



*Symposium on*

*Frontier  
Materials &  
Industrial  
Applications*  
**SFMIA2019**

**Programme &  
Abstract Book**

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## FOREWORD

Assalamualaikum w.b.t and greetings,

First and foremost, thanks to the Almighty God for making this Symposium on Frontier Materials and Industrial Applications 2019 (SFMIA 2019) and Seminar on Waste-water Wealth 2019 a reality. My deep appreciation to all the organizing committees as well as Entiti Kecemerlangan (EK) FMIA, reviewers, panel, seminar's facilitators from Universiti Teknologi MARA (UiTM) and Indah Water Konsortium (IWK), seminar's group leaders and members for their dedication and commitment to making this symposium a success.



This symposium is organized by the Frontier Materials and Industrial Applications (FMIA) Community of Research (CoRe) Universiti Teknologi MARA (UiTM). The symposium particularly encourages the interaction of researchers in research and academic communities as well as with the industrial players by presenting and discussing new and current works. Their contributions help to make the SFMIA 2019 an outstanding event.

Special appreciation to the top management of UiTM who has constantly driven the research community to achieve a tremendous increase in research activities and outputs. Last but not least, I would like to thank all invited speakers, paper contributors and also Seminar group leaders and members who have spent their valuable time and energy to participate this symposium.

**ASSOCIATE PROFESSOR DR. AIDAH JUMAHAT**  
Chairman, SFMIA 2019



UNIVERSITI  
TEKNOLOGI  
MARA



Institute of  
Research Management  
& Innovation

## ABOUT FMIA CoRe UiTM

**Frontier Materials and Industrial Application (FMIA)** is one of the main research priority areas in UiTM. FMIA is managed by the Communities of Research (CoRe) Institute of Research Management and Innovation (IRMI). FMIA is responsible for managing and inculcating research activities at UiTM in the field of materials, technology and industrial application. FMIA consists of 31 Research Interest Group (RIG) and 372 researchers as of June 2019. The researchers are encouraged to blend their expertise in various field related to functional materials and industry applications. Communication among materials scientists, chemists, physicists, engineers, mathematicians and others in interdisciplinary fields associated with materials and industrial technology are significantly meaningful in order to blossom research and make it a culture in UiTM. This is aligned with the objective of the development of CoRe which is to foster inter-disciplinary and trans-disciplinary collaborations that could transform UiTM's researchers to possess internationally acknowledged research capabilities.

All RC and RIG are strategically aligned to the FMIA niche areas (in accordance to the global, national and university priorities), which are Advanced Materials, Industrial Technology, Manufacturing & Automation and Transportation, Mobility & Infrastructure, as shown in Figure 1. These research groups comprise of dynamic and enthusiastic researchers who play a vital role in stimulating innovation and encouraging commercialization to produce high quality research outputs within the specified niche areas.

Research trust of each research groups may include theoretical, experimental, characterisation, simulation, maintenance, design or fabrication studies of materials and its relation to real industrial applications and sectors. Research on engineering and functional materials in macro-, micro- and nano-scale science are conducted and aligned with advanced technology applied and used in various industries such as automotive, robotics, automation, manufacturing, construction, defense, marine, aviation, agrotechnology, food, sports, textile, oil and gas, chemical and petroleum, dentistry and surgical, processing and packaging, biomaterials and biotechnology, etc. In addition, research on analysis, statistics, economic growth, marketing and management are also important and need to be focused in future.

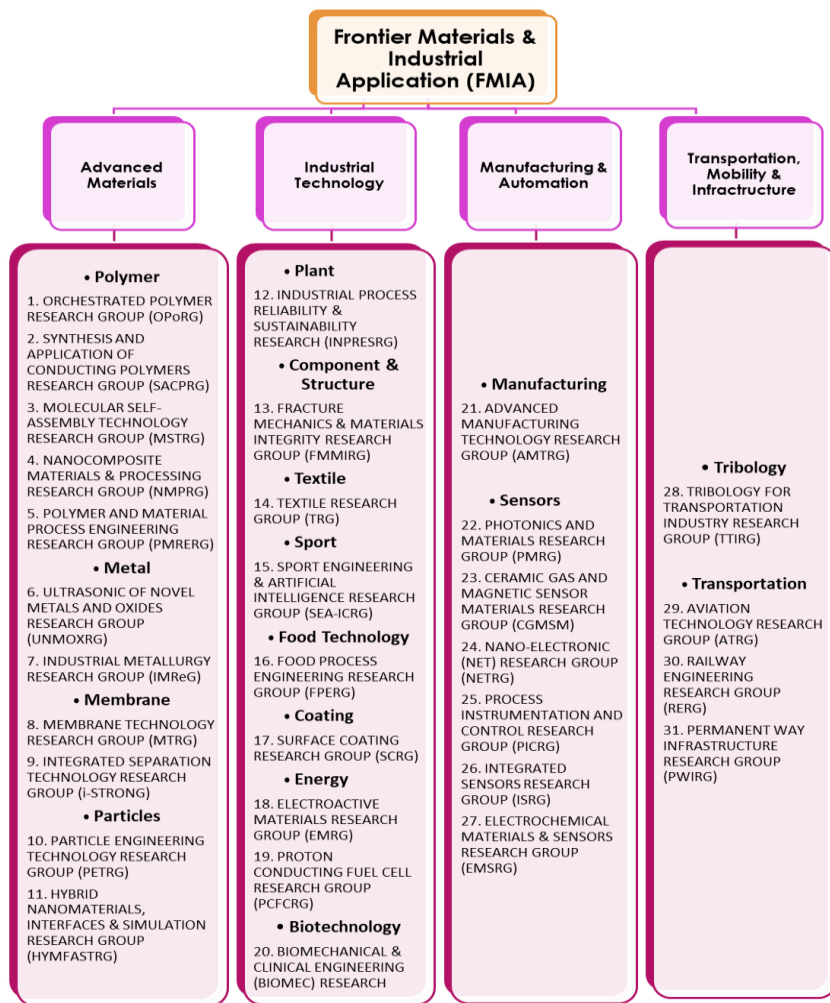


Figure 1: Mapping of FMIA Research clusters and 31 EK research groups

## VENUE

### GRAND BLUEWAVE HOTEL

Strategically located in the suburbs of Kuala Lumpur and in the heart of the business and commercial hub of Shah Alam, this 5-star hotel is located next to the State Museum and Library, and just a 5 minute walk away from the famous Blue Mosque. It is the perfect location for businesses from Kuala Lumpur City Centre and only 40 minutes to Kuala Lumpur international Airport in Sepang.

Grand BlueWave Hotel Shah Alam features 341 luxurious rooms that all rooms are modernly equipped and with wide glass windows offering a panoramic view of the majestic 'Blue Mosque' or garden city of Shah Alam.



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Mohamad Fariz	Mohamad Taib	Universiti Teknologi MARA
Hamidah	Mohd Saman	Universiti Teknologi MARA
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Yusairie	Mohd	Universiti Teknologi MARA
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Nurhidayati	Othman	Universiti Teknologi MARA
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Rosnah	Zakaria	Universiti Teknologi MARA
Nor Aida	Zubir	Universiti Teknologi MARA

## GENERAL PROGRAM SCHEDULE

Time	Activity	Venue
<b>0730 – 0830</b>	Registration	Registration and Fees Payment Counter, Ballroom Dewan Perdana
<b>0830 – 0900</b>	Poster Evaluation Briefing to Panels and Presenters Poster Setup & Booth setup for all FMIA EKs	Open pitching and Booth hall, Level 2
<b>0900 - 0905</b>	Malaysian National Anthem "Negaraku" and Wawasan Setia UiTM	
<b>0905 – 0910</b>	Doa Recital	
<b>0910 – 0925</b>	Welcoming Speech by Deputy Vice- Chancellor (Research and Innovation), Universiti Teknologi MARA (UiTM)	
<b>0925 - 0940</b>	Speech by Chairman, Indah Water Konsortium (IWK)	
<b>0940 – 1015</b>	Opening Speech and Officiation by Vice Chancellor Universiti Teknologi MARA (UiTM) Opening ceremony & FMIA Research Highlight Book launching Certificate giving: FMIA EK STAR 2018 Certificate giving: Best Paper Award SFMIA2019	
<b>1015 - 1030</b>	MoU signing MoU Photo session Exchange of gifts Mass Photo Session	

<b>1030 – 1130</b>	Press Conference, Coffee Break Booth Visit Poster Presentation and Evaluation Session by Judges	Level 2
<b>1130 - 1200</b>	<p>Parallel Session A1 Invited Speech A1: YBhg. Ir Mohamed Haniffa Hj Abdul Hamid, Chief Operating Officer (COO), IWK</p> <p>Parallel Session A2 Invited Speech A2: Dr. Mohammad Jawaid, Universiti Putra Malaysia (UPM)</p> <p>Parallel Session A3 Invited Speech A3: Lt. Kol. Ir. Mohammad Juani b. Sujana (B) TUDM, Marine Technology Company (MTC) Engineering Sdn Bhd</p> <p>Parallel Session A4 Invited Speech A4: Dr. Mohd Shahneel Saharudin, Universiti Kuala Lumpur (UniKL)</p> <p>Parallel Session A5 Invited Speech A5: Dr. Nor Dalila Nor Affandi, UiTM</p>	Ballroom Dewan Perdana, Room Gasing 2, Room Gasing 3, Room Gasing 4, Room Congkak
<b>1200 - 1300</b>	<p>Ballroom Dewan Perdana : Workshop on Wastewater 2019</p> <p>Break up rooms: Parallel Oral Presentation SFMIA2019</p>	Ballroom Dewan Perdana, Room Gasing 2, Room Gasing 3, Room Gasing 4, Room Congkak

<b>1300 - 1400</b>	Lunch Break And Solat	Café Hall, Balcony Dewan Perdana, Level 3
<b>1400 - 1545</b>	Ballroom Dewan Perdana : Workshop on Wastewater 2019  Break up rooms: Parallel Oral Presentation SFMIA2019	Ballroom Dewan Perdana, Room Gasing 2, Room Gasing 3, Room Gasing 4, Room Congkak
<b>1545 - 1600</b>	Coffee Break Poster Award Giving Ceremony	Open pitching and Booth hall, Level 2
<b>1600 - 1730</b>	Ballroom Dewan Perdana : Workshop on Wastewater 2019  Break up rooms: Parallel Oral Presentation SFMIA2019	Ballroom Dewan Perdana, Room Gasing 2, Room Gasing 3, Room Gasing 4, Room Congkak
<b>1730</b>	Adjourn	Level 2

## PARALLEL ORAL PRESENTATIONS

Parallel Session A2 Chairperson : Dr. Anizah Kalam Co-Chairperson : Nur Ain Mohd Zainuddin Rapporteur : Fadzli (Venue: Room Gasing 2)		
Time	Paper No.	Title
1130 - 1200		<b>Dynamic Mechanical Analysis of Polymer and Polymer based Composites</b> Speaker: Dr. Mohammad Jawaid, Universiti Putra Malaysia (UPM)
1200 - 1210	004	<b>Atmospheric Soda Pulping of Banana Stem</b> Nurul Amal Nadhirah Mohamad and Jai Junaidah
1210 - 1220	005	<b>Preliminary Design of a Coriolis Acceleration Experimental Device</b> Hafizan Hashim and Hanita Hashim
1220 - 1230	006	<b>Analysis and Evaluation of Coriolis Acceleration Experimental Device</b> Hafizan Hashim and Hanita Hashim
1230 - 1240	010	<b>S-Phase Layer Development on 316LVM Using Low Temperature Hybrid Thermochemical Treatment Process</b> Mohd Shahrman Adenan, Siti Umrah Zainal and Esa Haruman
1240 - 1250	012	<b>Damage Assessment Using Acoustic Emission on Concrete Beam</b> Sakhiah Abdul Kudus, Adiza Jamadin, Norliyati Mohd Amin, Anizahyati Alisibramulisi and Nurul Huda Suliman
1250 - 1300	013	<b>Adsorptive removal of Cu (II) ions from aqueous solution by magnetite nanoparticles from mill scale waste</b> Syazana Sulaiman, Rabaah Syahidah Azis, Ismayadi Ismail, Hasfalina Che Man and Nur Asyikin Abdul Nazri



Parallel Session A3 Chairperson : Dr. Ahmad Hussein Co-Chairperson : Mr Sharil Khusairi Rapporteur : Shida <b>(Venue: Room Gasing 3)</b>		
Time	Paper No.	Title
1130 - 1200		<b>MTC &amp; Local Technology Development</b> Speaker: Lt. Kol. Ir. Mohammad Juani b. Sujana (B) TUDM, Marine Technology Company (MTC) Engineering Sdn Bhd
1200 - 1210	014	<b>Effect of sintering temperatures on structural, magnetic and microwave properties of barium ferrites/epoxy composites</b> Nurshahiera Rosdi, Raba'ah Syahidah Azis, Ismayadi Ismail, Muhammad Syazwan Mustaffa and Nurhidayat Mokhtar
1210 - 1220	015	<b>Evaluation and Validation on the Reliability and Robustness of Smart Socket Outlet for Hall of Residences Usage</b> Mohamad Fauzi Omar, Harizan Che Mat Haris and Nooritawati Md. Tahir
1220 - 1230	016	<b>Simulation and Design of Neutral Point Type Buck Converter</b> Mohamad Fauzi Omar and Harizan Che Mat Haris
1230 - 1240	018	<b>Effect of Mordant Types and Methods on the Color Fastness Properties of Silk Fabrics dyed with Brown Seaweeds</b> Nabila Talib, Mohd Rozi Ahmad, Khudzir Ismail and Muhammad Ismail Ab Kadir
1240 -1250	019	<b>Shaking Table Test on Different Positions of Multiple Tuned Liquid Damper</b> Izzul Syazwan Ishak, Norliyati Mohd Amin and Nor Hayati Abdul Hamid
1250 - 1300	027	<b>Biomechanical Analysis of Spinal Fusion Cage for Lumbar Vertebrae</b> Rusnani Yahya, Muhammad Hazli Mazlan, Solehuddin Shuib and

<p>Parallel Session A4  Chairperson : Dr. Nik Rozlin Nik Masdek  Co-Chairperson : Ir. Zainal Abidin Kamarul Baharin  Rapporteur : Ilya  <b>(Venue: Room Gasing 4)</b></p>		
Time	Paper No.	Title
1130 - 1200		<b>Processing of epoxy-graphene nanocomposites</b> Speaker: Dr. Mohd Shahneel Saharudin, Universiti Kuala Lumpur (UniKL)
1200 - 1210	020	<b>Compressive Failure Behaviour of Unidirectional and Woven Kevlar/Epoxy Composite Laminates under Various Angles of Fiber Orientation</b> Mohamad Mali and Jamaluddin Mahmud
1210 - 1220	022	<b>Rayleigh Damping Coefficients Measurement of Laminated Rubber Bearing Using Finite Element and Experimental Modal Analysis</b> Ahmad Idzwan Yusuf and Norliyati Mohd Amin
1220 - 1230	023	<b>Magnetic Solid Phase Extraction Using Magnetic Mesoporous Silica for Preconcentration of Organophosphorus Pesticides</b> Nur Husna Zainal Abidin, Wan Nazihah Wan Ibrahim and Nor Suhaila Mohamad Hanapi
1230 - 1240	024	<b>Comparison Between Two Heuristic PID Tuning Methods for a 4-DOF Robot Arm Control</b> Mat Ariffin Muhammad Farhan, Ruhizan Liza Ahmad Shauri, Roslan Muhammad Izzat, Wan Zainudin Wan Muhammad Lukman and Rosli Muhammad Afiq
1240 -1250	026	<b>The Thermal Conductivity of 8 Yttria Stabilized Zirconia and Mullite Thermal Barrier Coating on Medium Carbon Steel Substrate</b> Muhammad Syazani Farhan Zaini, Mohd Shahriman Adenan, Juri Saedon and Aman Mohd Ihsan Mamat
1250 - 1300	116	<b>S-Phase Layer Development on 316LVM Using Low Temperature Hybrid Thermochemical Treatment Process</b> Mohd Shahriman Adenan, Siti Umrah Zainal and Esa Haruman

