyclic voltammetry (CV) test for ACZnO samples at ratio 50:50, 70:30 and 90:10 were 5.6 ,5.8 and 5.4 Fg^{-1}, respectively.

Keywords: activated carbon; zinc oxide; structural properties; composited; electrochemical properties

UPNM012

Influence of pH on Iron Removal by Polysulfone/Silver-Graphene Oxide Nanohybrid Membrane in Water Treatment

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Abstract. Iron (Fe) naturally occurs in groundwater and contributes to metallic taste and could stain clothes which are not suitable for drinking or daily usage. Membrane filtration could be considered as an alternative method for heavy metals removal from water. It is commonly reported that pH effect has substantial impact on membrane performance. The molecular weight cut-off of membranes was practically constant in acidic and neutral conditions. In this study, the nanohybrid polysulfone/silver-graphene oxide (PSf/Ag-GO) membranes were fabricated by wet phase inversion method. The PSf incorporated with silver graphene oxide (PSf/Ag-GO) membrane was investigated for the removal of iron from synthetic groundwater at pH 3, 4, 9 and 12. The rejection of iron was found to be 76% at acidic pH and increased to 96% pH 9. From this study, the water flux has decreased from 20.21 L/m^2.h at acidic pH to 9.58 L/m^2.h. It was found that the changes of the feed pH for iron removal have significantly influenced the performance of the fabricated nanohybrid membranes. Findings from this study showed that the adjustment of pH has impacted the ionic solute (Fe^{2+}) removal and water flux of filtration. This could be due to the solute-membrane interaction which has impacted the size of solute and surface charge of the membrane. This nanohybrid membrane with superior properties has the potential to remove iron to the desired extent for groundwater treatment.

Keywords: Polysulfone; Graphene oxide; Silver nanoparticles; Iron removal; pH effect

UPM008

Supercontinuum Generation from Erbium Gallium co-doped Mode-Locked Fiber Laser

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Abstract. We proposed a supercontinuum mode-locked fiber laser using a gain medium which is called Erbium Gallium co-doped fiber (EGDF). The EGDF has an absorption rate of 24.5 dB/m at 981 nm. With a 3-meter-long EGDF utilized as the primary gain medium in the laser system, the proposed laser can generate mode-locked solitons, with a central wavelength of 1560 nm, a 3 dB bandwidth of 3.20 nm, and an average output power of 18.23 mW. The generated pulse yields a repetition rate of 12.25 MHz with pulse duration and pulse energy of 860 fs and 1.49 nJ respectively. A different length of HNLF (200 m and 400 m) as the nonlinear media have been used for comparison purposes. A broader spectral bandwidth has been obtained by the insertion of 400 m HNLF which has a span range from 1530 nm to 2050 nm with a total span of 750 nm. The proposed work is the first time, to the knowledge of the authors, that the application of EGDF as an active gain medium in the development of supercontinuum mode-locked fiber laser.

Keywords: Supercontiuum Generation, Mode-Locked fiber laser, repetition rate, pulse duration, pulse energy.

UITM035

Ag_2CO_3-based photocatalytic materials for the removal of Bisphenol A from aqueous phase: A review

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Abstract. Utilising semiconductor photocatalysts in the photocatalytic technology has been one of the finest approaches for the treatment of hazardous organic compounds due to their efficiency and eco-friendly behaviour. The present research and development focus mostly on the visible light-responsive photocatalysts to fully use the visible light spectrum. Henceforth, among numerous types of visible light driven photocatalysts, Ag_2CO_3 has caught the interest of many researchers due to its excellent photocatalytic characteristics, high absorption of visible light and a narrow band gap of 2.3 eV. Moreover, Ag_2CO_3 yielded photogenerated holes that possess strong oxidation potential. Nevertheless, Ag_2CO_3 exhibit low structural stability in aqueous solutions due to its slightly soluble properties and its photocorrosion behaviour subjected to light irradiation has been revealed by numerous studies. This review is therefore focusing on the structural features and synthesising methods of Ag_2CO_3. Notably, some recent development approaches to improve the photocatalytic activity and recyclability of Ag_2CO_3-based photocatalysts towards the degradation of organic pollutants, like bisphenol A were also studied. Moreover, some opportunities and potentials of Ag_2CO_3-based photocatalyst applications were also proposed. This is because a variety of endocrine disrupting chemicals (EDCs), like bisphenol A has lately gotten a lot of attention across the world as it has been polluting the environment and causing disturbance of the endocrine system in wildlife and people. Therefore, this review confers an overview implementing Ag_2CO_3 for photocatalysis application for new motivation of studying to improve its efficiency and assembles worthy information on photocatalytic treatment of bisphenol A polluted wastewater.

Keywords: Endocrine disrupting chemicals, Bisphenol A; Photocatalysis; Silver carbonate

UPNM013

Benzoyl Kappa Carrageenan-based Sodium-Ion Conducting Gel Polymer Electrolytes

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Abstract. A novel benzoyl kappa-carrageenan (Bz-ƙcar) gel electrolyte is prepared with sodium perchlorate (NaClO4) at different percentages. Bz-ƙcar from the modification of kappa-carrageenan and benzoyl chloride is known to have more electron-rich sites from the pi (π) electrons in the benzene molecule. The addition of sodium salt has increased the ionic conductivity of Bz-ƙcar as ions are freely mobile in the polymer matrix. The ions and polymer interactions as well as possible conformational changes in the host polymer, Bz-ƙcar, due to the sodium ion entrapment and dispersion are examined by Fourier transform infrared (FTIR) analysis. The Bz-ƙcar gel polymer electrolyte achieved ionic conductivity of 3.10x 10-4 S cm-1 at room temperature, while the addition of Na salt into Bz-ƙcar has enhanced the ionic conductivity to 1.011x 10-3. The temperature dependence of the ionic conductivity from 25 to 100 °C is consistent and follows the Vogel–Tammen–Fulcher (VTF) behaviour.