Parallel Session A5 Chairperson : Dr. Muhad Rozi Mat Nawi Co-Chairperson : Dr. Lim Ying Pei Rapporteur : Ain <b>(Venue: Room Congkak)</b>		
Time	Paper No.	Title
1130 - 1200		<b>Nanotechnology textiles (Nano-textiles): Fabric of the Future</b> Speaker: Dr. Nor Dalila Nor Affandi, UiTM
1200 - 1210	029	<b>Calcination Effect On Structural Trasformation of Barium Titanite Ferroelectric Ceramic by Sol-Gel Method</b> Ahmad Firdaus Che Omar, Faizatul Farah Hatta, Tunku Ishak Tunku Kudin, Oskar Hasdinor Hassan and Mohd Ambri Mohamed
1210 - 1220	030	<b>Production of Biofuel (Bio-Ethanol) From Fruitwaste: Banana Peels</b> Muhamad Ariff Amir Hamzah, Azil Bahari Bin Alias and Nor Elina Ahmad
1220 - 1230	032	<b>Adsorption of Hydrogen Sulphide by Commercialized Rice Husk Biochar (RHB) &amp; Hydrogel Biochar Composite (RH-HBC)</b> Ashadi Azwan Abd Rahman, Azil Bahari Bin Alias, Nurul Najihah Jaffar, Muhamad Ariff Amir Hamzah and Wan Azlina Wan Ab Karim Ghani
1230 - 1240	033	<b>Adsorption kinetics and equilibrium isotherms modeling of h2s on hydrogel biochar and biochar adsorbent from rice husk</b> Ashadi Azwan Abd Rahman, Azil Bahari Bin Alias, Muhamad Ariff Amir Hamzah and Mohammad Aidil Ali
1240 -1250	034	<b>Wettability study on the XLPE nanocomposite with surface modified nanofiller</b> Anuaruddin Hanizan, Rahida Wati Sharudin, Zakiah Ahmad, Istikamah Subuki and Azerai Ali Rahman
1250 - 1300	036	<b>Sound Absorption Coefficient of Different Green Materials Polymer on Noise Reduction</b> Nadiatul Syima Mohd Shahid, Mohamad Ali Ahmad and Farah Liana Md Tahir

Parallel Session B2 Chairperson : PM Ya'kub Taib Co-Chairperson : PM Dr. Dzaraini Kamarun Rapporteur : Fadzli <b>(Venue: Room Gasing 2)</b>		
Time	Paper No.	Title
1400 - 1410	007	<b>The Improvement of Wear Characteristics on 316L Stainless Steel by Dual Surface Treatment Method</b> Bulan Abdullah, Muhamad Hafizuddin Mohamad Basir, Khalissah Muhammad Yusof, Siti Khadijah Alias and Mohd Faizul Idham Mohd Zulkipli
1410 - 1420	039	<b>The Effect of Slat Opening On Vortex Shedding Behind A Circular Cylinder</b> Azlin Mohd Azmi
1420 - 1430	103	<b>Collection Efficiency Enhancement of Cyclone Filtration System</b> Ahmad Hussein Abdul Hamid, Luqman Hakim Kamaruhen and Mohd Hafiz Mohd Noh
1430 - 1440	055	<b>Properties of Particleboard in Correlation with Mat Weight and Press Factor</b> Wan Mohd Nazri Wan Abdul Rahman, Muhammad Abdilah Ab. Rani, Nur Sakinah Mohamed Tamat and Nor Yuziah Mohd Yunus
1440 - 1450	056	<b>Flexural influence on screw withdrawal behaviour of selected commercial particleboard</b> Nor Yuziah Mohd Yunus, Nur Wafa Amalina Amali, Nur Sakinah Mohamed Tamat and Wan Mohd Nazri Wan Abdul Rahman
1450 -1500	057	<b>Screw Withdrawal Properties of Kelampayan and Sesendok Glue-Laminated Timber</b> Wan Mohd Nazri Wan Abdul Rahman, Nur Aishah Sajali and Nor Yuziah Mohd Yunus
1500 - 1510	074	<b>Adaptive Neuro-Fuzzy Inference System Prediction Method for Percentage Fatalities of Jet Fire Incident in Methanol Production Plant</b> Mohd Aizad Ahmad and Zulkifli Abdul Rashid
1510-1520	101	<b>Quantitative Risk Assessment For Two MeOH Process Route Production Plant Using Recycled CO2 With HYSYS</b>

		Zulkifli Abdul Rashid and Mohd Aizad Ahmad
1520 - 1530	129	<b>The Effect of The Jute Fabric Reinforced Vinyl Ester Composite Treated with Ammonium Polyphosphate on The Physical, Flammability and Thermal Properties</b> Khairul Naseem Mohd Rodzi and Mohd Iqbal Misnon
1530 - 1540	098	<b>The use of plant-based surfactant in removal of oil from oily sludge via thermochemical cleaning method</b> Siti Wahidah Puasa, Kamariah Noor Ismail, Siti Nur Sahira Daud, Muhammad Zamir Afiq Musman and Nur Amalina Sulong

<p>Parallel Session B3  Chairperson : Ts. Ir. Dr. Anizahyati Alisibramulisi  Co-Chairperson : Azzah Nazihah Che Abdul Rahim  Rapporteur : Shida  <b>(Venue: Room Gasing 3)</b></p>		
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Time	Paper No.	Title
1400 - 1410	136	<b>Flexural properties of chopped kenaf and carbon fibre reinforced polymer composites embedded with carbon nanotubes</b> <b>Presenter: Ummu Raihanah</b>
1410 - 1420	038	<b>Effects of Mesoporous Silica Addition on Electrochemical Properties of Carbon Electrode</b> Noramira Saad, Mohammad Noor Jalil, Zainiharyati Mohd Zain and Hamizah Mohd Zaki
1420 - 1430	041	<b>QR Code Supported GIS Web System for University Facility Damage Report</b> Nur Auni Suraya A.Rahim and Abdul Rauf Abdul Rasam
1430 - 1440	043	<b>QR Code Supported GIS Web System for University Facility Damage Report</b> Muhammad Faiz Osman Zaini and Abdul Rauf Abdul Rasam
1440 - 1450	044	<b>Effect of Shroud Hole on the Force Characteristics of a Circular Cylinder</b>

		Mohamad Faiz Osrin, Azlin Mohd Azmi, Hamid Yusoff and Norizham Abdul Razak
1450 -1500	047	<b>Development Of 3D Printed Symbrachydactyly Prosthetic Hand</b> Mohammad Azeeb Mazlan, Wan Fatimatul Aifaa Wan Fadzil, Helmi Rashid and Abdul Halim Abdullah
1500 - 1510	048	<b>Splat behavior under substrate temperature of 673K via coupling simulation</b> Mohd Hafiz Mohd Noh, Ahmad Hussein Abdul Hamid and Koichi Mori
1510-1520	062	<b>Effect of torsional motion on critical speed of high-speed rotating shaft at different boundary conditions</b> Abdul Malek Abdul Wahab
1520 - 1530	063	<b>The processing of epoxy/1 wt%-graphene nanocomposites: effects of ethanol on properties</b> Mohd Shahneel Saharudin, Asmimi Zulkifli and Nurul Fatihah Zailani
1530 - 1540	064	<b>Rheological properties of cassava starch film forming solution with kaffir lime oil</b> Norasmah Mohammed Manshor, Junaidah Jai, Fazlena Hamzah and Noorsuhana Mohd Yusof

<p>Parallel Session B4  Chairperson : Dr. Nor Fazli Adull Manan  Co-Chairperson : Dr. Sakhiah Abdul Kudus  Rapporteur : Ilya  <b>(Venue: Room Gasing 4)</b></p>		
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Time	Paper No.	Title
1400 - 1410	130	<b>Quantifying the Tensile Properties of Hevea brasiliensis – Silicone Biocomposite using Neo – Hookean Model</b> Noorainol Faiz Noor Haris, Jamaluddin Mahmud and Mohd Azman Yahaya
1410 - 1420	066	<b>Pineapple Leaf Fibers (PALF)/ Polyethylene Terephthalate</b>

		<b>(PET) Electrospun Nanofibers: Effect of Ratio on Chemical &amp; Morphological Properties</b> Siti Norasmah Surip, Fatimah Muyassarah Abdul Aziz and Khairunnadim Ahmad Sekak
1420 - 1430	067	<b>Modelling of Average Pore Size and Porosity of Porous Polycaprolactone/Hydroxyapatite (PCL/HA) Composite Blends</b> Suffiyana Akhbar, Istikamah Subuki, Rahida Wati Sharudin and Muhammad Hussain Ismail
1430 - 1440	068	<b>The Accuracy of Datria System In Improving Order Picking Process</b> Muhammad Akmal Asyraaf Adlan and Nur Farizan Tarudin
1440 - 1450	069	<b>Effect of Photoelectrochemical Electrolyte Additives on the Photoconversion Efficiency of Tungsten Trioxide Loaded Titania Nanotubes Prepared Via Electrodeposition</b> Lim Ying Chin, Nur Farah Atikah Harun, Asmaa Kadim Ayal, Yusairie Mohd and Lim Ying Pei
1450 -1500	070	<b>Photocatalytic Activity of Modified TiO<sub>2</sub> for Methyl Orange Removal</b> Lim Ying Pei, Tan Huey Ling and Lim Ying Chin
1500 - 1510	071	<b>Role of synthesized soil for minimizing heavy metal penetration into the plant's cell in phytoremediation process</b> Naim Mohd Nazli, Abd Rashid Nor Shaerah and Abu Bakar Noor Fitrah
1510-1520	073	<b>Prediction of Volatile Organic Compounds (VOCs) From Decomposition of Local Household Food Waste Using the Artificial Neural Network</b> Siti Rohana Mohd Yatim and Ku Halim Ku Hamid
1520 - 1530	075	<b>Empirical Study of Damage Gear Using Operational Modal Analysis</b> Mohammad Aarif Amirza, Muhamad Azhan Anuar, Ahmad Azlan Mat Isa and Zamri Abdul Rahman
1530 - 1540	076	<b>Impact Strength of HDPE Composites Roofing Panel from Natural Fibre</b> Nurul Atiqah Mohd Ayob, Mansur Ahmad, Syaiful Osman and Zawawi Ibrahim

Parallel Session B5 Chairperson : Dr. Mohd Nor Azmi Ab Patar Co-Chairperson : Dr. Hafizan Hashim Rapporteur : Ain (Venue: Room Congkak)		
Time	Paper No.	Title
1400 - 1410	078	<b>Physicochemical Properties of Enzymatically Synthesised Medium Chain Triacylglycerols-based Enhancer Cream</b> Salizatul Ilyana Ibrahim, Juan Matmin and Abu Bakar Abdul Majeed
1410 - 1420	079	<b>An IoT-Based Ovitrap System Applied for Aedes Mosquito Surveillance</b> Ismaliza Isa, Ahmad Razali Ishak, Nazri Che Dom, Zulkifli Mohamed and Muhamad Azhan Anuar
1420 - 1430	080	<b>Embryogenic Callus Induction of Aquilaria malaccensis Lam. and Aquilaria subintegra Ding Hou</b> Nursaadih Salam, Asmah Awal and Shamsiah Abdullah
1430 - 1440	084	<b>Effect of Zn-doping on the structural, optical, and humidity sensing properties of sol-gel synthesized NiO thin film</b> Nor Fadzleen Qistina Mohd Fahmi Visuvanathan and Mohamad Hafiz Mamat
1440 - 1450	085	<b>USPs on Damage Reduction of Concrete Railway Sleepers</b> Renga Rao Krishnamoorthy and Zobaer Saleheen
1450 -1500	086	<b>Screening and Isolation of Effective Microbes for Decomposition Process Among Different of Organic Wastes</b> Khairol Redzuan Mohamad and Muhammad Nuruddin Mohd Nor
1500 - 1510	087	<b>Influence of Location and Thickness Variations on Guided Waves in Defective Carbon/Epoxy Plate</b> Noorfaten Asyikin Ibrahim and Bibi Intan Suraya Murat
1510-1520	088	<b>Structural and Optical Properties of Sm<sup>3+</sup> Doped B-Site Ba<sub>0.5</sub>Rb<sub>0.5</sub>lateo<sub>6</sub> Double Perovskites</b> Zakiah Mohamed, Norazila Ibrahim, Muhammad Zharfan Halizan and Nur Syakirah Abdullah



1520 - 1530	090	<b>Finite Element Investigation on the Effectiveness of Different Insoles on Plantar Pressure Distribution</b> Rezchell Chame Alyson, Solehuddin Shuib and Nur Faiqa Ismail
1530 - 1540	091	<b>Determination of Joint Load of Human Lower Limb by Using 2D Inverse Dynamics Modelling</b> Muhamad Sharifudin Mat Intan, Mohd Afzan Mohd Anuar and Zulkifli Mohamed

<p>Parallel Session C2  Chairperson : Prof. Madya Dr. Wan Mohd Nazri Wan Abdul Rahman  Co-Chairperson : Dr. Ismaliza binti Isa  Rapporteur : Fadzli  <b>(Venue: Room Gasing 2)</b></p>		
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Time	Paper No.	Title
1600 - 1610	061	<b>Release of Ammonium-N (NH<sub>4</sub><sup>+</sup>) and Nitrate-N (NO<sub>3</sub><sup>-</sup>) by Different Leguminous Cover Crops (LCCs) Planted in Peat Soils</b> Muhammad Rahmat Abdul Rahman and Nur Qursyna Boll Kassim
1610 - 1620	065	<b>Effect of chitosan-starch enriched with turmeric essential oil coating on physical quality of strawberry</b> Noorsuhana Mohd Yusof, Junaidah Jai, Fazlena Hamzah, Norasmah Mohammed Manshor and Sitinoor Adeib Idris
1620 - 1630	093	<b>Highly Porous NiO Nanoflower-based Humidity Sensor Grown on Seedless Glass Substrate via One-Step Simplistic Immersion Method</b> Norfarariyanti Parimon, Mohamad Hafiz Mamat, Mohd Khairul Ahmad, I. B. Shameem Banu and Mohamad Rusop
1630 - 1640	094	<b>Inherent Safety in Offshore Drilling Operations</b> Siti Rafidah Ab Rashid and Mohamad Amirul Mohamad Kamal
1640 - 1650	095	<b>Blooming of Compounding Ingredients in Natural Rubber Compounds under Different Peroxide Loading</b> Ummu Qani'ah Yasin, Dzaraini Kamarun, Engu Zaharah Engku Zawawi, Noorazlina Adnan and Hairani Tahir

1650 -1700	097	<b>Preliminary Result of Development Of Monitoring System Using The Internet of Things For Industrial Revolution 4.0</b> Siti Aisyah Jaafar and Sukarnur Che Abdullah
1700 - 1710	099	<b>Design and Analysis of a New Humanoid Robot Torso</b> Norheliena Aziz, Nurul Syuhadah Khusainiand Zulkifli Mohamed

<p>Parallel Session C3  Chairperson : Dr. Siti Noor Suzila Bt Maqsood ul Haque  Co-Chairperson : Suffiyana Akhbar  Rapporteur : Shida  <b>(Venue: Room Gasing 3)</b></p>		
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Time	Paper No.	Title
1600 - 1610	100	<b>The Effects of Intrinsic Parameters on the Formation of Electrospun Polycaprolactone Fibre</b> Nur Aqilah Ibrahim, Nor Dalila Nor Affandi and Nurdiana Samsulrizal
1610 - 1620	102	<b>Characterization of Mussel Inspired Surface Modified and Metal Chelated Polymer Membrane</b> Azzah Nazihah Che Abdul Rahim and Muhammad Rifqi Hanif Hamzah
1620 - 1630	104	<b>Characteristics Micro-plastic and Removal of Ammonia-Nitrogen in Batch Culture</b> Nur Aliah Ahmad Tarmizi, Norhafezah Kasmuri and Nor Hazelah Kasmuri
1630 - 1640	106	<b>Knotty Tear Phenomena and Effect of Maturation Time on Knotty Tear in Filled NR Latex Films</b> Siti Aisyah Jarkasi, Dzaraini Kamarun, Azemi Samsuri and Engku Zaharah Engku Zawawi
1640 - 1650	108	<b>Optimization of Resistance Spot Welding Parameters (Single Response) by using Taguchi Method</b> Nor Atriah Mat Yasin, Anizahyati Alisibramulisi, Zuraidah Salleh, Farizah Adliza Ghazali and Anuar Pawan
1650 -1700	109	<b>Removal of Ammonia-Nitrogen and Phosphate in Leachate</b>

		<b>using a Mixed of Algae and Bacteria Culture</b> Muhammad Zaidi Misni and Norhafezah Kasmuri
1700 - 1710	110	<b>Permanent Deformation of Hot Mix Asphalt (HMA) using Simple Performance Dynamic Modulus Test</b> Ekarizan Shaffie

<p>Parallel Session C4  Chairperson : Ir. Dr. Bulan Abdullah  Co-Chairperson : Dr. Lim Ying Chin  Rapporteur : Ilya  <b>(Venue: Room Gasing 4)</b></p>		
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Time	Paper No.	Title
1600 - 1610	111	<b>Electrospun nitrogen-doped TiO<sub>2</sub> nanofibrous thin film using electrospinning for photovoltaic application</b> Hussain Mohamed Hasaan, Abu Bakar Noor Fitrah, Norman Wong Fareez Izwan, Lim Ying Pei, Lim Ying Chin and Naim Mohd Nazli
1610 - 1620	112	<b>Characterization of powdered Rhizophora Mucronata bark tannins extractives using different drying methods</b> Muhammad Muhayyidin Ahmad Hafizan, Abu Bakar Noor Fitrah, Ghazali Nurul Aimi, Sauki Arina and Ibrahim Wan Asma
1620 - 1630	114	<b>Verification Test of High Flap Macrofluidic Air Flow Sensor in Wind Tunnel</b> Mohamad Dzulhelmy Amari, Sukarnur Abdullah and Muhammad Imran Hafiz Ahmad Kamil
1630 - 1640	115	<b>The Effect of the Ultrasound Transmission Across Solid-Nanocomposite Materials</b> Najibah Ab Latif, Salmiah Kasolang, Mohamad Ali Ahmad and Mimi Azlina Abu Bakar
1640 - 1650	117	<b>A Preliminary Study on the Effect of Natural Fiber (NF) Mix on Mechanical Strength of NF Plastic Composites (NFPC)</b> Dzaraini Kamarun, Engku Zaharah Engku Zawawi, Nur Hikamah Seth, Norlaily Ahmad, Siti Rafedah Abdul Karim and Raja Roslan Raja Mohamed

1650 -1700	118	<b>Thermogravimetric analysis of various ratio of blended phenolic and epoxy composites</b> Mohammad Asim, M Jawaaid, Paridah Tahir and M Nasir
1700 - 1710	134	<b>The Effects of Dimethicone Crosspolymer on Porous Silicone and Biomaterial</b> Nur Nabila Mohd Nazali, Farah Nur Aisha Mohammad Nasir and Nor Fazli Adull Manan

Parallel Session C5  
Chairperson : Dr. Mohd Afzan Mohd Anuar  
Co-Chairperson : Dr.Ahmad Hussein Abdul Hamid  
Rapporteur : Ain  
(Venue: Room Congkak)

Time	Paper No.	Title
1600 - 1610	119	<b>Comparative study of thermal properties between nanocrystalline cellulose and cellulose nanowhisker</b> Lau Kia Kian and Mohammad Jawaaid
1610 - 1620	120	<b>Polymerization of Lactide to Polylactic Acid by Using Homogenous and Heterogenous Catalysts</b> Norliza Ibrahim and Alia Syazana Mohamed
1620 - 1630	126	<b>Flexural and Izod Impact Properties of Sugarcane Powder Reinforced Epoxy Composite</b> Siti Norazlini Abd Aziz, Muhaimin Kamarul Bahrain and Mimi Azlina Binti Abu Bakar
1630 - 1640	132	<b>In Vitro Mutation of Capsicum annum L. var. Kulai by Gamma Radiation</b> Shamsiah Abdullah, Nur Amalina Farhana Shariffudin, Norumaimah Omar, Abdul Rahim Harun and Shuhaimi Shamsudin
1640 - 1650	113	<b>Cost-Effective Vision based Obstacle Avoidance System integrated Multi Array Ultrasonic sensor for Smart Wheelchair</b> Mohd Nor Azmi Ab Patar
1650 -1700	125	<b>Stress Analysis of a Patient-specific Socket Design during Gait Cycle</b> Mohd Nor Azmi Ab Patar

## PARALLEL POSTER PRESENTATIONS

Parallel Poster Presentation P1 (Venue: Ballroom Dewan Perdana)		
Time	Paper No.	Title
1030 - 1040	003	<b>Experimental Investigation on The Pneumatic Lifting Method of Deformable Object</b> Rabiatul Adawiyah Jaafar and Muhammad Azmi Ayub
1040 - 1050	009	<b>Adsorption of Copper (II) Ion by Leucaena Leucocephala Pods</b> Noor Harliza Abd Razak and Nur Amalia Zulkepli
1050 - 1100	011	<b>Wind Tunnel Experiment of an Electric Ducted Fan (EDF)</b> Rizal E. M. Nasir and Nur Nadhirah M. Fadzil
1100 - 1110	017	<b>Structural Analysis of Silica Extract from Banana Stems via Acid Leaching at Different Times</b> Nurul Jannah Yusaiddi, Shahrul Azam Abdullah and Noratiqah Syahirah Mohd Zarib
1110 - 1120	025	<b>Prediction of Bone Damage Formation in Resurfacing Hip Arthroplasty</b> Nor Aiman Nor Izmin, Mitsugu Todo and Abdul Halim Abdullah
1120 - 1130	037	<b>Effect on Input Parameter of Cold Isostatic Press (CIP) Towards Properties of Zirconia Block</b> Noratiqah Syahirah Zarib, Shahrul Azam Abdullah and Muhammad Syazwan Mazelan

Parallel Poster Presentation P2 (Venue: Ballroom Dewan Perdana)		
Time	Paper No.	Title
1030 - 1040	028	<b>Effects of Infill Density On 3D Printed Socket For Transtibial Prosthetic Leg</b> Wan Fatimatul Aifaa Wan Fadzil, Mohammad Azeeb Mazlan, Fazah Akhtar Hanapiah and Abdul Halim Abdullah
1040 - 1050	035	<b>Extraction of magnetite from millscales waste for ultrafast</b>

		<b>removal of Cadmium ions</b> Nur Asyikin Nazri, Raba'Ah Syahidah Azis, Hasfalina Che Man, Ismayadi Ismail and Idza Riati Ibrahim
1050 - 1100	046	<b>The Effects of Palm Oil with Nanoclay Additive in Hydrodynamic Journal Bearing Lubrication</b> Izatul Hamimi Abdul Razak, Mohamad Ali Ahmad and Nadia Nurul Nabihah Ahmad Fuad
1100 - 1110	051	<b>Synthesis of ZnO Nanostructure by Chemical Bath Deposition: Influence of Growth Time towards Nanostructure Characteristics</b> Rohanieza Abdul Rahman, Muhammad Alhadi Zulkefle, Sukreen Hana Herman and Rosalena Irma Alip
1110 - 1120	052	<b>State Dynamic Modeling using Ionic Conduction Phenomenon for TiO<sub>2</sub>-based Memristive Thin Film</b> Raudah Abu Bakar, Nur Syahirah Kamarozaman, Wan Fazlida Hanim Abdullah and Sukreen Hana Herman
1120 - 1130	072	<b>Effects of Deposition Time on Surface Properties of Co-Ni-Fe Alloy Synthesised on Hex Bolts</b> Muhammad Syafiq Md.Nor, Zuraidah Salleh, Nik Rozlin Nik Mohd Masdek, Zainal Abidin Kamarul Baharin and Sahril Kushairi

<b>Parallel Poster Presentation P3 (Venue: Ballroom Dewan Perdana)</b>		
Time	Paper No.	Title
1030 - 1040	077	<b>Oil Spill Removal using Coconut Shell Based Composite Magnetic Activated Carbon</b> Putri Faizura Megat Khamaruddin and Muhammad Luqman Abdullah
1040 - 1050	081	<b>Nitrogen Removal Enhancement In Extended Aeration System</b> Jurina Jaafar, Suzana Ramli and Aminuddin Mohd Baki
1050 - 1100	082	<b>Rapid Expansion Supercritical Solution (RESS) of Carbon Dioxide as a Green Technology Method for Leucaena Leucocephala Solid Oil Particle Formation</b> Nur Ain Mohd Zainuddin and Nur Salihah Sulong

1100 - 1110	083	<b>Reduction of Chemical Oxygen Demand (COD) effluent of plastic recycling processing plant using LD slag</b> Nur Ain Mohd Zainuddin and Mohamad Farhan Rosley
1110 - 1120	089	<b>Analysis the Performance of Steam Absorption Chiller at Various Operating Conditions</b> Rosnadiyah Bahsan, Nor Merlisa Ali and Syamsul Nor Azlan Mohamad
1120 - 1130	096	<b>Vissim-based Simulation of Variable Slip Road Length Design</b> Kamaruz Danial Kamaruzzaman and Siti Mariam Abdul Rahman

**Parallel Poster Presentation P4**  
**(Venue: Ballroom Dewan Perdana)**

Time	Paper No.	Title
1030 - 1040	121	<b>Resistance Spot Weld assisted with Adhesive Bonding</b> Farizah Adliza Ghazali, Zuraidah Salleh, Norazwani Mohd Zain, Ya'Kub Md Taib and Aidah Jumahat
1040 - 1050	122	<b>Mechanical Characterization of Epoxy Filled with seed shells as reinforcement</b> Anizah Kalam, Fauziah Md Yusof, Zahurin Halim and Zuraida Ahmad
1050 - 1100	123	<b>Single Edge Notch Bend (SENB) of Kenaf/Fibreglass Hybrid Composites</b> Syarifah Yunus, Zuraidah Salleh, Ya'kub Md Taib, Nik Rozlin Nik Mohd Masdek and Zainal Abidin Kamarul Baharin
1100 - 1110	124	<b>Post Impact Tensile and Single Edge Notch Bending Test of Kenaf Hybrid Composite</b> Syarifah Yunus, Zuraidah Salleh, Ya'kub Md Taib, Nik Rozlin Nik Mohd Masdek and Muhammad Faris Che Hassan
1110 - 1120	127	<b>The Corrosion Behaviour of Co-Ni-Fe Coating in Different pH Environment</b> Nik Rozlin Nik Mohd Masdek, Muhammad Naufal Othman, Zuraidah Salleh and Zainal Abidin Kamarul Baharin
1120 - 1130	128	<b>Flexural Strength, Fracture And Impact Toughness Analysis of Kenaf/Woven Fibreglass Polyester Composite</b> Zuraidah Salleh, Sahril Khusairi, Syarifah Yunus, Yakub Md

Taib and Anizah Kalam

**Parallel Poster Presentation P5**  
**(Venue: Ballroom Dewan Perdana)**

Time	Paper No.	Title
1030 - 1040	092	<b>Additive Manufacturing of 316L Stainless Steel</b> Jamaliah Md Said, Muhammad Hussain Ismail, Nurul Amilin Zainal Abidin, Nurul Ain Haris and Adila Nalisa Mohd Roslan
1040 - 1050	136	<b>Effect on Input Parameter of Cold Isostatic Press (CIP) Towards Properties of Zirconia Block</b> Noratiqah Syahirah Zarib, Shahrul Azam Abdullah and Muhammad Syazwan Mazelan
1050 - 1100	138	<b>Impact Properties of Nanomodified Basalt Fiber Reinforced Polymer Composites</b> Nurul Emi Nor Ain Mohammad, Aidah Jumahat, Anthony Arthur and Mohd Fadzli Bin Ismail
1100 - 1110	141	<b>Wear Behavior of Short Glass Fiber Reinforced Polymer Composite With Nanoclay Modification</b> Aidah Jumahat, Jamaliah Md Said, Tengku Faizuddin T Mohd Azmi, Mohamed Adzummar Hakim Abdull Adziz
1110 - 1120	143	<b>Impact Response of Glass-Aluminium Fibres Metal Laminates: Effect of Fibre Architecture</b> Masaki Hozumi, Aidah Jumahat, Napisah Sapiai
1120 - 1130	145	<b>Effects of kenaf and basalt face sheets modified nanosilica of closed cell aluminium sandwich panel</b> Nurul Emi Nor Ain Mohammad, Aidah Jumahat, Napisah Sapiai

**Parallel Poster Presentation P6**  
**(Venue: Ballroom Dewan Perdana)**

Time	Paper No.	Title
1030 - 1040	060	<b>Development of Intelligent Food Packaging from Turmeric (Curcuma longa)</b> Siti Noor Suzila Maqsood Ul Haque



1040 - 1050	137	<b>Slurry Pot Erosion Wear of Nanoclay-modified Short Fiber Reinforced Polymer (SFRP) Composites</b> Aidah Jumahat, Nurul Ain Haris, Fatin Najwa Che Mohamad
1050 - 1100	139	<b>Chopped Carbon Fiber Reinforced Polymer Composites : Effect of Nanoclay on Adhesive and Abrasive Wear Properties</b> Aidah Jumahat, Norhashidah Manap, Anis Adilah Abu Talib, Tg Faizuddin Tg Mohd Azmi
1100 - 1110	142	<b>Enhancing The Mechanical Properties Of Chopped Basalt Composites By Incorporating Of Multiwall Carbon Nanotubes</b> Aidah Jumahat, Ilya Izyan Shahrul Azhar, Napisah Sapiai, Noor Farizza Romli and Mohamad Aizat Aminuldin
1110 - 1120	144	<b>Quasi-Static Indentation Properties of Woven and Unidirectional Glass-Aluminium Fibre Metal Laminates</b> Aidah Jumahat, Muhammad Naim Najib and Napisah Sapiai

## SEMINAR OF WASTEWATER

Time	Activity	Venue
1115 - 1130	Group arrangement and participant initial setting up G1 Sanitation system G2 Collection system G3 Sewage treatment G4 Resources Recovery - ENERGY GENERATION G5 Resources Recovery - BIOEFFLUENT QUALITY G6 Resources Recovery - BIOEFFLUENT DISTRIBUTION SYSTEM G7 Resources Recovery - FERTILIZER, AQUACULTURE & FARMING G8 Resources Recovery - BIOGAS	
1130 - 1145	SCENE SETTING Presentation by Deputy Vice-Chancellor (Research and Innovation), UiTM, YBhg. Prof. Dr. Mohd Nazip Suratman	
1145 - 1215	Invited Speech Speaker: YBhg. Ir Mohamed Haniffa Hj Abdul Hamid, Chief Operating Officer (COO), IWK Speech Title: Opportunities in Research and Capacity Development for the Water and Wastewater Sector – Malaysia and Beyond	
1215 - 1300	Group discussion on research grant proposals	

	G1, G2, G3, G4, G5, G6, G7, G8	
1300 - 1400	Lunch break and solat	Café Hall, Level 3
1400 - 1545	Finalise the research grant proposals G1, G2, G3, G4, G5, G6, G7, G8	Ballroom Dewan Perdana, Level 2
1545 - 1600	Coffee break	Level 2
1600 - 1610	Group presentation - briefing on summary of potential research topics and proposals  Presentation : G1 Sanitation system	
1610 - 1620	Presentation : G2 Collection system	
1620 - 1630	Presentation : G3 Sewage treatment	
1630 - 1640	Presentation : G4 Resources Recovery - ENERGY GENERATION	
1640 - 1650	Presentation : G5 Resources Recovery - BIOEFFLUENT QUALITY	
1650 - 1700	Presentation : G6 Resources Recovery - BIOEFFLUENT DISTRIBUTION SYSTEM	
1700 - 1710	Presentation : G7 Resources Recovery - FERTILIZER, AQUACULTURE & FARMING	
1710 - 1720	Presentation : G8 Resources Recovery - BIOGAS	
1720 - 1730	Closing Remark & Certificate Giving	

## LIST OF ABSTRACTS

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**002** Epoxidation of Waste Cooking Oil  
Using Catalytic In Situ Generated  
Performic Acid

Mohd Jumain Jalil

Nowadays, utilizing renewable resources is one of the top research interests among researchers around the world in order to maintain the synthesis of products based on chemicals. Oleic acid (C18:1) derived from palm oil contains the unsaturated double bond (C=C) in its long alkyl chain makes it an attractive fatty acid for the production of eco-friendly epoxide. The epoxidation of oleic acid was carried out by using in situ generated performic acid (HCOOOH) to produce epoxidized oleic acid. Epoxy ring-opening also known as epoxide cleavage or epoxide ring degradation occurs in the epoxidation of vegetable oils. It is imperative to minimize process losses via ring-opening in order to achieve good yields and high peroxide values of the epoxidized vegetable oil. In this study, it shows that the cleaving of oxirane rings is most pronounced in the presence of sulfuric acid, followed by formic and hydrogen peroxide which lead to formation of diol and  $\alpha$ -glycol as side products.

**003** Experimental Investigation on The  
Pneumatic Lifting Method of  
Deformable Object

Rabiatul Adawiyah Jaafar and  
Muhammad Azmi Ayub

Industries such as agriculture and food have used polypropylene bag widely used as it is cheap and easy to find. Fertilizers industry especially needed to use the polypropylene bag that have high protection barrier against the high-level humidity especially we living in Malaysia that have high humidity in the

air. By layering the polypropylene bag with another polypropylene bag, the moisture problem can be overcome. The polypropylene bag for fertilizers consists of 2 layer which is the woven polypropylene bag and the clear polypropylene bag. However, when assembling this two-polypropylene bag, worker needed to manually insert the clear polypropylene bag into the woven bag. This increases the time process in production, high labour force needed and also higher cost for mass production. Furthermore, repetitive works can cause strain to the worker and increases the number of errors. To overcome this issue, the automated polypropylene bag assembly system is proposed. For this paper, we only focus on the lifting method of the automated polypropylene bag assembly system. With the use of the automated polypropylene bag assembly system, the repetitive works and labour force can be reduced. This will also give out cleaner and consistent last product.