Keywords: Kappa-carrageenan, biopolymer, electrolyte

USIM 001

Quantum Communication Policies and National Security: A Benchmarking Analysis

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Abstract. Quantum technology was first developed in the early 20th century. It is based on the principles of quantum mechanics. Quantum Communication Technology (QCT) is a recent field of research. QCT accelerates the exchange of data and communication, but it is exposed to various security threats. Government, businesses, banks, and financial institutions are among those that are highly exposed to a security risk, as the insecure transfer and transmission of their data and communication can lead to serious consequences. Therefore, it is imperative to introduce a national policy to protect sensitive data and ensure more secure communications. Malaysia established the National Cyber Security Agency (NACSA) as part of the National Security Council under the Prime Minister's Office (PMO) in 2017 to protect Malaysia's national cyber security, but QCT has not been specifically mentioned in any of its policies and strategies. Thus, this study aims to review the policy concerning QCT in Malaysia and other countries. Articles and documents pertaining to QCT policy were reviewed. Findings show that a few countries have in place a national policy on QCT. Among them are European Union, Canada, the United States, Australia, Russia, and China. The benchmarking analysis revealed that those QCT security policies cover similar aspects as the Malaysia Cyber Security Strategy 2020-2024. They emphasize prediction, detection, deterrence, and response to technology threats. The results of the study can serve as a reference for policymakers in reviewing and revising cyber security plans and strategies in Malaysia. The results will also determine Malaysia's position and capability to synergize and collaborate in global quantum communication initiatives. The findings will enable policymakers in Malaysia to draft a policy to protect national sovereignty and security in the Quantum era.

Keywords: Quantum technology, Quantum Communication Technology (QCT), security, cyber security, policy.

UITM036

Boosting physicochemical and structural design of ZnO-based systems for photocatalytic endocrine disrupting compounds degradation: A mini review

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Abstract. Photocatalysis has been gaining huge amount of attention these past years due to its clean energy operations which in this work is considering the photocatalytic endocrine disrupting compounds. Among those usage of photocatalysts for endocrine disrupting compounds, ZnO is commonly used and a very encouraging non-metal semiconductor for various reasons. However, pure ZnO alone has limitations due to its large band gap. Accordingly, much research has made advances to minimise those limitations of ZnO in the aspects of lowering its band gap as well as modifying its structure. Thence, this article discusses those methods of boosting the physicochemical of ZnO and summarizes the effectiveness of resulted ZnO-based products for the photocatalysis of endocrine disrupting compounds.

Keywords: ZnO, photocatalysis, endocrine disrupting compounds and bisphenol A

UITM037

Cellulose-based materials for photocatalytic degradation of acetaminophen : A mini review

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Abstract. At present, many researcher groups have been ubiquitously adopting cellulose-based materials as photodegradation's photocatalyst in water treatment. It has been indispensable to retrieve the clean water nowadays, especially to degrade acetaminophen in wastewater in order to avoid any further harmful effects that can be done towards humans, plants and our ecosystem. Cellulose possesses excellent properties and features such as high porosity, large surface area, physical and chemical resistance, low density, low thermal expansion, good mechanical properties, inexpensive and eco-friendly. Out of all the properties mention, abundant of hydroxyl groups contained in cellulose's structure benefiting its interaction with metal ions and other cations while forming the homogenous dispersion of inorganic nanoparticles onto the cellulose matrix which enhances the new functions, it also contributes to higher photocatalytic activity. Currently, with the aim of improving the photodegradation efficiency, increasing the recyclability and narrowing the photocatalyst's band gap, numerous studies have been done on combining cellulose-based materials with metal oxides, metal spinel ferrites and semiconductors such as TiO_2 and ZnO, via various synthesis routes. Thus, the latest literature information on the performances of several cellulose-based photocatalytic materials to remove acetaminophen in aquatic ecosystem, the synthesis techniques and modified material properties are summarized in this review. Herein, the mechanisms involved in the cellulose-based photocatalyst's activity have been discussed, and some related scientific hypotheses and perceptions have been presented for further research on this topic.

Keywords: Photocatalytic Degradation; Cellulose; Cellulose-Based Materials; Wastewater Treatment; Acetaminophen; Acetaminophen Degradation

UMS001

Optical Properties of Epoxy-based Plastic Scintillator Doped with PPO and P-Terphenyl

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Abstract. This study attempts to prepare epoxy-based scintillator and to investigate the effect of different concentration of primary dopants on the optical properties of the prepared epoxy-based plastic scintillator. Four samples of plastic scintillators were prepared using commercially available epoxy resin by polymerization method at room temperature. Two sample was prepared using epoxy and PPO as primary dopant, meanwhile, for the other two sample P-terphenyl were added as their primary dopant. The optical properties such as the absorbance, transmittance in the visible light of the prepared plastic scintillators using spectrophotometer. Physically, the plastic scintillator shows low transparency due to low solubility of the dopant used in epoxy. The transmittance of all the sample is in the 70% range which deemed as excellent, however sample with 2.5w% of P-terphenyl shows the transmittance falls on the 20% range. Similar trends are observed in absorbance properties of the plastic scintillator as the concentration of PPO and P-terphenyl is increased. It was found that an increase of primary dopant concentration resulted in decreased in optical properties of the epoxy-based plastic scintillator.

Keywords: Plastic scintillator, scintillator, epoxy, polymer, spectrophotometry

UMT003

Study on The Effect of TiF_3 on the Performance of MgH_2 Hydrolysis

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Abstract. Magnesium hydride (MgH_2) is a promising hydrogen storage material and has a theoretical hydrogen generation of up to 1703 mL/g when it combines with water. A study was done to understand the effects of TiF_3 on the kinetics of MgH_2 hydrolysis. The preparation of the sample was done by mechanical ball milling technique. The addition of 10 wt% TiF_3 was found to significantly enhance the hydrogen production via the MgH_2 hydrolysis. At 50 °C, the MgH_2-10 wt% TiF_3 system showed the fastest hydrolysis rate where it produced 533 mL/g of hydrogen in 5 min, 779 mL/g hydrogen in 30 min, and 932 mL/g hydrogen in 60 min. The outcomes showed a novel approach to enhance the hydrolysis of MgH_2, suggesting that TiF_3 is a potential reagent for boosting the hydrolysis of MgH_2 for green hydrogen generation systems.

Keywords: Magnesium Hydride; Hydrolysis; Hydrogen Production; Titanium (III) Fluoride; Catalyst

UMT004

The Effect of $TiBr_4$ on the Hydrolysis Performance of the MgH_2 System

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Abstract. Magnesium hydride (MgH_2) is a very promising hydrogen storage material, and it is gaining greater attention for the use of supplying hydrogen on-board since its theoretical hydrogen generation is up to 1703 mL/g when it combines with water. However, the passivation layer of $Mg(OH)_2$ produced on the surface of MgH_2 quickly inhibits the hydrolysis reaction. This study reveals that the hydrolysis of MgH_2 can be vastly improved by the addition of $TiBr_4$ as a catalyst. The MgH_2-10 wt% $TiBr_4$ composite was obtained by the high-energy ball milling technique. Excellent kinetics of hydrogen generation of 867 mL/g in 5 min, 1237 mL/g in 30 min and 1329 mL/g in 60 min at 50 ℃ was achieved for the MgH_2-10 wt% $TiBr_4$ system. The findings implied that the MgH_2-$TiBr_4$ system may be employed as a promising hydrogen generation system in the practical application of supplying hydrogen on-board.

Keywords: Magnesium Hydride; Hydrolysis; Hydrogen Production; Titanium Tetrabromide;

UMK035

Performance of Particleboard from Fast-Growing Species

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Abstract. In Malaysia, wood-based industry is facing raw material shortage due to insufficient supply of rubberwood. Usage of fast-growing trees is essential to add sources to mills. In this study, fast-growing species, namely Kelempayan (Neolamarckia cadamba) was evaluated for its suitability for particleboard production. This study investigated MOE, MOR, IB and thickness swelling of particleboard from particle sizes 0.5 and 1.0 mm, densities 600 and 700 kgm^{-3}, resin contents 9 and 11% and hot press temperatures 155 and 165°C based on Malaysian Standards (MS). The results showed that boards made from particle size 0.5 mm, density 700 kgm^{-3} and 11% resin content at 165°C of hot press temperature exhibited the greatest mechanical performance. The lowest percentage of thickness swelling showed by boards made from particle size 0.5 mm with the density 600 kgm^{-3} presence 9% resin and pressed using 155°C hot press temperature. The boards met the requirements of the standards.

Keywords: Kelempayan; particleboard; particle size; density; resin content; hot press temperature

UMK 022

Synthesis and Characterization of Graphene Oxide Embedded with Gold Nanoparticle for Antibacterial Activity

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Abstract. This study reports the preparation of gold nanoparticle (AuNPs) using seed mediated growth method and embedded with graphene oxide (GO) using ultrasonication method for antibacterial activity. With the emerging of antibacterial resistance which threatens the effective prevention and treatment infections caused by bacteria, parasites, viruses, and fungi, an alternative solution must be generated to control and prevent the rapid development of bacteria mediated infectious disease. Hence, the investigation of GO-AuNPs antibacterial properties plays a crucial role to overcome the problems. AuNPs was embedded into GO sheet by ultrasonication method and characterized by using ultraviolet visible spectroscopy (UV-Vis), X-Ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) to confirms the formation of AuNPs on GO layer. The antibacterial of GO-AuNPs with different ratio (1:1, 1:15, 1:2) was investigated using Kirby Bauer disk diffusion method and the result were recorded after 24h and 48h. GO-AuNPs shows an excellent antibacterial activity towards Escherichia coli (E. coli), and Staphylococcus aureus (S. aureus) were the maximum inhibition zone recorded was 8.0 mm and 11.0 mm which reveals the promising antibacterial properties of the nanocomposite.

Keywords: Graphene oxide, gold nanoparticle, antibacterial, ultrasonication, seed mediated growth.

UMK023

Shape stabilized phase change material by pinecone adsorption

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Abstract. Energy efficient building is crucial for sustainability of our earth. Phase change material has gained interest to be used in building materials due to their ability to absorb and release heat from and to the environment. The phase change material transforms between solid and physical phase when temperature changed. When in liquid state, the phase change material cannot stand by itself, thus a shape stabilizing mechanism is needed. Therefore, the objective of this study is to investigate the pinecone particles as a shape stabilizer for capric acid as the phase change material. Leakage test and FT-IR were conducted to evaluate the shape stabilizing ability of pinecone and to confirm the presence of the capric acid in the material mixture.

Keywords: Phase change material; Biomass; Energy; Wood; Fourier Transform Infrared

USIM002

Absorption and Slow Released Fertilizer by Hydrogels to Stimulate Early Growth of Pak Choy

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Abstract. Hydrogels are an emerging technology in the agriculture due to its ability to swell when it encounters water. Therefore, it is suitable to be used as water and fertilizer storage for plant growth. The aims of this study were to apply the concept of the slow-released fertilizer by applying hydrogel in soil to grow Pak Choy seeds. Organic planting soil was prepared according to the suitable ratio and transferred into several pots. Dry hydrogels were formulated at different hydrogel percentages and allowed to absorb water and fertilizer before mixing with the soil. Consequently, Pak Choy seeds were sowed directly on the organic plating soil, and water was added to the potting soil to allow a homogeneous mixture. Eventually, leave it self-grow under controlled conditions (UV light and black box). The ability of hydrogel to uptake water and fertilizer were studied. It shows that the hydrogel able to absorb water up to 350% of its initial weight when 1% of hydrogel was added. Meanwhile, the fertilizer absorption by the hydrogel was 530% after 48h immersion time. In addition, ability of soil to uptake water was also investigated, and it is found that the soil able to hold water up to 230 % after 24h immersion time. Seeds germination study investigated that the higher percentage of hydrogel demonstrated better Pak Choy germination of Pak Choy seeds and early seedling at cotyledonary. This shows that the dissemination of hydrogel in soil for agriculture can be applied as an alternative technique for self-planting management.

Keywords: biodegradable hydrogel; NPK fertilizer; seed germination; self-watering system

UPM011

Refractive Index Based-SPR for Metal Ion Detection with Enhanced Sensitivity Using NCC/GO Thin Film

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Abstract. Surface plasmon resonance (SPR) is an optical sensor that detect the changes of the optical properties near the metal thin film surface. By modification of the metal thin film with nanocrystalline cellulose-graphene oxide (NCC/GO), the sensitivity of the SPR has been enhanced for metal ion detection. The developed SPR system has high sensitivity toward Cu^{2+}, Ni^{2+}, and Zn^{2+} sensing with lowest detection of 0.01 ppm. Moreover, by comparing the shift of resonance angle with the metal ion concentration, the NCC/GO thin film has good sensitivity value of 3.271° ppm^{-1}, 1.509° ppm^{-1}, and 2.579° ppm^{-1} for Cu^{2+}, Ni^{2+}, and Zn^{2+} respectively. Besides that, binding affinity analysis also shows that the NCC/GO has high binding affinity towards Cu^{2+} followed by Zn^{2+} and Ni^{2+} with binding affinity constant 4.075×10^3 M^{-1}. Further analysis of the thin film using XPS also has been carried out to investigate the possible interaction of the NCC/GO layer with metal ion. Based on the result, metal ion may interact with the COOH functional group that exist on the NCC/GO surface thus, leads to the changes of the thin film optical properties.