#### **004 Atmospheric Soda Pulping of Banana Stem**

Nurul Amal Nadhirah Mohamad and Jai Junaidah

Banana stem is one of the most explored non-wood lignocellulose due to its high cellulose content with small amount of lignin. The conventional pulping processes efficiently removed the lignin, but there is potential to reduce the energy and chemical consumptions due to the low lignin content of banana stem. In this work, soda pulping was carried out for 60-120 minutes using 16-20% w/v alkali charge at boiling temperature. The

efficiency of lignin removal at low temperature was evaluated using kappa number analysis. The effects of pulping time and alkali charge on pulp properties were investigated using fourier transform infrared spectrometry (FTIR), scanning electron microscopy (SEM) and thermogravimetric analysis (TGA). Soda pulping using 18% w/v alkali charge at 10 liquid-to-solid ratio for 90 minutes under atmospheric pressure efficiently removed lignin with minimal cellulose degradation. Extended pulping time and concentrated alkali charge would induce cellulose degradation. FTIR analysis verified that alkaline pulping caused depolymerization on both lignin and cellulose. SEM images of banana stem showed orderly structured cellulose fibrils. Removal of lignin and hemicellulose was observed through smoother surface of the banana pulp. However, TGA analysis suggested that a better thermal stability could be achieved through pulping using 16% w/v alkali charge.

**005 Preliminary Design of a Coriolis Acceleration Experimental Device**

Hafizan Hashim and Hanita Hashim

Important drawbacks of Coriolis experimental setup and devices are their multiple parts and cost to own. Simplicity, traceability, and measurability are the major concern. This paper presents a preliminary design process of Coriolis acceleration experimental device to visualize the effect of Coriolis and enable the calculation of acceleration components to facilitate students for a better

understanding of this phenomenon. This is realized through a slidable collar with a marker and accelerometer attached on it and a rotating rod that shows a visible yet erasable mark from the marker's path. The design process went through typical engineering design processes such as morphological study, functional decomposition, and Pugh chart. Next, Finite Element Analyses (FEA) were performed to determine the mode shapes, followed by analytical calculation of the dynamic reaction experienced by motor. In addition, this kit provides opportunity for students to manually calculate the actual acceleration component based on theory learnt which is considered innovative. The use of controllable motor for rotating the rod could vary the travelling path of the marker, subsequently diversify the problems for student to solve.

**006 Analysis and Evaluation of Coriolis Acceleration Experimental Device**

Hafizan Hashim and Hanita Hashim

The Coriolis acceleration is the product of linear and rotational velocities. Acceleration analysis is important because inertial forces are proportional to their rectilinear, angular, and Coriolis accelerations. The magnitudes of Coriolis acceleration vary according to the conditions of motions of an object. This paper presents kinematic analyses of a preliminary design of a Coriolis kit. The Coriolis kit consists of a rotating rod and a slidable collar. A motor is used to rotate the rod and accelerometer is attached to the slider for recording the accelerations. The Coriolis effect is

visualized through the mark left by the slider during motion. Common analytical expressions of the Coriolis acceleration are derived and calculated using measured values. Results show that the Coriolis kit is capable to visualize and sketch the travelling path of the object in motion.

**007 The Improvement of Wear Characteristics on 316L Stainless Steel by Dual Surface Treatment Method**

Bulan Abdullah, Muhamad Hafizuddin  
Mohamad Basir, Khalissah Muhammad  
Yusof, Siti Khadijah Alias and Mohd  
Faizul Idham Mohd Zulkipli

Stainless steel is used widespread in various industries but it has poor wear resistance. Therefore, this study aims to investigate the wear resistance of enhanced surface of 316L stainless steel by applying the combination of surface treatments that consist of shot blasting followed by paste boronizing. Glass beads with diameter 250 microns and the blasting pressure of 6 bar has been used as the shot material in conducting shot blasting process. Paste boronizing process was conducted at temperature 950°C for 8 hours soaking. Data were collected and analyzed which concentrating on the samples' microstructure, microhardness and wear evaluation. Shot blasting improves the case depth of boride layers formed after performing paste boronizing by boosting the boron diffusion owing to the grain refinement created by shot blasting. The ultimate combination of shot blasting and paste boronizing parameters enhance the case depth of the smooth and compact boride layers with high boron content. The hardness performance increase 624% compared to untreated 316L stainless steel which also highly improve the wear resistance



of the material. In this investigation, these dual processes of surface treatment which are shot blasting and paste boronizing can be applied in fabricating the improved 316L stainless steel for industrial usages.

**009 Adsorption of Copper (II) Ion by  
Leucaena Leucocephala Pods**

Noor Harliza Abd Razak and Nur  
Amalia Zulkepli

Agriculture solid waste was used to recovery of valuable material such as *Leucaena leucocephala* pods that finds the significant role in adsorption. Agriculture solid waste was used to recovery of valuable material such as *Leucaena leucocephala* pods that finds the significant role in adsorption. The objective of this paper is to study on adsorption of copper metal ions by *Leucaena leucocephala* pods. ICP-AES ensures the optimizations of the influences of the effective parameters including contact time, pH and adsorbents. The different instrumental analysis like TGA, FTIR, XRF and zeta potential measurement which additionally authenticated the sorption phenomenon describe the features of the biomass. The best condition of adsorption happened at pH 8.0 and the process adsorption was quite fast at 0.75 g dosage and within time 140 min. From the Fourier Transform Infrared (FTIR) Spectra result, it was showing that the *Leucaena leucocephala* pods had indicate the contribution of carboxyl groups with the binding of Cu (II) ions which presented that the carboxylic group peak shifted from 1609 to 1644  $\text{cm}^{-1}$  after copper metal ions binding. The best rate of

adsorption of copper by *Leucaena leucocephala* pods within 140 min. The study established that *Leucaena leucocephala* pods can adsorb copper and altogether showing that the adsorption method was used to successfully execute post adsorption elution of the loaded metal.

**010 S-Phase Layer Development on 316LVM Using Low Temperature Hybrid Thermochemical Treatment Process**

Mohd Shahrman Adenan, Siti Umrah Zainal and Esa Haruman

This investigation focuses on the improvement of surface properties of medical grade austenitic stainless steel (AISI 316LVM). The aim is to develop a homogenous supersaturated hard layer of expanded austenite (s-phase) at the surface of AISI 316LVM using low temperature hybrid thermochemical heat treatment process. The s-phase layer produced by this process is able to improve the surface properties of AISI 316LVM, overcoming its drawback of low surface hardness and wear resistance, without impairing the corrosion resistance of the steel. During the heat treatment process, ammonia (NH<sub>3</sub>) and methane (CH<sub>4</sub>) gasses were introduced into the furnace with temperatures of 425°C and 475°C, at 6 and 12 hours with gas composition of 75% of NH<sub>3</sub>, 10% of CH<sub>4</sub>, and 15% of Nitrogen (N<sub>2</sub>). Characterization on the microstructure showed the formation of the S-phase layer with variation of thickness according to parameters used. The S-phase formation was confirmed with phase analysis using XRD. Besides, the surface hardness also significantly increased from 210.9 HV to 1170.0 HV. In conclusion, low

temperature hybrid heat treatment  
process is able to produce a  
homogenous hard s-phase layer.

**011 Wind Tunnel Experiment of an  
Electric Ducted Fan (EDF)**

Rizal E. M. Nasir and Nur Nadhirah M.  
Fadzil

EDF or Electric Ducted Fan comes in various sizes and often a compact unit. It can be mounted externally or inside a fuselage of an unmanned aerial vehicle (UAV). Generally, the EDF does not have combustion chamber and is powered by an electric motor which is then powered by a rechargeable battery pack. EDF propulsion is suitable in many types of UAV. The exact behaviour of a small EDF for variation of flight airspeed is unknown. Therefore, it is important to analyse the EDF thrust in various flight airspeeds and throttle settings. In this paper, the relationship between thrust available and airspeed of Dr Mad Thrust 90mm 1400kv Electric Ducted Fan is discussed. Experiments are performed in 0.5 m x 0.5 m test section, low speed suction type wind tunnel located at Aerospace Laboratory, Flight Technology & Test Centre of Universiti Teknologi MARA. EDF Thrust data are measured in wind tunnel testing with throttle variation of 0%, 25%, 50% and 100% at each variation of airspeed of 0 m/s, 10 m/s, 20 m/s, 30 m/s and 40 m/s. The results show that available thrust decreases almost linearly with respect flight airspeed while the thrust increases parabolically with increasing throttle. The maximum power available produced by the EDF at 100% throttle was 1737.9 Watts during 0 m/s airspeed

with an overall efficiency of 78.3%.

**012 Damage Assessment Using Acoustic Emission on Concrete Beam**

Sakhiah Abdul Kudus, Adiza Jamadin,  
Norliyati Mohd Amin, Anizahyati  
Alisibramulisi and Nurul Huda Suliman

Acoustic emission (AE) is one of the powerful NDT tools used for evaluating the damage in civil engineering structure. The present study emphasized on the using of basic AE parameter for damage assessment on concrete specimen which is Ultra High Performance Concrete (UHPC). The UHPC beam with dimension of 515 x 98 x 98mm was tested under three-point bending test with stepwise flexural load. In order to detect and to collect the AE data, Micro-SAMOS ( $\mu$ -SAMOS) digital AE system and R6I sensors type were used while data analyses were carried out using AEwin software. The AE technique was successfully used to determine damage mechanism and to indicate the damage level that take place during increasing static loading on tested concrete beams.

**013 Adsorptive removal of Cu (II) ions from aqueous solution by magnetite nanoparticles from mill scale waste**

Syazana Sulaiman, Rabaah Syahidah  
Azis, Ismayadi Ismail, Hasfalina Che  
Man and Nur Asyikin Abdul Nazri

In this study, the magnetite nanoparticles (MNP) was successfully synthesized from mill scale waste to investigate the removal of Cu (II) ions from the aqueous solution. The micron-sized magnetite were milled using the high energy ball mills (HEBM) milling hours 3,5 and 7 to produce nano-sized particles. The characterization methods of the samples are X-Rays Diffraction (XRD), Transmission Electron Microscopy (TEM), Brunauer-Emmett-Teller (BET) and Atomic Absorption Spectroscopy (AAS). Studied

parameters are contact time, the initial concentration and particle size. The adsorption kinetics was relatively fast and equilibrium at about 30 minutes. In kinetic studies, the pseudo-second-order model was employed. Langmuir model ( $R^2 > 0.9987$ ) were more correspond with the adsorption isotherm data of Cu (II) ions. The adsorption capacity of Cu (II) ions onto magnetite nanoparticles (MNP) are 11.36 mg/g at 7 hours milling hours. Pseudo-second-order and Langmuir isotherm were fitted with experimental data.

**014 Effect of sintering temperatures on structural, magnetic and microwave properties of barium ferrites/epoxy composites**

Nurshahiera Rosdi, Raba'ah Syahidah Azis, Ismayadi Ismail, Muhammad Syazwan Mustaffa and Nurhidayat Mokhtar

This study highlights the structural magnetic and microwave properties of M-type barium hexagonal ferrites ( $\text{BaFe}_{12}\text{O}_{19}$ ) nanoparticles. The samples were sintered at varied sintering temperatures (800, 900, 1000 °C). The effect of temperatures on the structural, magnetic and microwave properties was highlighted. Barium ferrites are well-known materials used for radar absorbing materials (RAM). RAM materials with good absorbing performance should have high permeability, small permittivity and high magnetic or dielectric loss at microwave frequency. High microwave absorption can be created effectively in magnetic materials, as well as wideband absorption. The structural, microstructural, magnetic and microwave properties were analyzed via an X-ray Diffractometer (XRD), a Field Emission Scanning Electron Microscope (FESEM), a Vibrating

Sample Magnetometer (VSM), and a Vector Network Analyzer (VNA), respectively. The XRD results showed a full phase hexagonal structure was formed in the samples sintered at 900 and 1000 °C. BaFe<sub>12</sub>O<sub>19</sub> composite with a thickness of 3.0 mm showed a minimum reflection loss (RL) at -9.01 dB at a frequency of 9.16 GHz at temperature 1000 °C.

**015 Evaluation and Validation on the Reliability and Robustness of Smart Socket Outlet for Hall of Residences Usage**

Mohamad Fauzi Omar, Harizan Che  
Mat Haris and Nooritawati Md. Tahir

This paper presents the validation and evaluation of the 3-pin socket outlet for student hall of residence specifically university halls appliances. It is a new method of reducing the electricity usage in residences at the same time increasing the safety aspect for the socket. Smart Socket Outlet is a project that has safety and economic aspects. Different with others, Smart Socket Outlet will cut the supply when current flow reaches the maximum amount that has been pre-set. This socket is able to improve in safety aspect to overcome over flow of current. This system also has potential to reduce the electricity usage in student residents. By applying this Smart Socket Outlet, consumer will be more secured and at the same time electricity usage will decrease.

**016 Simulation and Design of Neutral Point Type Buck Converter**

Mohamad Fauzi Omar and Harizan Che  
Mat Haris

This paper presents a simulation and design of neutral point type buck converter has been utilized in order to improve power factor near to one (1) which is unity. The circuit of the simulation has been design using

Simulink MATLAB. The circuit was set to 50 kHz to generate the carrier signal and compared it with the reference signal. By adjusting the capacitor in the main circuit, the result of the simulation shows that the input current and voltage were in phase which is unity power factor while the output current and voltage produced having a low ripple. Therefore, the simulation shows that the neutral point type buck converter is suitable to maximize the rate of power factor close to unity (1).

**017 Structural Analysis of Silica Extract from Banana Stems via Acid Leaching at Different Times**

Nurul Jannah Yusaidi, Shahrul Azam Abdullah and Noratiah Syahirah Mohd Zarib

Agricultural waste such as the banana stems has potential of a source of silica via the acid leaching treatment. Citric acid ( $C_6H_8O_7$ ) was used as substitute for conventional hydrochloric acid (HCL) and sulphuric acid ( $H_2SO_4$ ) because it is safer and less harmful to the human health. The main parameter in leaching treatment is leaching time and acid concentration. The acid concentration used was 1.0 mol/L of citric acid ( $C_6H_8O_7$ ) and leaching time of 30, 60 and 90 minutes, respectively. The leaching treatment results showed that around 47.8% to 99.9% of silica was successfully extracted. The samples were characterized using the X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). Therefore, the focus of this study is to examine the effect of leaching time on the silica extraction where three leaching times; 30, 60 and 90 minutes were used in this

study.

**018 Effect of Mordant Types and Methods on the Color Fastness Properties of Silk Fabrics dyed with Brown Seaweeds**

Nabila Talib, Mohd Rozi Ahmad,  
Khudzir Ismail and Muhammad Ismail  
Ab Kadir

Natural dyes come from plenty of sources including plants, animals, insects or microorganisms. At present, natural dyes are highly demanded in textile application. In this study, brown seaweed (*Sargassum spinosum*) extracts were utilized for silk coloration with the use of metallic salts mordants (Iron II Sulphate and Aluminium Sulphate) and biomordants (cinnamon and chitosan). Dyeing was performed with pre-mordanting and simultaneous mordanting methods. The dyed fabrics were analyzed in terms of color fastness properties to washing, perspiration, rubbing and light. The results showed that seaweed dyes with cinnamon mordant gave darker shades and higher absorbency towards silk which is comparable to iron mordant. The approach of using biomordant is parallel to the sustainability demand of natural dyes in textile application.

**019 Shaking Table Test on Different Positions of Multiple Tuned Liquid Damper**

Izzul Syazwan Ishak, Norliyat Mohd  
Amin and Nor Hayati Abdul Hamid

Earthquake can cause many problems to the structures, which lead to building collapse and may takes humans life. It is a nature's hazard that cannot be stop. One of the effort is by introduce the damping system to the buildings where the energy of the system is slowly reduced until the vibration of the system is totally eliminated and the system is brought to rest. Several techniques are available nowadays, however passive control system has



advantage in term of cost compare to other systems. Multiple Tuned Liquid Damper (MTLD) is a passive system that traditionally made of several rigid tanks filled with water, usually placed on top of a building. The energy will dissipates through the sloshing and wave-breaking of the liquid once the earthquake strike the buildings. Shake table tests were carried out on a two-bay, two-story steel frame with water tanks for different location. In this test, the displacement and acceleration for top and base were studied.

**020 Compressive Failure Behaviour of Unidirectional and Woven Kevlar/Epoxy Composite Laminates under Various Angles of Fiber Orientation**

Mohamad Mali and Jamaluddin  
Mahmud

Studies have shown that the angle of fiber orientation significantly affects the mechanical properties of a composite laminate. Due to this, accurate prediction of the laminate response because of the loading effect is crucial. Many investigations on the properties of composite materials have been conducted. However, there is still the lack of study related to Kevlar/Epoxy laminate. Therefore, this study aims to investigate the effect of the angle of fiber orientation to woven and UD Kevlar/Epoxy laminates under compression state. The study was conducted in two stages comprising of numerical validation and failure analysis. For the failure analysis, a flat plate and flat plate with circular hole under compression were modelled using ANSYS. Two of the most common failure models, Maximum Stress Theory and Tsai-Wu Failure criteria were selected for the failure

prediction. The laminates were made of 24 layers woven Kevlar/Epoxy and the stacking sequence was (04/04/-04)s. The angle of fiber orientations,  $\theta$ , have been varied from  $0^\circ$  to  $90^\circ$  and failure loads for both flat plate and flat plate with circular hole were determined. The trend of displacement and failure behaviour for both types of plate were compared. From the results, it is found that the failure behaviour on the woven Kevlar/Epoxy is much easier to predict compared to UD Kevlar/Epoxy. These analysis and findings are important in aiding the engineers at designing a reliable woven Kevlar/Epoxy composite laminate. Therefore, it can be concluded that the current study is useful in contributing significant knowledge to better understand the failure behaviour of composite plate.

**022 Rayleigh Damping Coefficients  
Measurement of Laminated Rubber  
Bearing Using Finite Element and  
Experimental Modal Analysis**

Ahmad Idzwan Yusuf and Norliyati  
Mohd Amin

Laminated rubber bearing is a significant device found in structure that used to isolate the ground structure and the above ground structure from seismic loads. Since it is a complex material made up from a combination of rubbers and steel shim plates in alternate layers, the measurements of damping is difficult in practice. Damping is a dissipation of energy or energy losses in the vibration of the structure. It is essential to measure the accurate amount of damping as damping plays a crucial role in fixing the borderline between stability and instability in structural systems. Modal analysis is one of the methods that can

be used to determine dynamic properties including damping in any materials. Hence, the main objective of this research is to determine the Rayleigh's damping coefficients  $\alpha$  and  $\beta$  and to evaluate the performance of the laminated rubber bearing using finite element and experimental modal analysis. Based on the finding, the finite element modal analysis with the added of Rayleigh's damping coefficients  $\alpha$  and  $\beta$  shows a good agreement with the experimental modal analysis in term of natural frequencies and mode shapes. The values of natural frequencies are reduce after the accurate Rayleigh's damping coefficients were added into the finite element modal analysis. It can be concluded that both theoretical and experimental modal analysis method can be used to estimate the accurate values of damping ratio and to determine the Rayleigh's damping coefficients  $\alpha$  and  $\beta$  as well.

**023 Magnetic Solid Phase Extraction Using Magnetic Mesoporous Silica for Preconcentration of Organophosphorus Pesticides**

Nur Husna Zainal Abidin, Wan Nazihah  
Wan Ibrahim and Nor Suhaila  
Mohamad Hanapi

The present study describes the synthesis, characterization and application of two mesoporous silica material based coated magnetic nanoparticles namely Fe3O4-SBA-15 and Fe3O4-MCM-41 for the simultaneous preconcentration of three organophosphorus pesticides (OPPs) from water samples. The resultant sorbent material was physicochemically and morphologically characterized by field emission scanning electron

microscopy (FESEM), X-ray diffraction (XRD) and N<sub>2</sub> adsorption analysis. OPPs pesticides extraction efficiency of two sorbent were evaluated through magnetic solid phase extraction (MSPE) using high performance liquid chromatography with ultraviolet detector (HPLC/UV). The main parameters affecting the sorbent efficiency namely extraction time and desorption solvent were optimized. Under the optimum conditions, excellent percent recovery was achieved for Fe<sub>3</sub>O<sub>4</sub>-SBA-15 and Fe<sub>3</sub>O<sub>4</sub>-MCM-41 at (97.5%) and (87.1%) respectively. The result appealed that the Fe<sub>3</sub>O<sub>4</sub>-SBA-15 composite was efficient sorbent with good capability for the preconcentration of selected OPPs from water samples.

#### **024 Comparison Between Two Heuristic PID Tuning Methods for a 4-DOF Robot Arm Control**

Mat Ariffin Muhammad Farhan,  
Ruhizan Liza Ahmad Shauri, Roslan  
Muhammad Izzat, Wan Zainudin Wan  
Muhammad Lukman and Rosli  
Muhammad Afiq

This paper discusses the development of closed-loop position control for the joint motor of a 4-DOF robot arm. In developing a practical robot, types of input and control algorithm are important elements in the control system. The objectives of this paper are to select an input type that could produce smooth arm's motion and to apply PID control for the joints. Step and parabolic inputs have been tested as reference trajectory where the former used step signal as the constant value of motor angle while the latter requires calculation using spline interpolation method based on initial and end points of each joint motion given by user. From the latter, a parabolic curve input

which consists of point-to-point values calculated for each 1ms sampling time was produced. Meanwhile, the PID position control tuned by trial and error and Ziegler Nichols (Z-N) methods were carried out and measured for comparison in terms of steady state error, overshoot and response time in real-time experiments. It could be observed that step input has caused abrupt movements and vibration to the arm body compared to the parabolic input that moved the arm smoothly to imitate motion like human. Meanwhile, the intuitive values of trial and error method were found to produce not much different with the Z-N tuned gains but comparatively produced small error against the parabolic input reference during the transient state. The result from this study is useful in the future to ensure position accuracy of robot joints when attending object for manipulation.

**025 Prediction of Bone Damage  
Formation in Resurfacing Hip  
Arthroplasty**

Nor Aiman Nor Izmin, Mitsugu Todo  
and Abdul Halim Abdullah

Resurfacing Hip Arthroplasty (RHA) is a hip replacement method that is widely known nowadays. However, the complication on femoral bone fracture often happens in this hip replacement method which associated with the implant positioning. The objective of this study is to predict the damage formation on the bone which resulting from the RHA pin malposition. Finite element analysis was conducted in order to predict the damage formation on the bone model based on the computed tomography (CT) image of a

patient. A 3D inhomogeneous bone model was developed from a 47 year old patient with an osteoarthritis disease located on the left femur. The material used for the RHA implant model is cobalt chromium and the implant is then being inserted into the femoral bone. Straight implant position with angle  $130^\circ$  was selected as a reference in the analysis while another three position of varus ( $> 130^\circ$ ) and valgus ( $<130^\circ$ ) were selected and known as the pin malposition. The simulation was conducted on each of the selected angles in order to predict the damage formation towards the bone model. The damage formation obtained was from the results of elements failure which occurred after applying the load. Physiological loading of a human which focusing on the normal walking condition was selected as the loading and boundary condition in this study. The femoral bone model experienced the highest damage formation when the implant located at the varus position while reduced significantly when the implant placed at the valgus position.

**026 The Thermal Conductivity of 8 Yttria Stabilized Zirconia and Mullite Thermal Barrier Coating on Medium Carbon Steel Substrate**

Muhammad Syazani Farhan Zaini,  
Mohd Shahrman Adenan, Juri Saedon  
and Aman Mohd Ihsan Mamat

Thermal conductivity is one of the main features of a thermal barrier coating (TBC) that is important in making sure that the TBC gives its best functionality to the system. A good TBC has low thermal conductivity, so that the temperature can drop across the coating which allows the system to operate in extremely high temperatures. There are several factors that can influence the

thermal conductivity of the TBC such as the type of ceramic material used, the deposition method and the physical features of the TBC itself. For this research, air plasma spray (APS) is used to deposit 8 wt% yttria stabilized zirconia (8YSZ) and mullite on medium carbon steel substrates to study their respective thermal conductivities. The aim here is to develop a heat shield using TBC to protect the electric motor in an electrical turbocompounding system. The characteristics of the deposited TBC such as microstructure, element composition, phases and thermal conductivity are studied. The thermal conductivity is reduced when medium carbon steel substrate deposited with TBC. The thermal conductivity of 8YSZ, mullite and uncoated sample at minute 60 is 0.868 W/mK, 0.903 W/mK and 1.057 W/mK, respectively. Therefore, the deposition of 8YSZ TBC will lower the thermal conductivity of the medium carbon steel heat shield.

**027 Biomechanical Analysis of Spinal Fusion Cage for Lumbar Vertebrae**

Rusnani Yahya, Muhammad Hazli Mazlan, Solehuddin Shuib and Abdul Halim Abdullah

Lumbar spinal fusion or lumbar interbody fusion is a surgical procedure done by putting the cages implant between the lumbar vertebra supported by rods and screws to hold the vertebra. This procedure is widely accepted as one of the surgical technique to treat disc degeneration diseases and other medical conditions. However, vertebral endplate subsidence failure has been detected as one of the major problems that might increase the potential of pain

and mechanical instability. There are broad range of designs and material types of the spinal implant cages that can be used in spinal fusion. Posterior lumbar interbody fusion (PLIF) cage is used to maintain stability and promote fusion between vertebrae. There are four different types of biomaterials that can be used to produce the cage namely as metal, ceramic, polymer and composite. The purpose of this study is to examine the interbody fusion effect of a different type of cage's materials. A three-dimensional (3D) finite element (FE) model of third (L3) and fourth lumbar (L4) vertebrae with interbody fusion made up of different types of cage's materials namely as Polyether ether ketone (PEEK), poly lactic acid (PLA), Cobalt Chromium, Titanium Alloy and Stainless Steel were developed and analysed. A fusion model developed based on the respective surgical protocols. The von Mises stress and displacement of the cage at the vertebra were measured under different types of compressive loadings and motions. The results showed a significant effect of material properties on flexibility in extension, axial rotation and lateral bending. Titanium Alloy have been identified as a good material for the metal categories, while for the composite categories PLA (Polylactic acid) has shown a great potential as an alternative material which would provide cheaper material and lower production costs. The cage subsidence occurred at both materials, with an overall of higher



cage-endplate stresses for stainless steel as compared to PLA and controlled configurations. In addition, the stress distribution in PLA cage are better. Further investigation of PLA cage's mechanical properties should be done to determine the accuracy and reliability of the simulation.

**028 Effects of infill density on 3d printed socket for transtibial prosthetic leg**

Wan Fatimatul Aifaa Wan Fadzil,  
Mohammad Azeeb Mazlan, Fazah  
Akhtar Hanapiah and Abdul Halim  
Abdullah

Diabetic foot syndrome (DFS) has become the major cause of lower limb amputations in Malaysia. The main reason why amputees in Malaysia did not receive suitable prostheses for them in the cost of prostheses which includes the service and material and fabrication time. The cost to fabricate a suitable prosthesis differ between public and private companies in Malaysia. The time taken to fabricate a socket took two weeks minimum and thus may become unfit during fitting session. The socket of the lower limb prosthesis will require modification or replacement to accommodate the changes seen in the residual limb over time. As an alternative solution to the problem, this biomechanical project is conducted to (i) design a lower limb socket for below knee amputees according to size and shape of residual stump, (ii) analyze the performance of the socket at different thickness, material and infill and (iii) fabricate the lower limb socket using 3D Printing technology. The material that will be considered in this project are Polylactic Acid (PLA) with thickness 15mm. The infill density that been considered are 20%, 40%, 60%,

80% and 100%. On the analysis, the force 600N will be exerted to the socket to find out its Von Mises Stress, Total Deformation and Shear Stress. After obtaining the result, suitable infill density will be chosen. The best condition that has been chosen is PLA with 15 mm thick and 60% infill density.

**029 Calcination Effect On Structural Trasformation of Barium Titanite Ferroelectric Ceramic By Sol-Gel Method**

Ahmad Firdaus Che Omar, Faizatul Farah Hatta, Tunku Ishak Tunku Kudin, Oskar Hasdinor Hassan and Mohd Ambri Mohamed

Highly-purity barium titanate BaTiO<sub>3</sub> was successfully synthesized by using the sol-gel technique. Barium acetate Ba(CH<sub>3</sub>COO)<sub>2</sub> and tetrabutyl titanate, Ti(C<sub>4</sub>H<sub>9</sub>O)<sub>4</sub> dissolved inadequate solvent of glacial acetic acid and ethanol was added as the chemical modifier. The synthesized BaTiO<sub>3</sub> nanoparticle was calcined at the temperature range from 700 °C to 1100 °C. The powders were further characterized by X-ray diffraction and scanning electron microscopy (SEM). Fined BaTiO<sub>3</sub> powders result indicate the phase of tetragonal structures and high crystallites of BaTiO<sub>3</sub>. It was observed that the crystallinity and particle size of BaTiO<sub>3</sub> is greatly influenced by the calcination temperature.

**030 Production of Biofuel (Bio-Ethanol) From Fruitwaste: Banana Peels**

Muhamad Ariff Amir Hamzah, Azil Bahari Bin Alias and Nor Elina Ahmad

Bio-ethanol, a type of biofuel, is known as renewable energy source as it is derived from biomass as its raw material. Biomass can be found in abundance and sustainable i.e. sources are available continuously, unlike the currently used conventional fossil fuels

where these sources are limited and depleting. In this study, biomass from fruit waste, banana peels, were utilized to produce bio-ethanol via hydrolysis and fermentation process. Banana peels, a lignocellulosic biomass, possesses compositions which favour these processes, where the banana peels are rich in cellulose content and low in lignin content. Mechanical pre-treatment of the banana peels was conducted to further ease the hydrolysis process by reducing the particle size of the biomass. Hydrolysis was carried out for 24 hours at 50°C at different pH using sulfuric acid H<sub>2</sub>SO<sub>4</sub> acid and sodium hydroxide NaOH as the base, to study the effect of pH on the hydrolysis process and hence the final bio-ethanol production, in terms of concentration. Fermentation of the hydrolysis products were carried out using glucose-yeast broth for 4 days at temperature of 35°C. Water content in the bio-ethanol product from fermentation process was separated using rotary evaporator, prior to ethanol analysis using Gas Chromatography (GC-MS). Concentration of ethanol was found to be the highest at acidic pH conditions; pH 4 to 6. Lowest ethanol concentration was recorded at higher pH values, indicating alkaline conditions do not favour the hydrolysis process.

**032 Adsorption of Hydrogen Sulphide by Commercialized Rice Husk Biochar (RHB) & Hydrogel Biochar**

Hydrogen sulphide (H<sub>2</sub>S) is naturally occurring component found during microbial decomposition and processing of natural gas & oil which

### **Composite (RH-HBC)**

Ashadi Azwan Abd Rahman, Azil  
Bahari Bin Alias, Nurul Najihah Jaffar,  
Muhamad Ariff Amir Hamzah and Wan  
Azlina Wan Ab Karim Ghani

can cause health and environment issue if being released into atmosphere at high concentration. Activated carbon which cost a lot in manufacturing is use as adsorbent for removing these hazardous gases. As an alternative, the abundance waste of biomass available can be converted into good use. Biochar is one of the most sustainable and promising adsorbent that shows a great potential as adsorbent for removal of contaminants in wastewater and gas treatment. This study covered on the characteristics and adsorption performance of two adsorbents Activated Rice Husk Biochar (RHB) and Rice Husk Hydrogel Composite (RH-HBC) on hydrogen sulphide. RHB is prepared by treating grinded rice husk biochar using aqueous Zinc Chloride ( $\text{ZnCl}_2$ ) and hydrochloric acid (HCl) solution to increase the size of pores of active sites and remove the impurities present in on the adsorbents. The RHB then polymerised by using acrylamide (AAm) as monomer, N,N'-methylenebisacrylamide (MBA) as crosslinker and ammonium persulfate (APS) as initiator to form the treated hydrogel biochar (RH-HBC). The adsorption performance is conducted to study the effect of sorbent weight (20 g, 30 g, 40 g),  $\text{H}_2\text{S}$  gas flow rate (100 L/hr, 150 L/hr, 200 L/hr) and temperature (30°C, 50°C, 70°C). RHB shows better porosity compared to RH-HBC where it has higher surface area (222.85m<sup>2</sup>/g) compared to RH-HBC (8.68m<sup>2</sup>/g). While the presence of alkene group C=C in RH-HBC gives

more stability to withstand high temperature compared to RHB. From the result, it can be concluded that the increased the sorbent weight, give an increased in adsorption capacity. When increased the gas flow rate, it give a shorter contact time between gas and adsorbent which result to less adsorption capacity. RHB give longest breakthrough time and highest adsorption capacity compared with RH-HBC in all experiment. However, the faster breakthrough time give advantage to RH-HBC in processes that require shorter time.

**033 Adsorption Kinetics And Equilibrium Isotherms Modeling Of H<sub>2</sub>S On Hydrogel Biochar And Biochar Adsorbent From Rice Husk**

Ashadi Azwan Abd Rahman, Azil Bahari Bin Alias, Muhamad Ariff Amir Hamzah and Mohammad Aidil Ali

Hydrogen sulphide is a poisonous gas that is commonly found in swamps and areas of high volcanic activities. Due to the dangers and hazards that it may impose such as neurological disorders and miscarriages, continuous innovative attempts to remove the gas are in place. A study was conducted to synthesize an adsorbent that is made from activated rice husk biochar and also hydrogel biochar. This study is complementary to that study where the adsorption processes using the two adsorbents are mathematically modelled. Three parameters were studied which were the adsorbent mass, the gas flow rate, and the gas temperature. It was found that for rice husk-based activated biochar, for all three parameters, the adsorption processes could be mathematically represented using Thomas Model and Yoon-Nelson Model. Meanwhile, for rice husk-based hydrogel biochar, the

adsorption process could be mathematically represented using Thomas and Yoon-Nelson Model for the effect of mass of adsorbent, and Adam-Bohart for the effect of gas flow rate and gas temperature. Although the coefficient of determination ( $R^2$ ) suggested that Thomas and Yoon-Nelson Model are more appropriate to be used to model the latter two parameters, because the exit concentration reached the point when it was greater than half the inlet concentration well before 0-th second, the linearly regressed equation became mathematically inconsistent with the isotherm models. Kinetic studies were also done, and it was found that the adsorption processes using the activated biochar fit both pseudo-first and pseudo-second order equation. This means that the adsorption processes using the activated biochar are both physisorption and chemisorption. Meanwhile, the adsorption processes using the hydrogel biochar fit only the pseudo-second order equation, suggesting that the adsorption process is chemisorption.