Keywords: Surface plasmon resonance; Nanocrystalline cellulose; Graphene oxide; Metal Ions; Sensing

UPNM014

The effect of microstructure and electrical conductivity of Bismuth Oxyiodide on solar cells performance.

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Abstract. Lead-free bismuth oxyiodide (BiOI) perovskite solar cells (PSCs) have been successfully fabricated using successive ionic layer adsorption and reaction (SILAR) technique. The effect of heat treatment temperature on thickness, conductivity and microstructure of BiOI thin films has been studied prior to the device fabrication. From SEM result, flower shaped flakes microstructure is obtained in as-deposited BiOI layer and it enlarged as the heat treatment increased up to 350ºC, and afterward crushed with higher heat treatment temperature. This is associate with the trend in conductivity measurement where BiOI achieved the optimum conductivity when it was heat treated at 350ºC and reduced as the heat treatment exceed 450ºC. This could be due to the reduction of grain boundaries as a result of development of the flakes sizes during the heat treatment, material sublimation and particle aggregation that developed higher resistance in the BiOI layers. The device performance under optimum heat treatment has been characterized using I-V measurement under a solar spectrum simulator with AM 1.5 illuminations. BiOI PSCs treated at 350ºC showed ~6% efficiency. This study provided better understanding on BiOI thin film behaviors under several heat treatments and its potential to be applied as lead-free PSCs.

Keywords: Bismuth oxyiodide, heat treatment, lead-free perovskite solar cells

UKM024

The Potential of Lignocellulose-Based Biopolymer in Additive Manufacturing

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Abstract. 3D printing has sparked interest in the use of natural materials from plants and microorganisms such as cellulose, lignin, alginate, chitosan, and algae. All of these resources may be acquired in large quantities from certain portions of plants and animals, most often used substance in medical goods because it has a safe and convenient impact on people and animals. 3D printing is a good approach for complex designs to extend the use of biopolymer. Whereas, lignocellulose-based biodegradable polymer prove to be superbly ideal for the medical and water treatment industries due to its excellent shear adjustment, alteration of viscosity and attribute of shape. Both fractions of cellulose and lignin provided a potential application in 3D printing technology. In this work, organosolv lignin proved to be a compatible biodegradable filler can act as twofold purposes, as reinforcement and interlayer adhesion in 3D printing technique. The addition of lignin in filament making improved up to 30% mechanical strength. Furthermore, since additive manufacturing is moving in the direction of smart materials that respond to particular stimuli or conditions, cellulose to nanocellulose is projected to be widely used in the medical and pharmaceutical industries in the future. Nanocellulose printed composite structure exhibit excellent mechanical properties with tensile strength ranging from 55-80 MPa. Thus, lignocellulose fractions in 3D printing meets all of the criteria for biological application, and many recent research have focused on 3D printing including tissue engineering, drug delivery, protein, microalgae, bacteria, and cell immobilisation.

Keywords: 3D printing; Additive manufacturing; Biopolymer; Bioprinting; Cellulose

OTRS010

A Simple Palm-Shell Biochar Production and The Impacts of Its Amendments on CO_2 and CH_4 emissions from Mineral Soils of Smallholder Oil Palm Plantation Sumatra Indonesia

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Abstract. The release of greenhouse gas (GHG) emissions from mineral soils of oil palm plantations contributes to the increase of global warming. Biochar may offer a substantial potential as a climate change mitigation from soils of oil palm plantations. The aim of this field experiment was to investigate the impact of biochar amendment on CO_2 and CH_4 emissions released from the soils of smallholder oil palm plantations. In this study, the potential of biochar amendment to the soils produced using a simple technology to reduce GHG emissions to atmosphere is estimated. Palm-shells biochar produced using a conventional reactor was amended to the soils of the smallholders oil palm plantations in Jambi, Indonesia. Three randam plots of 50mx50m with 9 subplots of 1 m x 1 m were amended with biochar of 0, 10 and 20 Mg ha^{-1}. Gas were measured on days of 0, 5, 10, 20, 40 and 60 using static chamber. All measurements were triplicates. Biochar reduced cumulative CO_2 emission compared with the control after the 5^{th} day. However, CO_2 reduction was not significant. At initial stage of day 5^{th} of experiment CH_4 emission decreased but increased after the day of 20^{th}. The highest emission was observed after the 30^{th} day. Biochar also reduced cumulative CH_4 fluxes compared with the control. These results show that the effect of biochar amendment to the soil of oil palm plantations decreased the cumulative emissions of both CO_2 and CH_4 gas. Higher reduction of CO4 and CH4 were observed at higher biochar addition.

Keywords: Biochar, greenhouse gas emission, oil palm plantation, soils

USIM004

Surface Plasmon Resonance Based Fiber Bragg Grating Sensor for Food Security Applications: A Review

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Abstract. This article reviews the potential of plasmonic based fiber Bragg grating (FBG) for food security applications. Gold thin film with range of thicknesses between 35nm to 50nm is the most common noble metal that has been used to excite surface plasmon resonance (SPR) due to its stability and non-oxidization properties. As the gold layer become thinner (between 35nm to 50nm thicknesses), the attenuation of SPR becomes weaker in which leads to the maximum generation of SPR signal. An optical communication wavelength range, 1500nm-1550nm are the optimum light source compares with other wavelengths due to its low attenuation during transmission. Various types of SPR FBG have been deployed in food security area which are standard FBG, tilted FBG (TFBG), etched FBG and long period grating configurations. This review found that the SPR TFBG sensors resulted the best sensitivity up to 688 nm/RIU and have been used in wide range of food security area such as for detection of biomolecules, pathogens and viruses. These sensors able to generate a wavelength-dependent set of cladding modes with single grating design that interacting the metal film at large incidence angle. In food security application, 33% of SPR FBG based sensors have been deployed in relevant breast cancer biomarker HER2 protein detection follows by methane gas sensing which is about 25%. In conclusion, the deposition of suitable thin film metal on the outer side of TFBG cladding by transmitting optical communication wavelength are the keys factors to enhance the SPR sensor's sensitivity for food security application.

Keywords: Surface plasmon resonance, fiber Bragg grating, optical fiber, sensor, food security

UMK043

Characterization of Respiratory Capabilities of Newly Isolated Iron-Reducing Bacteria Strains

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Abstract. Iron-reducing bacteria (IRB) are microorganisms that are suitable for application in various industries, including environmental activities. IRB play a prime role in the natural iron transformation. The capabilities to generate energy by reducing metal and non-metal allowed IRB to sustain their lives under anaerobic conditions. This research aims to characterize the capabilities of the newly isolated IRB strains Cronobacter sp. KP 19 and Klebsiella pneumoniae KP 20 were isolated from Kuantan Port marine sediment, and Bacillus licheniformis EPSK 21 was isolated from South China sediment, to respire on metal and non-metal electron acceptors. The anaerobic respiratory capabilities of the three newly isolated IRB strains were tested by using ferric citrate and nitrate as the electron acceptor and lactate as the electron donor. The growths of all newly isolated iron-reducing bacteria were compared to model IRB strain, Shewanella oneidensis MR-1 and Escherichia coli EC100D as the negative control. Results from this research indicated all the strains are capable of reducing both ferric citrate and nitrate with varying rates

Keywords: Iron reducing bacteria, Cronobacter sp., Klebsiella pneumoniae, Bacillus licheniformis.

UITM045

DFT Study of The Cation Distribution on Stability, Structural and Electronic Properties of Ni-Doped Spinel Co_3O_4

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Abstract. The origin of spinel cobaltite properties can be attributed to the cation distribution between tetrahedrally and octahedrally coordinated. The choice of spinel types is primarily considered due to the different octahedral and tetrahedral crystal fields where the degeneration of the 3d orbital is different and could lead to dissimilar electronic properties. In this work, a theoretical study using density functional theory (DFT) by using CASTEP is performed on Ni-doped Co_3O_4 ($NiCo_2O_4$) to explore the structural, magnetic and electronic properties. From the computed inversion energy and formation energy resulting $NiCo_2O_4$ is energetically favourable in inverse spinel type where the Ni prefer to substitute with Co at the octahedral site. The result revealed that the substitution of Ni cation has substantially changed from cubic to tetragonal due to the elongation of the Ni-O bonding at the octahedral site has caused Jahn-Teller (JT) distortion. DOS results have verified that $NiCo_2O_4$ has transformed from semiconductor Co_3O_4 into half-metallic material as seen in the spin-down channel has crossed the Fermi level. In addition, details of octahedral crystal field splitting have demonstrated the reason on Jahn-Teller active occur in $NiCo_2O_4$.

Keywords: Density functional theory, spinel Co_3O_4, doping, electronic properties, magnetic properties

UITM046

Ni-Co Double Hydroxides Prepared via Electrodeposition as Potential Electrode Materials for Supercapacitor

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Abstract. Ni-Co hydroxides with different Ni:Co ratio were synthesized using 2-electrode electrodeposition. The effects of Ni:Co ratio on the hydroxides' structural and optical properties were investigated over FTIR, XRD, and SEM. The shifting, changing in shapes and intensity of corresponding $Ni(OH)_2$ and $Co(OH)_2$ characteristic bands in Ni-Co hydroxides FTIR spectra confirmed that the Ni-Co hydroxides were successfully deposited onto substrate's surface. SEM micrographs of Ni-Co hydroxides also showed that all corresponding particles were uniformly distributed and meet the ratio of Ni:Co accordingly. Moreover, XRD patterns confirmed the amorphous nature of nano-sized Ni-Co hydroxides as they were thinly coated. Effect of cobalt on the physical and electrochemical properties of $Ni(OH)_2$ were also investigated. SEM images of Ni-Co hydroxides portrayed that cobalt creates flower-like pores on $Ni(OH)_2$ surface where such pores are important for facile ions diffusion for better electrochemical performance. The Ni-Co hydroxides' electrochemical properties were characterized by means of cyclic voltammetry and electrochemical impedance spectroscopy. It was further confirmed in the cyclic voltammetric and impedance spectroscopic studies that Ni:Co=1:3 has the best electrochemical performance.

Keywords: Supercapacitor, Nickel nitrates, Cobalt nitrates, Hydroxides, Electrodeposition.

UITM047

Accelerated Innovation Via Modelling of $LiFePO_4$/Graphene Cathode for Li-Ion Battery

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Abstract. Lithium-ion batteries (LIBs) are the most popular battery storage option and control more than 90% of the global grid battery storage market. In turn, the electrification of transportation is heavily reliant on advancements in storage technologies, with LIBs being the fastest-growing storage technology in power systems and transport that requires both high-energy and high-power density simultaneously. The olivine structured $LiFePO_4$ material is considered a competitive candidate for cathode material of LIBs due to excellent cycling stability, low cost, and good safety making it stable in nearly all electrolytes typically used in LIBs. However, the low electronic conductivity and low diffusion coefficient of Li^+ have hampered its commercial applications. Doping and conductive layer coating are the most common methods to improve its performance. Due to the availability of better computational resources, the computational analysis and predictions of materials offer a sensible approach before the practical synthesis of material. The density functional theory (DFT) calculations can emerge various properties of structural and stability, conduction behavior, and Li-ion diffusion, which can provide an atomic understanding of the capacity, reaction mechanism, rate capacity, and cycling ability. The DFT results help reveal the properties of the modified $LiFePO_4$, hence supporting the design of novel electrode materials.