**034 Wettability study on the XLPE nanocomposite with surface modified nanofiller**

Anuaruddin Hanizan, Rahida Wati Sharudin, Zakiah Ahmad, Istikamah Subuki and Azerai Ali Rahman

Advanced polymer materials typically is used as an insulator in the electrical cable, especially in medium and high voltage applications. Cross-linked polyethylene (XLPE) is preferred due to its excellent insulation character despite its deficiency on the higher water absorption ability by the composite has exposed the material

toward electrical treeing forming and shorten the lifetime of the material against electrical charges. The intention of this study is to observe the surface free energy and wetting behaviour of XLPE with the combination of surface modified nanosilica and nanoclay by using contact angle assessment with water and methylene iodide as the solvents. The analysis shows that the incorporation of organoclay with XLPE has a greater non-wetting behaviour up to 5 wt % of nanoclay, as well as a decreasing pattern of the surface free energy by 36% compared to the neat XLPE system. Results of the study suggest that the improvement on the hydrophobicity of the nanocomposites is contributed by the microstructure development, in which the latter is also related to the dielectric response enhancement.

**035 Extraction of magnetite from  
millscales waste for ultrafast removal  
of Cadmium ions**

Nur Asyikin Nazri, Raba'Ah Syahidah  
Azis, Hasfalina Che Man, Ismayadi  
Ismail and Idza Riati Ibrahim

This research is conducted to produce the magnetite ( $\text{Fe}_3\text{O}_4$ ) nanoparticles extracted from the industrial millscale waste. Then, the micron size samples are extracted and grounded on the high energy ball milling (HEBM) at various milling time for 4, 8, 12, 16 and 20 h. The formation of nanosized single-phase hexagonal spinel has been observed with XRD analysis as early as 4 h milling time. The FTIR transmission spectrum shows the appearance of a Fe-O functional group for each sample. HRTEM images showed that all the samples had a small particle size of 5-20 nm with uniform

distribution. Specific surface area of the 5 adsorbents increased after the 8 h milling time and it showed reduction after that. The magnetite adsorbents then utilized the adsorbent in Cadmium ions removal of the aqueous solution. Fe<sub>3</sub>O<sub>4</sub> with 8 h milling time was able to remove 9.81 mg of Cadmium ions with 1 g of adsorbents consume. The removal of the Cadmium ions detected related to the particles size, surface areas and saturation magnetization. This research successfully revealed that the higher saturation magnetization contributed to high removal percentages in Cadmium ions of aqueous solutions Fe<sub>3</sub>O<sub>4</sub> extraction from mill scales waste is cost effective and, the process is eco-friendly and is potential in wastewater treatment.

**036 Sound Absorption Coefficient of Different Green Materials Polymer on Noise Reduction**

Nadiatul Syima Mohd Shahid,  
Mohamad Ali Ahmad and Farah Liana  
Md Tahir

The usage of electrical and mechanical appliances at home and industries has created noise pollution to the environment. Urbanization and heavy growth of construction work further emphasize the need for new technologies for noise reduction. The most recognized technique to reduce noise is sound absorption on the materials itself. The aim of this study the potential of turning agricultural waste into a sound absorber. There are two main objectives in this study; First is to produce acoustic absorber by using natural materials. Second is to identify their sound absorption coefficients. The study was carried out by fabricating samples from raw materials of banana



stem, grass, palm oil leaves and lemongrass mixed with binding agents of polyurethane and hardener to the ratio of 1:4. The diameters of the samples consist of 28mm and 100mm and the thickness is 10mm. The sound absorption coefficients of samples were measured according to American Society for Testing and Material (ASTM) E1050-98 / ISO 105342-2 standards for the sound absorption coefficient testing two-microphone method. This method is known as impedance tube method (Two-Microphone Method). The absorption coefficient depends on the frequencies. The frequencies values used in this study were in the range from 500Hz to 4500Hz. The sample made of grass showed the highest average value of the sound absorption coefficient which is 0.553 compared to the other samples. All the sample tested showed the value of sound absorption coefficient from class D.

**037 Effect on Input Parameter of Cold Isostatic Press (CIP) Towards Properties of Zirconia Block**

Noratiqah Syahirah Zarib, Shahrul  
Azam Abdullah and Muhammad  
Syazwan Mazelan

Zirconia have become widely studied as a consequence of their outstanding mechanical properties, such as hardness, mechanical strength and fracture toughness, which allow them to cover a wide spectrum of applications as structural ceramics, including the field of biomaterials. This study was to compare the strength properties of zirconia block with and without Cold Isostatic Press (CIP). The mechanical properties of zirconia block with and without CIP were characterized.

Samples of zirconia block will undergo forming process via Cold Isostatic Pressing (CIP), four levels of soaking time (no CIP, 60, 90 and 120 minutes). All of the sample with different soaking time then were sinter in the furnace. The parameter for sintering process was fixed 1300°C at rate of 3°C / min. All of the sample were tested for its strength properties using Vickers test. The density and shrinkage of the zirconia block was be analyzed. Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD) were used to characterize samples of zirconia block.

**038 Effects of Mesoporous Silica Addition on Electrochemical Properties of Carbon Electrode**

Noramira Saad, Mohammad Noor Jalil,  
Zainiharyati Mohd Zain and Hamizah  
Mohd Zaki

Mesoporous silica is material that possesses the pore sizes between 2 nm to 50 nm which had expanded their applications rapidly. In this study, mesoporous SBA-15 and SBA-16 were synthesized via surfactant templating approach using triblock copolymer as directing agent and tetraethyl orthosilicate (TEOS) as silica source. The synthesized materials were characterized by X-ray diffraction (XRD) spectroscopy, scanning electron microscopy (SEM) and nitrogen absorption-desorption tests. The pore diameters are 5.5 nm and 3.2 nm for SBA-15 and SBA-16 respectively, were determined with BJH method based on adsorption data. Three different electrodes were fabricated, carbon paste electron (CPE) and two modified carbon paste electrodes (MCPE): SBA-15/MPCE and SBA-16/MPCE. The

fabricated electrodes were tested using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). SBA-16/MCPE showed better adsorption, enhanced the response signal to 81% and a lower resistance ( 4.04K $\Omega$ ). The synthesized mesoporous materials have the potential to be used in the development of high performance, lightweight and flexible devices in electrochemistry.

**039 The effect of slat opening on vortex shedding behind a circular cylinder**

Azlin Mohd Azmi

Add-on devices are widely used as one of the means of suppressing vortex induced vibrations from bluff bodies. The present study numerically investigates flow over a circular cylinder attached by an axial slat. The axial slat were of uniform and non-uniform openings of 67% and 44% porosity. The governing equation was solved using viscous-laminar model at Reynolds number,  $Re=300$ . It was found that the presence of the axial slats significantly suppressed vortex shedding behind the circular cylinder. The non-uniform slats showed longer vortex formation length with lower drag, in comparison to that of the uniform slats. In addition, the slats with 67% porosity of both uniform and non-uniform openings suppressed vortex better than that of 44% porosity slats, indicated by the longer vortex formation length and weaker intensity of vortices.

**041 QR Code Supported GIS Web System  
for University Facility Damage  
Report**

Nur Auni Suraya A.Rahim and Abdul  
Rauf Abdul Rasam

This study aimed at creating a Quick Response (QR) code supported web-based geographical information system (GIS) for facility damage report in university buildings. In general, some academic buildings such as facility management system of Faculty of Architecture, Planning and Surveying (FSPU), Universiti Teknologi MARA (UiTM) seems to have a problem of technicians spending more time to manually search for information about damaged equipment. Data processing such as scanning, georeferencing, and digitizing of the building plans were performed to create geodatabase file of the building. QR Codes at the different rooms were then generated by utilising QR Code Generator software. The waterfall or SDLC model was applied to produce a web-based system. This integrated system has facilitated the users with Home and Menus pages that benefit the outsourced parties to directly receive damages reports of the faculty. A survey of user satisfaction was also conducted to evaluate the practicality of the system and the result has shown that the system has the potential to be used by the department of facilities management by integrating with existing database system (e-Aduan) towards a better facility damage management. The proposed web-based system application will assist technicians and staff in managing the facility easier.

**043 QR Code Supported GIS Web System  
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Muhammad Faiz Osman Zaini and  
Abdul Rauf Abdul Rasam

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**044 Effect of Shroud Hole on the Force  
Characteristics of a Circular Cylinder**

Mohamad Faiz Osrin, Azlin Mohd  
Azmi, Hamid Yusoff and Norizham  
Abdul Razak

Characteristics of flow pass a shrouded cylinder were investigated experimentally using uniform and non-uniform hole shrouds. The experiments were performed to compare the effect of hole-uniformity of the perforated shroud on the cylinder lift and drag. The porosity for uniform hole shrouds in triangular and square configurations were set around 0.30, while that for non-uniform hole shrouds were set from 0.25 to 0.37. The diameter ratio between the shroud and the bare cylinder was set at 2.0. The experiment was performed in a wind tunnel at Reynolds Number of  $9.345 \times 10^3$  based on the bare cylinder diameter and constant incoming air flow speed. Results showed that although all shrouded cylinder models reduced drag significantly in comparison to that of the bare cylinder case, the non-uniform hole shrouds were considerably effective than the uniform hole shrouds. Total drag reduction achieved by the non-uniform hole shrouds of 30% porosity was between 90-95% whereas that of uniform hole was only 55-80% at the same porosity.

**046 The Effects of Palm Oil with  
Nanoclay Additive inHydrodynamic  
Journal Bearing Lubrication**

Izatul Hamimi Abdul Razak, Mohamad  
Ali Ahmad and Nadia Nurul Nabihah  
Ahmad Fuad

In this study, palm oil been tested to study its capability as a lubricant to replace the mineral oil. To enrich the performance of the oil, nanoparticles additives is added. Previous studies proved that by adding small size of additives into lubricating oil can lessen the friction and improve anti-wear properties. In this research, size of the nanoparticle used was below 20nm. Four ball tester following ASTM D4072-94 was conducted to determine the optimum concentration of palm oil bio-lubricant with Nanoclays additive ranged 0.02% to 0.08%wt of Nanoclay. The optimum concentration of palm olein with Nanoclay also tested in journal bearing to characterize the hydrodynamic lubricant and compared to the mineral oil (20W-40). The properties that have been observed were the coefficient of friction (CoF), pressure profile and temperature profile in journal test rig. Results discovered that 0.04 wt% of Nanoclay additive added into palm olein was the optimum concentration of the lubricant with coefficient of friction 0.081 where reduce 22.16% compared to mineral oil. It is also promoting better wear scar diameter that recorded as 0.692mm which was 32.16% smaller compared to mineral oil with 1.02mm. As in journal bearing application, results shown that modified palm olein with Nanoclay provide better performance with low coefficient of friction (reduced 40%-55% compared to mineral oil) and also temperature profile (reduced 19%-21%

compared to mineral oil) according to each load applied. As for the pressure profile, mineral oil has lowest pressure due to its high viscosity. Due to the improvement by adding Nanoclay additive into the palm olein, it shows massive potential as an alternative lubricant to the same range current industrial mineral oil.

**047 Development of 3D Printed  
Symbrachydactyly Prosthetic Hand**

Mohammad Azeeb Mazlan, Wan  
Fatimatul Aifaa Wan Fadzil, Helmi  
Rashid and Abdul Halim Abdullah

Symbrachydactyly is a genetical problem occurred to newborn where the newborn will have underdeveloped or shorten fingers. This condition will prevent them from experiencing the normal life like normal people as even a simple task of holding an item or pushing a button could be very hard for them. A device is needed to be developed to help these people to experience a better life. The proposed prosthetic hand will not be using any electrical component and will only use the wrist to control the prosthetic part which is the prosthetic fingers. The prosthetic hand will also have the patient specific features as the prosthetic hand will be designed based on the person's hand geometry by using a 3D scanner for better comfort to user. It will be fabricated using 3D printer for cheaper and faster option. The project's objectives will cover on designing the prosthetic hand and to analyze it by different material used in 3D printing. Lastly, it is to fabricate the prosthetic hand using 3D printer with the best determined material. People with these conditions will have a better life using



the prosthetic hand and this project would open for more application of 3D printing technology in medical field.

**048 Splat behavior under substrate temperature of 673K via coupling simulation**

Mohd Hafiz Mohd Noh, Ahmad  
Hussein Abdul Hamid and Koichi Mori

The process of collision flattening is difficult to evaluate via experiment because is normally under rapid conditioned (in  $\mu\text{sec}$ ). Via simulation, under compressible flow condition we propose a moving particle semi implicit method (MPS) coupling with finite volume method (FVM) to examine the deformation, splitting and conjoining of liquid. The substrate temperature has been constant at 673K. The result shows that the phenomena of splat behavior have been successfully being observed. The validation of droplet flow field also being confirm visually. Besides, the substrate temperature also influences the shape of the splat.

**051 Synthesis of ZnO Nanostructure by Chemical Bath Deposition: Influence of Growth Time towards Nanostructure Characteristics**

Rohanieza Abdul Rahman, Muhammad  
Alhadi Zulkefle, Sukreen Hana Herman  
and Rosalena Irma Alip

Growth of zinc oxide (ZnO) nanostructure on seeded indium tin oxide (ITO) via chemical bath deposition were presented in this study. Growth time is believed to have vital role in order to control the morphological, structural and optical properties of ZnO nanostructures. Different growth time were varied (1.0 H, 1.5 H, 2.0 H, 2.5 H, 3.0 H and 3.5 H), as the purpose to investigate its effect towards the growth of ZnO nanostructures, as well as their characteristics. In this study, the

influence of growth time was determined using field emission scanning electron microscope (FESEM), ultra-violet visible spectrometer (UV-Vis) and x-ray diffraction (XRD). Based on the results obtained, morphological, optical and structural characteristics of ZnO nanostructure thin films growth with different growth time present different characteristics and properties. According to the results obtained, it is proved that growth time is a vital parameter to control the growth of the ZnO nanostructure. The morphology of the ZnO nanostructure changes significantly with the changes of the growing time process. As well as optical properties, the changes of absorbance and transmittance value influence the optical energy band gap of ZnO nanostructure in this study. Significance with the different growth time, the structural properties of the ZnO nanostructure also affected where the crystallinity is improved with the longer growth time.

**052 State Dynamic Modeling using Ionic Conduction Phenomenon for TiO<sub>2</sub>-based Memristive Thin Film**

Raudah Abu Bakar, Nur Syahirah  
Kamarozaman, Wan Fazlida Hanim  
Abdullah and Sukreen Hana Herman

In this work a Simulation Program with Integrated Circuit Emphasis (SPICE) model was developed for metal-insulator-metal (MIM)-based memristors. The proposed model was based on the combination of Schottky and tunneling conduction mechanism with the state variable dynamic phenomenon. To account for ionic conduction in memristor, the Mott-Gurney law for ion hopping was

incorporated in the state variable derivative. As compared to the experimental data, the proposed model is found in good agreement with the measured data. The memristance and root mean square (RMS) error were calculated to be  $120 \Omega$  and 0.02 respectively. The simulation results show that the proposed model memristive behaviour tends to diminish as the frequency increases.

**055 Properties of Particleboard in Correlation with Mat Weight and Press Factor**

Wan Mohd Nazri Wan Abdul Rahman,  
Muhammad Abdilah Ab. Rani, Nur  
Sakinah Mohamed Tamat and Nor  
Yuziah Mohd Yunus

This study was conducted to investigate the influence of resin types and correlation with mat weight and press factor on commercial production of particleboard. The resins used in this study were E0, E1 and EC. Rubberwood and mix tropical species were used as raw material for manufacturing particleboard with thickness of 18mm. This research was done at Mieco Chipboard Bhd. The boards were tested for their mechanical and physical properties including modulus of rupture (MOR), modulus of elasticity (MOE), internal bonding (IB) and screw edge. Overall, the result shows that board made from E0 resin had better MOE, MOR and IB. Meanwhile the result of screw edge showed that board made from E1 resin is better with the value of 510N. The result also showed that correlation between mat weight and press factor is highly correlated (0.937) and contributed in particleboard manufacturing.