Keywords: Density functional theory, Lithium-ion batteries, $LiFePO_4$, cathode, Li-ion diffusion

UITM048

Structural Investigation and Electrochemical Performance of $Li_2FeP_2O_7$ Cathode

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Abstract. A $Li_2FeP_2O_7$ cathode material was successfully synthesized by stoichiometrically weight Li_2CO_3, $FeC_2O_4 \cdot 2H_2O$ and $NH_4H_2PO_4$ and dispersed in acetone and ball milled under cold milling and heat treatment technique. The lattice information, crystal structure and observation of the space group was determined by rietveld refinement and x-ray diffraction (XRD) analysis revealed to be having monoclinic structure with space group of $P2_{1/c}$ (14) and the crystallite size was 60.59 nm. Fourier transform infrared (FTIR) spectra confirms chemical bonds of all phosphate bonds including $(P_2O_7)^{-4}$ bonds of $Li_2FeP_2O_7$ family. The 80:10:10 weight ratio of $Li_2FeP_2O_7$: carbon black: PVDF composite was fabricated into a half cell. The first discharge specific capacity is 154 mAh/g at 0.1 mA in the 2.5 – 4.2 V potential range, 70% of the theoretical capacity. After the tenth cycle, the capacity retention reduced to 72% of the initial capacity. Cyclic voltammetry (CV) at 0.1 mV/s of the half-cell is reported and two redox peaks at 3.22 V and 3.65 V.

Keywords: $Li_2FeP_2O_7$, Monoclinic, Rietveld, Cyclic Voltammetry

OTRS011

Evaluation of Banana Peel/PLA Composites Properties

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Abstract. Due to ecological and environmental concerns, researchers are moving their focus from synthetic fiber-based polymeric composites to natural fiber-based biocomposites. Synthetic fibres have remarkable physical and mechanical qualities, but they also take a lot of energy to process, non-renewability, non-biodegradability and non-recyclability. Therefore, the utilization of the banana peels derived from the waste material as reinforcement can be beneficial for the develop of stainable and eco-friendly biocomposites. Polylactic acid (PLA) based polymers composites were filled with banana peel powder (BPP). BPP/PLA composites were prepared by dissolving PLA pellets and incorporated BPP in 5, 10, 15 and 20 wt% loading. Percentage of water adsorbed increased with the increment of BPP loading. All composites samples showed a quite similar FTIR wavelength pattern with hydroxyl groups owing to the carbohydrate structure and CH_2 groups from the addition of BPP. Thermal analysis of BPP/PLA composites was also investigated by using DSC. From the study, BPP/PLA composite is suitable for the lessening of banana peel waste and developing value-added biocomposites materials.

Keywords: Banana Peel; PLA; composites properties

UMT007

Crystalline Structure, Optical Properties and Surface Morphology of CdS Photocatalyst Synthesized Via Precipitation for Water Remediation of Aqueous Rhodamine 6G

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Abstract. Cadmium sulfide (CdS) photocatalyst was synthesized at room temperature without thermal treatment via drop-wise precipitation method by intercalating the cadmium chloride ($CdCl_2$) and thiourea as precursors in the sodium hydroxide (NaOH) aqueous solution as buffer. The crystalline structure, surface morphology, functional groups and photocatalytic degradation activity of CdS were studied by utilizing the X-ray powder diffraction (XRD), scanning electron microscope (SEM), Fourier-transform infrared spectroscopy (FTIR) and UV-Vis spectrophotometer. Miller indices of the corresponding lattice plane verifies the cubic structure of CdS and the Scherer's formula was applied to calculate the average crystallite size. The SEM images show that the morphology of CdS demonstrates uniform dispersion of spherical-shape nanoparticles. From the FTIR spectra, a well-resolved characteristic peak observed near 650 cm^{-1} represents the CdS compound. The CdS shows appreciable photocatalytic degradation effect on Rhodamine 6G dye under UV illumination, which is beneficial for water cleaning process.

Keywords: CdS Photocatalyst, Precipitation, Photocatalytic Degradation, Rhodamine 6G, Optical Properties

UITM051

Studies of $BaTiO_3$/PVDF/RGO based nanocomposites as nanogenerator application

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Abstract. The energy harvesting nanogenerator using piezoelectric material based on Barium Titanite – poly (vinylidene fluoride)-reduced graphene oxide ($BaTiO_3$-PVDF-rGO) nanocomposite has been investigated. The performance of energy harvesting using several compositions of BTO-PVDF and BTO-PVDF-rGO. The nanocomposite was obtained by polymerization of rGo into BTO-PVDF, as prepared BaPVG5 (rGO = 5%) exhibited maximum output performance. BaPVG5 -NG showed a maximum voltage peak to peak of 54 V and a short current of 16.2 nA at an applied force of 15 N, BaPVG5-NG displayed an output energy power of 486 nW and power density of 154.69 nW/cm^2. All fabricated energy harvester output was recorded without any external poling process. The device has excellent stability even after a 500 pressing releasing cycle. This indicated that fabricated BaPVG5-NG is a promising flexible energy harvesting.

Keywords: piezoelectric, polymer, reduced graphene oxide, nanogenerator

USM007

Estimation of Dose Reference Level (DRL) for children in computed tomography scanner in two public hospitals in Wilayah Persekutuan Kuala Lumpur and Selangor

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Abstract. Computed Tomography (CT) scanners have made significant contributions in diagnosing patients' illnesses in hospitals and health facilities around the world accurately and effectively. However, because the dose produced is very high compared to other x-ray irradiation apparatus, there has been an increased concern among pediatric medical experts in particular and the public in general regarding the long-term effects caused by the exposure. The IAEA and ICRP have recommended Dose Reference Levels (DRLs) as a strategy to optimize doses received in pediatric patients. The purpose of this research is to estimate Computed Tomography Dose Index Volume (CTDIvol), Dose Length Product (DLP) and Effective Dose (ED) values for children in Tunku Azizah Hospital (HTA), Kuala Lumpur and Selayang Hospital (HS), Selangor. A total of 654 CT x-ray examinations were conducted at HTA, while 304 CT x-ray examinations were conducted at HS between January 2020 and December 2021. The retrospective analysis was divided into head, chest and abdominal examinations and categorized into four age groups: <1, 1-5, 6-10 and 11-15 years. CTDIvol, DLP and ED values recorded in the Picture Archiving and Communication System (PACS) and vendor-provided dose monitoring application were compared with $CTDI_{vol}$, DRL values from other studies. The results of the study found that the dose values of $CTDI_{vol}$ for HTA and HS were lower compared to other studies except for CTDIvol for the for-abdomen examinations resulting in maximal difference 35% for HTA and HS. The DLP value for chest examination resulting maximal differences 32.48% for HTA and 48% for abdomen examinations at HS. The highest effective doses at HTA were estimated for head 6.02 mSv, chest 25.16 mSv, abdomen 50.60 mSv and for HS, the highest effective doses were estimated for head: 5.76 mSv, chest: 14.88 mSv, abdomen: 11.01 mSv. In conclusion, the dose values of $CTDI_{vol}$ and DLP in this study are in the optimal value except for DLP values for the chest and abdomen examinations for HTA and the abdomen examinations for HS which gives the impression that there is room for an improvement process so that the output parameters could be optimized for future protocol examinations.

Keywords: DRL; CTDIvol; DLP; ED;

UPM016

A Comparative Study on the Electrical Transport Properties of YBCO Synthesized via Different Modified Methods

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Abstract. This comparative study involved fabricated bulk $YBa_2Cu_3O_{7-\delta}$ (YBCO) with different modified synthesis methods such as thermal treatment, solid state, and decomposition methods in air. The analysis for comparison is based on the measurement of (i) orthorhombicity value of crystal structure (ii) the oxygen content (iii) the appearance of impurity phases such as $BaCuO_2$ and (Y_2BaCuO_5) Y-211 (iv) the critical temperature such as $T_{c\text{-}onset}$ and $T_{c(R=0)}$ and (v) the sharpness of transition width, ΔT_c. Additionally, we also qualitatively discuss the surface morphology, average grain sizes, and ratio of the elementals contained in all specimens. On the other points, this comparative study highlights the importance of immediately grinding and heat treatment process for good quality bulk rare-earth based high temperature superconductor fabrications. The future study also will focus on Ca and K addition with optimum sintering temperature via the most advanced method.

Keywords: orthorhombicity, oxygen content, impurity phases, critical temperature, transition width

UMK 042

Utilization of silica from rice husk ash and modification with m-toulylchloride in shellac; Its microbial effect on Pulai wood

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Abstract. Bamboo leaves (Gigantochloa albociliata) is a huge agro-waste material and known as biomass is considered to have quite a high amount of silica. The uses of SiO_2 in wood alteration were previously unknown. The silica collected from this study was immobilized with a biocide found in shellac. Moisture content and anti-microbial tests will be performed. The objective of this study will be to extract and characterize silica from the ash of bamboo leaves (BLA) and to immobilized silica onto the modified wood with selected biocide and shellac. The extraction of silica from bamboo leaves ash (BLA) can be done by using sol-gel method. On a small scale, *m*-Toluoyl chloride- containing silica was produced. The processes were also employed in a scaled-up and modified version. FTIR, SEM, and EDS will be used to characterize the biocide encapsulated in silica. The essential functional groups in the silica were discovered via FTIR research. SEM and XRD analyses show that a silica-based structure may encapsulate and stabilize biocide molecules in their open configurations prior to their addition into the coating formulation. EDS analysis is also carried out in this study to determine the chemical compositions in some spots of the (BLA) silica and silica containing biocide. The results of using silica as a moisture absorbent demonstrate that BLA silica has good characteristics for absorbing moisture. Based on all the test, fungi are sensitive to biocidal substances containing silica or without a biocidal substance containing silica on the wood surface. The result of anti-microbial effect on wood with brown-rot fungi shown that BLA silica containing biocidal with shellac are satisfactory.

Keywords: silica, biocide, encapsulated, characterize

UPM010

Enhanced Grain Coupling for Increasing Critical Current Density of Ex-Situ MgB_2

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Abstract. *Ex-situ* MgB_2 has a higher packing factor than that of its *in-situ* counterpart. However, intergrain connectivity of the former is much weaker resulting in its lower critical current density, J_c. Hence, it is the aim of this work to increase grain coupling of the ex-situ MgB_2 bulks. In this study, commercial MgB_2 was used as precursor (*ex-situ* MgB_2 bulks). The precursor was mixed with Mg or (Mg+B) with excess Mg. The mixture was then sintered at 600 °C - 1000 °C for 1 h. Magnetization measurement was carried out in order to determine the superconducting critical temperature, T_c and J_c. Phase formation and lattice properties of the samples were checked using powder X-ray diffraction. Field-emission electron microscope was used to image morphology of the samples. It was found that the T_c remained unchanged at around 38 K. With the addition of Mg or (Mg+B), J_c was enhanced pronouncedly. Self-field J_c of up to 10^4 A·cm^2 was obtained at 20 K. The increased J_c is due to the improved intergrain coupling which enhanced further by optimisation of the heat treatment.

Keywords: *ex-situ* MgB_2, sintering, grain coupling, critical temperature, critical current density

UKM022

Borophene/ TiO_2 Heterojunction for Photocatalytic Water Splitting Application: A Density Functional Theory Study

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Abstract. Photocatalytic water splitting has been considered the most preferred hydrogen generation method. The method employs semiconductor material such as TiO_2 as photoactive material, which is cheap and abundant material. However, since TiO_2 has a wide bandgap energy of about 3.2 eV, causing photogenerated electrons and holes are easy to recombine. Forming a heterojunction system with other materials has been proven to prolong the lifetime charge separation, thus improving the TiO_2 photocatalytic performance. Recently, 2D materials such as graphene and borophene have been widely investigated catalysts for hydrogen evolution reactions (HER). Borophene has near-zero free energy of hydrogen adsorption and metallic conductivity expected can inject direct electrons to the conduction band of TiO_2 semiconductor. This study evaluates the band structure and hydrogen adsorption energies onto borophene/TiO_2 composite heterostructures through ab initio calculation of density functional theory study. The calculation was conducted by CASTEP software using GGA-PBE functional. The electronic structure of the heterosystem forming type II band alignment, in which the conduction band position of borophene lying at more positive potential compared to the conduction band of TiO2. This band structure makes the electron can flow easier and improve the overall photocatalytic water splitting performance.