**056 Flexural influence on screw withdrawal behaviour of selected commercial particleboard**

Nor Yuziah Mohd Yunus, Nur Wafa Amalina Amali, Nur Sakinah Mohamed Tamat and Wan Mohd Nazri Wan Abdul Rahman

A study was conducted to evaluate the influenced of flexural toward screw withdrawal and surface soundness based on selected commercial particleboard. The material was collected from MIECO Manufacturing Sdn. Bhd. The selected commercial particleboard includes 3 different thickness of board (16mm, 18mm and 25mm) were tested. The particleboard ratio was 60% rubberwood and 40% mixed tropical wood with dimension of 60 cm x 120 cm x thickness of board. This study is to investigate the mechanical properties of board that determined internal bonding, flexural, screw withdrawal and surface soundness of board. The result shows there is correlation on flexural. Meanwhile for surface soundness, the positive correlation was with value of 0.415 according to Pearson correlation analysis.

**057 Screw Withdrawal Properties of Kelampayan and Sesendok Glue-Laminated Timber**

Wan Mohd Nazri Wan Abdul Rahman, Nur Aishah Sajali and Nor Yuziah Mohd Yunus

Glue-laminated timbers were produced using two species, Kelampayan and Sesendok. Polyvinyl Acetate (PVAc) was used as binder for the glue-laminated timber manufacturing. Screws with same diameter (3.5mm) and length (50mm), but with different angle and distance of pitch were used. The screw-withdrawal test position was selected for 3 direction designated as the surface, front and side. The test result found that both of pitches of screws are suitable for Kelampayan species. In side position, Kelampayan

species showed the best screw holding strength and this result is followed by Sesendok species. In surface position, Pitch 2 has highest withdrawal strength for the Kelampayan species. In all position, Pitch 1 is suitable for Sesendok species and Pitch 2 is suitable for Kelampayan species. In both of pitches, Kelampayan attained higher withdrawal strength when compared to Sesendok.

**060 Development of Intelligent Food Packaging from Turmeric (*Curcuma longa*)**

Siti Noor Suzila Maqsood Ul Haque

In this study, intelligent food packaging in the forms of film and coating were developed based on starch, chitosan and curcumin extracted from turmeric. Solution casting method was applied to develop the film. Both of the film and coating were evaluated and compared by their chemical, physical and biological properties. The film was evaluated in terms of tensile strength measurement, FTIR spectroscopy, antioxidant activity and antimicrobial activity as well as color difference parameters after application on the strawberry. The results obtained showed that the film has a tensile strength of 1.37 MPa, elongation at break of 18.9%, antioxidant activity of 95.65% and high antimicrobial activity as had successfully delayed the formation of mould on the strawberry after 5 days of storage. In addition, the stability of both film and coating were evaluated based on their applications on strawberries at two different conditions which are at room temperature and chiller temperature during 5 days

storage to identify their potential use as intelligent food packaging. After 5 days, it was found that the film at room temperature had been partially degraded and the coating had caused colour degradation and texture deterioration of the strawberry. In contrast, the film and coating stored at chiller temperature remained same in term of physical structure and abled to monitor and extend the shelf life of the strawberry. For evaluation of the film as pH sensing film, the colour of the film changed after 5 days from 53.46 to 48.92 for L\*, 26.01 to 22.68 for a\* and 42.49 to 44.65 for b\* at chiller temperature, while at room temperature, the values of L\* changed from 53.96 to 48.96, 25.54 to 20.36 for a\* and 46.34 to 44.10 for b\*. These showed that the film abled to monitor the freshness of the strawberry by changing its colour in respond to pH changes of the strawberry. The results obtained revealed that both of the film and coating have a greater stability at chiller temperature as compared to storage at room temperature and both have a strong antioxidant activity and strong antimicrobial activity that they delayed the spoilage of the strawberries. Therefore, the film and coating based on starch, chitosan and curcumin can be used to monitor freshness of refrigerated food and have the potential to be used as intelligent food packaging.

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**061 Release of Ammonium-N ( $\text{NH}_4^+$ ) and Nitrate-N ( $\text{NO}_3^-$ ) by Different Leguminous Cover Crops (LCCs) Planted in Peat Soils**

Muhammad Rahmat Abdul Rahman and  
Nur Qursyna Boll Kassim

Peat soils is renowned for the low mineral-N concentration which is crucial for crop's growth. One of the effective and conserving method to improve the soil mineral-N concentration is by planting leguminous cover crops (LCC) which is common in oil palm plantation area. However, different LCC was found to release different concentration of mineral-N into the soils. Hence, this study aims to determine the concentration of mineral-N in form of ammonium-N ( $\text{NH}_4^+$ ) and nitrate-N ( $\text{NO}_3^-$ ) by different types of LCCs namely *Mucuna bracteata*, *Calopogonium mucunoides*, *Pueraria javanica* and *Centrosema pubescens* as well as to evaluate the effects on physico-chemical properties of peat soils. Results showed most of the LCCs can survive in acidic peat condition whilst improving the concentration of mineral-N in the soils. *Mucuna bracteata* was found to release a significant amount of mineral-N into the soils and shows a vigorous growth compared to others during the study period. However, it should be noted that different LCCs required distinct time to fix N since the maturity for different LCCs is different. Hence, prolonged studies on release of mineral N into the soil by LCCs are recommended.

**062 Effect of torsional motion on critical speed of high-speed rotating shaft at different boundary conditions**

Efficiency improvement that can be provided by the high-speed rotating equipment becomes a concern for designers nowadays. Since the high-

Abdul Malek Abdul Wahab

speed rotating machinery was capable of rotating at very near to critical speed, the accurate estimation of critical speed needs to be considered. In this study, the effect of torsional motion on the critical speed of high-speed rotating shaft system was investigated for pinned-pinned (P-P), clamped-free (C-F) and clamped-free (C-F) boundaries condition. Finite element (FE) formulation based on the Nelson's finite element model that considers the torsional effect was developed and used to derive the Mathieu-Hill's equation. The Bolotin's method was applied to plot the forward and backward frequencies of the shaft in the Campbell's diagram. It was found that torsional motion has significant effect on the critical speed for different boundary conditions. The difference between critical speed of 4DOF and 5DOF models can be as high as 6.91 %.

**063 The processing of epoxy/1 wt%-graphene nanocomposites: effects of ethanol on properties**

Mohd Shahneel Saharudin, Asmimi  
Zulkifli and Nurul Fatimah Zailani

Nanocomposites of four different types were successfully produced using solution casting technique. Graphene was dispersed in four different ethanol concentrations; 0g, 1g, 2.5g and 5g. In general ethanol is an excellent dispersant agent for 1 wt% graphene dispersed in epoxy matrix. The maximum increase in flexural properties, impact strength and microhardness were observed in the case of 1 wt% graphene dispersed in 1g ethanol. The flexural strength and modulus increased 62% and 61% respectively. The highest impact



strength was recorded also in the case of 1 wt% graphene dispersed with 1g ethanol, where an improvement of 9.5% was observed. The maximum Vickers microhardness was recorded to improve 3% compared with monolithic epoxy. SEM images revealed that graphene can impede the advancing cracks and significantly change the fracture mode from straight fracture path to radially emanated path. It is worth to point out that if ethanol is not completely evaporated during processing, it can cause porosity which is unfavourable to mechanical properties.

**064 Rheological properties of cassava starch film forming solution with kaffir lime oil**

Norasmah Mohammed Manshor,  
Junaidah Jai, Fazlena Hamzah and  
Noorsuhana Mohd Yusof

Biopolymer film has attracted interest in food preservation and packaging. In order to obtain biopolymer film of good characteristics, rheological properties of film forming solution is important. In this study, the rheological properties of film solution of cassava starch incorporated with kaffir lime oil were determined. The flow behavior measurement was made at shear rate of 0.1 to 100 s<sup>-1</sup> and 25°C, whereas temperature dependency on viscosity was measured at 25 to 70°C and shear rate of 10 s<sup>-1</sup>. The flow behavior was well described by power law or Ostwald de Waele model. The film solution showed flow behavior index (n) in the range of 0.20 to 0.72 which belonged to a non-Newtonian or pseudoplastic behavior. The shear stress increased with increasing shear rate,

while the viscosity decreased with increasing shear rate and temperature. The dependency of temperature on viscosity was described by Arrhenius model which allowed the determination of activation energy ( $E_a$ ). The  $E_a$  range between 4.92 to 13.23 kJ mol<sup>-1</sup>. The results provide a basis to correlate the film forming solution properties to the characteristics of produced biopolymer film.

**065 Effect of chitosan-starch enriched with turmeric essential oil coating on physical quality of strawberry**

Noorsuhana Mohd Yusof, Junaidah Jai,  
Fazlena Hamzah, Norasmah  
Mohammed Manshor and Sitinoor  
Adeib Idris

The aim of this study was to prepare chitosan edible coatings containing turmeric essential oil and plasticized with glycerol and starch using the dip coating method. The effects of starch on surface tension and turmeric essential oil amounts on firmness and weight loss of the strawberries were studied. The adhesion properties of coatings were greatly influenced by starch but not by turmeric essential oil so 2.0% (w/v) of starch will be used in this study. Results showed that chitosan-starch coatings enhanced with turmeric essential oil were effective on preserving strawberries. It was observed that the weight loss of coated strawberries was significantly lower than that of the uncoated ones. Based on the findings, chitosan-starch coating with 150 ppm of turmeric essential oil showed potential coatings for extending shelf life during the storage of strawberries.

**066 Pineapple Leaf Fibers (PALF)/  
Polyethylene Terephthalate (PET)  
Electrospun Nanofibers: Effect of  
Ratio on Chemical & Morphological  
Properties**

Siti Norasmah Surip, Fatimah  
Muyassarah Abdul Aziz and  
Khairunnadim Ahmad Sekak

Nanofibers capabilities in produced small materials up to nanoscale dimension, making them the perfect fundamental materials that can help improving effectiveness of many applications. In this study, the properties of PALF/PET electrospun mats were studied. Different ratio of PALF/PET were electrospin to determine the optimum parameters for fabricating electrospun PALF/PET with minimum defect. FTIR studies were done to understand the interaction occurred between PALF and PET with increasing PALF ratio. From the FTIR result, PALFPET4-5 showed similarities with raw PALF peak at 1100cm<sup>-1</sup> indicating the influence of PALF in the fibers. This peak was not appeared at PALFPET1-3. The obtaining electrospun mats were observed under FESEM to characterize their morphological properties. Increasing in PALF ratio attributes to the decreasing of size diameter and distribution.

**067 Modelling of Average Pore Size and  
Porosity of Porous  
Polycaprolactone/Hydroxyapatite  
(PCL/HA) Composite Blends**

Suffiyana Akhbar, Istikamah Subuki,  
Rahida Wati Sharudin and Muhammad  
Hussain Ismail

The objective of this paper is to develop mathematical relationship between average pore size and porosity of porous polycaprolactone/hydroxyapatite (PCL/HA) composite and investigate the combined effect of temperature and pressure of foaming process and presence of HA. Porous PCL/HA composite was prepared using supercritical carbon dioxide (ScCO<sub>2</sub>)

solid state foaming process. Three different temperatures and pressures of foaming process were varied at 35°C, 40°C, 45°C and 10MPa, 20MPa, 30MPa respectively. Meanwhile weight of HA was varied at 10, 20, 30 and 40 wt%. The result from analysis of variance (ANOVA) using Microsoft Excel found that average pore size is reduced with higher pressure and content of HA presence does not significantly affect the average pore size due to poor distribution of HA. Meanwhile for porosity, higher temperature is more dominant in increasing of porosity compared to the HA content. In addition, both designed models have low values of Average Absolute Relative Deviation (%AARD) and high value of coefficient of determination (R<sup>2</sup>) which reflects a good and satisfying result between the experimental values and model predicted values.

**068 The accuracy of datria system in improving order picking process**

Muhammad Akmal Asyraaf Adlan and  
Nur Farizan Tarudin

Order picking is an essential part of the supply chain operation. It forms as much as 55% of the operating cost at any distribution centre, as opposed to shipping, receiving, storage and has a direct impact on the level of customer contentment [1]. The ability to process customer orders quickly and accurately is now an essential part of doing business. In order to improve order picking processes within warehouse, the company must choose an order picking method that is suitable for their business. Therefore, XYZ Combined

Distribution Centre (CDC) was implemented DATRIA system to dramatically increase productivity in their order picking process Based on this practices, researcher want to investigate the accuracy of DATRIA system in improving the order picking process at XYZ CDC. There are three factors that have been discussed in this study which are order picker, equipment, and interference. In this study, researchers have used questionnaire and observation as a method of data collection. The questionnaire has been distributed to order pickers at XYZ Distribution Centre and researcher also has looked at the data from order fulfilment report. At the end of this study, recommendations for efficient practicing of this system have been provided. By identifying the factors that could affect the accuracy of DATRIA system, it is easier to come up with various ideas and suggestions in improving the operations that will eventually improve the company's overall performance besides maintaining a positive image among the customers throughout the nation.

**069 Effect of Photoelectrochemical Electrolyte Additives on the Photoconversion Efficiency of Tungsten Trioxide Loaded Titania Nanotubes Prepared Via Electrodeposition**

Lim Ying Chin, Nur Farah Atikah  
Harun, Asmaa Kadim Ayal, Yusairie

This study aims to investigate the effect of additives (sulfuric acid and ethanol) in sodium sulfate as photoelectrochemical (PEC) electrolyte on the photoconversion efficiency of tungsten trioxide loaded titania nanotubes (WTNT). Titania nanotubes (TNT) were first fabricated via anodization while the deposition of

Mohd and Lim Ying Pei

tungsten trioxide onto the titania nanotubes (WTNT) were successfully carried out via electrodeposition at various potentials. Assessing the PEC performance of WTNT fabricated at pH 1.5 in solely sodium sulfate was not adequate to enhance the PEC performance of WTNT compared to blank TNT. A similar result was obtained when sulfuric acid was added or when fabricating WTNT at pH 0.8. Adding ethanol into sodium sulfate electrolyte has successfully improved the PEC performance of WTNT with observable inclining photoconversion efficiency trend upon increasing electrodeposition potentials of WTNT from  $-0.45$  V to  $-0.75$  V.

**070 Photocatalytic Activity of Modified TiO<sub>2</sub> for Methyl Orange Removal**

Lim Ying Pei, Tan Huey Ling and Lim Ying Chin

In this study, the researchers review on the modified TiO<sub>2</sub> preparation via wet impregnation method for dye removal application. The bare TiO<sub>2</sub> and Ag-TiO<sub>2</sub> that have been synthesized undergo characterizations using XRD, FESEM-EDX and UV-Vis spectroscopy. The XRD pattern showed that the synthesized TiO<sub>2</sub> was of pure anatase phase. The crystal structure of anatase TiO<sub>2</sub> was not disturbed upon doping with Ag. FESEM images revealed that the TiO<sub>2</sub> constitutes of various sizes of spherical and square-like shapes. EDX mapping illustrates that dopant metals are dispersed in a uniform manner onto the TiO<sub>2</sub> support and appeared as metal oxides. The bare TiO<sub>2</sub> that has been modified acts as a photocatalyst to remove MO

through the batch method. The effects of initial dye concentrations (5-25 ppm), pH solutions (2-9), catalyst loadings (0.5-4) g/L, and light sources (visible, solar, UV) were analyzed. It was discovered that photocatalytic experiment performed using Ag-TiO<sub>2</sub> has greater efficiency of MO removal that ranges from 32 to 100% in contrast to bare TiO<sub>2</sub> with MO removal of 12-67% for comparable dosages of photocatalyst at initial MO concentration of 5 ppm in both alkaline and acidic conditions under UV irradiation. It was postulated that Ag-TiO<sub>2</sub> photocatalyst is the better candidate for an effective dye removal.

**071 Role of synthesized soil for minimizing heavy metal penetration into the plant's cell in phytoremediation process**

Naim Mohd Nazli, Abd Rashid Nor Shaerah and Abu Bakar Noor Fitrah

The advantages of synthesized soil for minimizing the heavy metal penetration into the plant cells during phytoremediation process was investigated. The synthesized soil was prepared by modifying the as-received soil into fine and coarse particles via a sieving process before subjecting the prepared soil to the lotus plant for the phytoremediation process. The as-received soil was obtained from a common paddy soil and consist of major clay elements including SiO<sub>2</sub>, Fe<sub>3</sub>O<sub>4</sub> and Ca. After the phytoremediation process for 30 days, the bulk water, soil and rhizomes were sent for inductively coupled plasma (ICP) optical emission spectrometry. The fine soil absorbed more metal content than the coarse soil and as-received soil. Further analysis was

conducted by downsizing the as-received soil into the aqueous solution of pH 4, 6 and 8 and followed by an ultrasonication process. A nanometer order particle of 157, 78 and 100 nm with various particles's surface charge of 22, 4.9 and -19.9 mV were obtained from pH 4, 6 and 8 respectively. The surface charge of the clay element that contained in the as-received soil adsorbs the heavy metals onto its surface and hindered the penetration of heavy metal from entering the plant cells.