Keywords: Borophene, TiO_2, band structure, water splitting; DFT

UKM023

Design of Highly Efficient CZTS/CZTS Tandem Solar Cells with thin film solar cell

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Abstract. Copper zinc tin sulfide (CZTS) is a bright prospective kesterite material for collecting holes due to its abundance and non-toxicity. Tandem cells are one way to exceeding the efficiency limits of single-material cells. There had been reported CZTS/CZTSSe tandem solar cell with 21.7% efficiency, proposed Se/CZTSSe tandem solar cell with 30.2% efficiency from numerical stimulation and CZTGS/CZTS tandem solar cell efficiency solar cell with 17.51% efficiency. In this paper, propose 2-terminal CZTS/CZTS tandem solar cell had been proposed to be research. The 2-terminal CZTS/CZTS tandem solar cell is in monolithic device. The difference J–V characteristics of the top cell and bottom cell condition is simulated, and experimental data is recorded in the result section. The data and analyses presented in this work would help in accomplishing highly effective eco-friendly thin-film solar cells.
Keyword: CZTS, CZTS/CZTS, tandem cells, kesterite, monolithic device, thin film

UMT002

Surface Morphological Metamorphosis of Electroless Copper Growth on Si Wafer

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Abstract. In the present work, the evolution of electroless deposition of copper on the surface morphology of the Si substrate has been investigated. The deposition was first carried out by immersing the Si in HF and copper (II) nitrate hemi(pentahydrate) mixture solution by varying the rapid immersion time between 10 and 40 s. The high-resolution scanning electron microscope (SEM) was employed to monitor the surface morphology of the current samples. From the results, the improved surface morphology is obtained at prolonged immersion duration, in which a more homogeneous and wider coverage area of copper on the Si surface is produced at longer deposition time. Meanwhile, it could be also deduced from the result that 20 s is the optimal time in order to generate the most uniform and better coating between copper and Si substrate. Consequently, the preliminary finding of this study is expected to pioneer the manufacture of tunable Si properties for desired microelectronic devices fabrication.

Keywords: Si; copper, immersion, deposition, copper (II) nitrate hemi(pentahydrate)

UMK038

IoT Solar Panels Monitoring System

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Abstract. Photovoltaic systems used in many locations since, although taking up less space than conventional systems, they are less expensive to set up and maintain. It is often installed on an open terrace at small generating plants to manage space occupancy. However, installing large-scale power-producing units demands acres of land. It is difficult for human workers to handle such a sizable power station area. On the other hand, the Internet of Things (IoT) has been crucial in several fields. The IoT makes it possible to continuously monitor and analyze data, giving consumers a clear real-time picture of the performance of their system. This information may improve performance, lower energy waste, and identify solar power system failure or problematic areas, as well as the regularity of power generation. To improve the performance of a complete solar power system, a prototype device was developed as part of this research that can be integrated into any level system which can monitor voltage and current of individual panel using IoT to enhance the effectiveness, reliability, and overall performance of solar power systems.

Keywords: IoT, Solar System, Solar Panel Maintenance, Maximum Power Generation.

UPNM006

Biopolymer Electrolyte Host Based on Newly Synthesized Benzoyl Kappa Carrageenan

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Abstract. Newly synthesized benzoyl carrageenan (Bz-ƙcar) has been successfully synthesized by Friedel Craft acylation method. The acylated carrageenan has been confirmed by Fourier transform infrared spectroscopy (FTIR), nuclear magnetic resonance (NMR) and elemental analyses. FTIR analysis showed successful substitution by the formation of new carbonyl (C=O) bond at 1716 cm^{-1}. A pair of new peak is also detected at 1451 and 1605 cm^{-1} belongs to the aromatic C=C stretch, thus confirming the successful substitution of benzoyl molecule (C_6H_5CO-) into the ƙcar matrix. H-NMR confirmed the substitution of C_6H_5CO- into carrageenan matrix by the appearance of multiple new peaks at (δ =7.20-9.50 ppm) belongs to the characteristic signals of protons in aromatic benzoate group. Elemental analysis revealed the increase percentage of carbon and oxygen in Bz-ƙcar suggesting the successful acylation reaction. Based on XRD data, the crystallinity index of Bz-ƙcar is 24.3% which is less than ƙcar at 26.7%, due to the disordered structural arrangement of Bz-ƙcar matrix. The FESEM analysis showed that the synthesis has significantly affected the morphology of the biopolymer as perforated structure was observed in Bz-ƙcar due to the inclusion of bulky and crystalline benzoyl chloride salt molecule into ƙcar matrix. The electrochemical impedance spectroscopy (EIS) analysis of the gel sample Bz-ƙcar showed improved ionic conductivity as compared to ƙcar, thus has given new idea to improve the properties of ƙcar-based electrolyte.

Keywords: benzoyl, kappa carrageenan, electrolyte, biopolymer, acylation

UITM011

Effect of Fe Substitution on the Structural, Transport and Magnetic Properties of $Pr_{0.75}Na_{0.05}K_{0.20}Mn_{1-x}Fe_xO_3$ manganites

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Abstract. The effects of partial substitution of Fe at Mn site on structural, electrical, and magnetic properties in monovalent doped $Pr_{0.75}Na_{0.05}K_{0.20}Mn_{1-x}Fe_xO_3$ (x = 0 and x =0.03) manganite prepared by solid state method were investigated. An X-ray diffraction measurement indicated that the samples formed a single phase. Further analysis using Rietveld refinement revealed that the samples crystallized in orthorhombic structure. The unit cell volume was found slightly increased from 230.60 $Å^3$ (x = 0) to 231.53 $Å^3$ (x = 0.03) which may be related to similar ionic radius of Mn^{3+} (rMn^{3+} = 0.645 Å) and Fe^{3+}. Resistivity measurements showed x = 0.03 sample exhibit insulating behavior with increased in resistivity while x = 0 sample exhibit metal-insulator transition behavior at metal-insulator transition temperature, T_{MI} ~ 122 K. Magnetic measurement showed that both samples exhibit ferromagnetic to paramagnetic transition behavior with decreased in T_C values from 140. 73 K (x =0) to 125. 49 K (x = 0.03). The reduction in T_C values may be related to enhancement of antiferromagnetic (AFM) super-exchange interaction as a result of Fe substitution. The observed changes in resistivity behavior are suggested due to dominant effect of reduction of number of itinerants, e_g electrons and weakening of Mn^{3+}-O-Mn^{4+}double exchange mechanism. *MR* vs *T* curves showed that Fe substitution significantly enhances magnetoresistance (MR) effect at low temperature region indicates the Fe substituted sample potentially be used as magnetic sensor elements.

Keywords: manganites, Solid-state method, resistivity, magnetic, iron-doped, double-exchange

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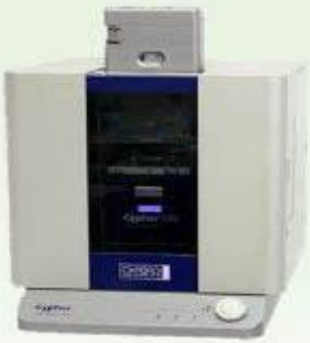

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