**072 Effects of Deposition Time on Surface Properties of Co-Ni-Fe Alloy Synthesised on Hex Bolts**

Muhammad Syafiq Md.Nor, Zuraidah Salleh, Nik Rozlin Nik Mohd Masdek, Zainal Abidin Kamarul Baharin and Sahril Kushairi

Electrodeposition is one of the methods used to perform a protective coating. It is commonly used in the industry because it capable to produce coating with good properties. The objective of this study is to perform the electrodeposition process of cobalt-nickel-iron (Co-Ni-Fe) alloy coatings onto the mild steel hex bolt (M12 x 50). This study also investigated the effect of deposition time on thickness, hardness, surface roughness and the corrosion rate of the electrodeposited Co-Ni-Fe alloy coating. The electrodeposition was performed on the substrate with four different deposition times: 15, 30, 60 and 120 minutes. The working temperature of the sulphate solution was 60°C with tolerance  $\pm 5^\circ\text{C}$  and the current supplied was 1.5 A. All the samples undergone surface properties analysis. For the corrosion rate, it was conducted using the potentiodynamic polarization (PDP)



test. There were three types of solution used for PDP; hydrochloric acid (HCL), distilled water and sodium hydroxide (NaOH) with pH3, pH7 and pH9 respectively. Scanning electron microscope (SEM) image showed the lowest thickness was 4.74  $\mu\text{m}$  for deposition time of 15 minutes and the thickest coating with 102.77  $\mu\text{m}$ . The coating hardness decreased as deposition time increased and the lowest hardness obtained was 349HV at 120 minutes deposition time. The surface roughness decreased until 60 minutes of deposition time (1.0279  $\mu\text{m}$ ) and started to increase at 120 minutes of deposition time (4.0655  $\mu\text{m}$ ). The sample with 60 minutes of deposition time had the lowest corrosion rate in all solution; pH 3 = 0.1311 mmpy, pH 7 = 0.0393 mmpy and pH 9 = 0.0512 mmpy. Therefore, it is proven that deposition time is an important plating parameters that determine the surface properties and subsequently the corrosion resistance of electrodeposited Co-Ni-Fe alloy.

**073 Prediction of Volatile Organic Compounds (VOCs) From Decomposition of Local Household Food Waste Using the Artificial Neural Network**

Siti Rohana Mohd Yatim and Ku Halim Ku Hamid

This study examines the potential of artificial neural network (ANN) to predict Total Volatile Organic Compounds (TVOCs) released via decomposition of local food wastes. To mimic the decomposition process, a bioreactor was designed to stimulate the food waste storage condition. The food waste was modeled based on the waste composition from a residential area. A feed-forward multilayer

backpropagation (Levenberg – Marquardt training algorithm) was then developed to predict the TVOCs. The findings indicate that a two-layer artificial neuron network (ANN) with six input variables and these include (outside and inside temperature, pH, moisture content, oxygen level, relative humidity) with a total of eighty-eight (88) data are used for the modeling purpose. The network with the highest regression coefficient (R) is 0.9967 and the lowest Mean Square Error (MSE) is 0.00012 (nearest to the value of zero) has been selected as the Optimum ANN model. The findings of this study suggest the most suitable ANN model that befits the research objective is ANN model with one (1) hidden layer with fifteen (15) hidden neurons. Additionally, it is critical to note that the results from the experiment and predicted model are in good agreement.

**074 Adaptive Neuro-Fuzzy Inference System Prediction Method for Percentage Fatalities of Jet Fire Incident in Methanol Production Plant**

Mohd Aizad Ahmad and Zulkifli Abdul Rashid

This research highlights on development of simpler prediction method for percentage fatalities occurred during jet fire incident in methanol production plant. A lot of parameters involved before fatalities can be determined using consequence model analysis. The parameters involved needed to calculate surface emitting power, view factor, transmissivity and area affected footprint to determine estimated fatalities. HYSYS software used to simulate density of mixture, mass and volume fraction of each component

resulting from carbon dioxide and hydrogen reaction. These values used as input in ALOHA simulation to estimate area footprint. Affected area footprint then calculated in MARPLOT, which in turn used for estimating percentage fatalities. These resulting fatalities used as ANFIS prediction analysis to predict percentage fatalities, then compared to the simulation data from ALOHA and MARPLOT. The selected input data was operating pressure, volume, mass, size of leakage and wind speed. The predicted data from ANFIS attained R2 at 0.9998 for both membership function used, triangular and Gaussian while for capabilities test, R2 of 0.998 was achieved using Gaussian. Therefore, simpler method to predict percentage fatalities for the event of jet fire in methanol plant was successful.

**075 Empirical Study of Damage Gear Using Operational Modal Analysis**

Mohammad Aarif Amirza, Muhamad Azhan Anuar, Ahmad Azlan Mat Isa and Zamri Abdul Rahman

As natural frequencies and mode shapes are often a key to understanding dynamic characteristics of structural elements, modal analysis provide a viable means to determine these properties. This paper investigates the dynamic characteristics of a healthy and unhealthy condition of a commercially used helical gear using the Frequency Domain Decomposition (FDD) identification algorithm in Operational Modal Analysis (OMA). For the unhealthy condition, a refined range of percentage of defects are introduced to the helical gear starting from one (1) tooth being defected (1/60 teeth) to six (6) teeth being defected (6/60 teeth).

The specimen is tested under a free-free boundary condition for its simplicity and direct investigation purpose. Comparison of the results of these varying conditions of the structure will be shown to justify the validity of the method used. Acceptable modal data are obtained by considering and accentuating on the technical aspects in processing the experimental data which are critical aspects to be addressed. The natural frequencies and mode shapes are obtained through automatic and manual peak-picking process from Singular Value Decomposition (SVD) plot using Frequency Domain Decomposition (FDD) technique and the results are validated using the established Modal Assurance Criterion (MAC) indicator. The results indicate that OMA using FDD algorithm is a good method in identifying the dynamic characteristics and hence, is effective in detection of defects in this rotating element.

**076 Impact Strength of HDPE Composites Roofing Panel from Natural Fibre**

Nurul Atiqah Mohd Ayob, Mansur Ahmad, Syaiful Osman and Zawawi Ibrahim

In recent years, there has been an increasing interest to utilize residues from agricultural waste for useful products. This paper will focused on the effect of density and type of fibres on impact strength of roofing panel from natural fibre reinforced HDPE. Natural fibre reinforced HDPE with three different types at different ratios for each composite were prepared in laboratory. Dynatup 9250HV was used to test impact strength of the composite. Energy (J) value was evaluated to

determine the impact strength of all various composite boards. It was found that density and types of natural fibre has significantly affected the impact strength. Bamboo fibre gave the best impact properties compared to coconut coir and kenaf. There is only slightly difference between impact strength value for bamboo and kenaf which is in the range of 2.76MPa to 3.82MPa. Ratios at fourty (40) gave higher density value and results in better impact strength. In general, there is significantly difference between the ratios among the fibres.

**077 Oil Spill Removal using Coconut Shell Based Composite Magnetic Activated Carbon**

Putri Faizura Megat Khamaruddin and  
Muhammad Luqman Abdullah

Coconut shell based activated carbon has been extensively used as an oil adsorbent for various applications because of its high surface area, micro porosity and good sorption properties. However, it is difficult to be collected after the sorption process due to its granular form. Impregnating the activated carbon with magnetic particle can solve the problem by removing the used adsorbent using magnet. The objectives of this study were to determine the optimum activation temperature and to compare the effect of immersion time. The study also investigated the effect of the iron to activated carbon ratio on oil removal capacities and the potential of reusability of the composite magnetic activated carbon. The activated carbon of dried coconut shell was produced by pyrolysis and activated at 600°C, 800°C and 1000°C. This was followed

by the preparation of the composite magnetic activated carbon by co-precipitation method. The magnetic adsorbent was then characterised by using FTIR spectra and the surface characteristics was analysed using surface analyser. The highest oil removal were samples prepared at activation temperature of 800°C with the composite adsorbent oil removal was at 2 g/g which was 11.5% more than the activated carbon sample. Higher concentration of iron did not benefit the oil removal process as the higher the concentration of iron used, the less oil was adsorbed. Finally, the reusability of the composite magnetic activated carbon showed promising result.

**078 Physicochemical Properties of Enzymatically Synthesised Medium Chain Triacylglycerols-based Enhancer Cream**

Salizatul Ilyana Ibrahim, Juan Matmin  
and Abu Bakar Abdul Majeed

Structured lipids (SLs) containing medium chain triacylglycerols (MCTs) were produced by lipase catalysed acidolysis of both octanoic acid and the virgin coconut oil (VCO). The production of SLs namely structured virgin coconut oil (SVCO) was previously optimised using the central composite design (CCD) based on the percentage of octanoic acid incorporated in the reaction products. The fatty acids and triacylglycerols composition and their corresponding rheological properties of the formulated SVCO incorporated  $\alpha$ -tocopherol cream were also determined. It was suggested that the highest incorporation of octanoic acid (68.07%) would be achieved by the following parameter:

octanoic acid to VCO ratio of 1.70 (w/w); an enzyme load of 22.60%; at 63.4°C; a water content of 3.53%; and at 96 h. The amount of octanoic acid (carbon-8), the medium chain fatty acids present in the structured lipid after enzymatic esterification was increased to 60.1% as compared to the natural VCO with only contains 5.45%. Based on the calculated equivalent carbon number (ECN), the most probable MCTs found in the SVCO were CpCpCp, CpCCp, and CpLaCp. Based on the rheological analysis, it is determined that the SVCO creams were less viscoelastic as compared to the VCO. It shows that the decrease of the saturated fatty acids composition (carbon-12, 14, and 16) in the SVCO creams had significantly decreased the elasticity of the cream.

**079 An IoT-Based Ovitrap System  
Applied for Aedes Mosquito  
Surveillance**

Ismaliza Isa, Ahmad Razali Ishak, Nazri  
Che Dom, Zulkifli Mohamed and  
Muhamad Azhan Anuar

Since the number of dengue fever cases has become the endemic disease in Malaysia, it is urgently need for rapid and efficient calculation of mosquito populations particularly for early detection and control measures. An ovitrap surveillance is used to determine the density of Aedes mosquito and it is one of the implemented method for vector control application. In this study, the prototype of an IoT-based ovitrap system was developed to automatically and simultaneously detect the Aedes mosquitoes using NodeMCU as the main IoT platform. The existing sticky ovitrap was modified to integrate the

selected IoT components and to ensure its functionality for automatic detection. There are two phases were conducted in this study, with phase 1 evaluating the right IoT components to be selected and applied for automatic detection. Integrating the selected IoT components and modification of present ovitrap was carried out in phase 2 and the final revised design was considered. SWOT analysis and Pugh chart analysis also known as decision matrix method were used to select the best IoT components and final ovitrap design. It has been observed that the prototype D was the best design and be able to detect the adult mosquitoes. The lessons learned in the development of the IoT-based ovitrap were discussed in order to be employed for Aedes mosquitoes surveillance in the future.

**080 Embryogenic Callus Induction of  
Aquilaria malaccensis Lam. and  
Aquilaria subintegra Ding Hou**

Nursaadiah Salam, Asmah Awal and  
Shamsiah Abdullah

*Aquilaria malaccensis* Lam. and *Aquilaria subintegra* Ding Hou belong to the family of Thymelaeaceae which is commonly known as gaharu or agarwood. It is a commercially important tree and identified as a potential aromatic plant. The overwhelming responses in the lodging sector reduce gaharu species in the forest. Mass propagation through plant tissue culture technology will substitute this problem. The present study was conducted to investigate the embryogenic callus induction between these two species. The most optimum sterilization method for both species was sodium hypochlorite 5.0% which



gave the highest percentage of aseptic culture (95%) with the absence of tissue browning. The leaves of both species were cultured on Murashige and Skoog, (1962) (MS) media supplemented with combination of various concentrations of 6-benzylaminopurine (BAP) (0.5, 1.0, 2.0 and 2.5 mg/L) and 2,4-dichlorophenoxyacetic acid (2, 4-D) (0.5, 1.0, 1.5 and 2.0 mg/L) and kept under dark condition. The explants produced embryogenic, white and compact callus at the end cut of the explants after two weeks of culture in all treatments. The highest frequency of embryogenic callus formation was observed in explants cultured on 2.0 mg/L BAP and 0.5 mg/L 2,4-D for both species. From the present study, the optimum sterilization technique and embryogenic callus induction for *A. malaccensis* Lam. and *A. subintegra* was established.

#### **081 Nitrogen Removal Enhancement In Extended Aeration System**

Jurina Jaafar, Suzana Ramli and  
Aminuddin Mohd Baki

This study presents the results of experimental research of laboratory and theoretical design in term to implement biological nutrient removal system in Mawar wastewater plant. The main objective of the study is to modify the existing operation at Mawar treatment plant to enhance nutrient removal. The works of this study includes characterization of wastewater in the treatment plant, modifying the aeration tank to include aerobic and anoxic zones and evaluate the treatment improvement. Samples collected and analyzed to measure biochemical

oxygen demand (BOD<sub>5</sub>), suspended solids (SS), chemical oxygen demand (COD), ammonical nitrogen (NH<sub>4</sub>-N), nitrate nitrogen (NO<sub>3</sub>-N), total nitrogen, pH and temperature. Samples collected during eight working days. Operations at the aeration tank were changed to include nitrification and denitrification processes and samples analyzed during eight working days to evaluate concentrations of the same parameters. Wastewater in the treatment plant was classified as weak domestic wastewater. The findings indicate that, nitrogen removal increased especially in ammonical nitrogen reduction. The modification practice affected the removal efficiency of some parameters. However, majority of the parameters concentrations were below the discharge limits. The effect of this modification was slight but it could be avoided if the clarifiers were working properly.

**082 Rapid Expansion Supercritical Solution (RESS) of Carbon Dioxide as a Green Technology Method for Leucaena Leucocephala Solid Oil Particle Formation**

Nur Ain Mohd Zainuddin and Nur Salihah Sulong

Rapid expansion supercritical solution (RESS) is a technology introduced that produces a small solid oil particle with organic solvent free particle. RESS method is better method compare to the traditional method due to have many advantages which are produce clean extraction yields, obtain free solvent traces, environmental friendly and short processing time that can be used in various industrial such as cosmetic and pharmaceutical. Therefore, RESS technique is applied in this experiment in order to produce direct solid oil

particle from *Luecaena Leucocephala* (*L. Leucocephala*) pods instead of oil. In this study, the operating condition that applied during the RESS process in order to obtain the highest solid oil particle from the *L. Leucocephala* pods sample are extraction temperature of 40 °C, 45 °C, 50 °C, 55 °C and 60 °C and extraction pressure of 3000psi, 4000psi, 5000psi, 6000psi and 7000psi at the constant extraction time of 40 minutes. In conclusion, the highest yield of *L. Leucocephala* solid oil particle that attained from this study is about 0.65% at 60°C and 7000psi. The major component that obtained from the highest yield are 2,2,3-trimethyldecane, Cyclopentanone, propanoic acid and Cyclobutane, 1,2-diphenyl- by using Gas Chromatography Mass Spectrometry (GCMS).

**083 Reduction of Chemical Oxygen Demand (COD) effluent of plastic recycling processing plant using LD slag**

Nur Ain Mohd Zainuddin and Mohamad Farhan Rosley

In plastic recycling processing plant, there is a major problem which is contains high COD concentration. The concentration should be reduced with certain process or treatment before discharging it to the discharging point. Coagulation-flocculation, adsorption and foam fractionation are the examples of treatment processes that can reduce COD concentration in wastewater. Steel slag or LD slag can be used as an alternative to adsorbent to reduce COD concentration of wastewater with using adsorption process. LD slag can be obtain from any steel manufacturing plant. LD slag also contains many alkali oxides, porous characteristic, large

surface area and contain an easy solid-liquid separation. This research is to study the percentage reduction of COD in wastewater using LD slag. The research covers on the particle size of LD slag, dosage of LD slag and contact time between LD slag and wastewater. The optimum value of particle size of LD slag is  $0.2\mu\text{m}$ , the dosage of LD slag is 6gram and the contact time between LD slag and wastewater is at 60 minutes. Besides studying on the percentage reduction of COD, this research is also been done to compare between coagulation-flocculation, adsorption using activated carbon and adsorption using LD slag processes. Based on the research that had been done, LD slag can reduce 2% higher of COD percentage reduction compared to activated carbon. LD slag should be invested more in wastewater treatment process.

**084 Effect of Zn-doping on the structural, optical, and humidity sensing properties of sol-gel synthesized NiO thin film**

Nor Fadzleen Qistina Mohd Fahmi  
Visuvanathan and Mohamad Hafiz  
Mamat

This paper presents the fabrication process and characterization process of zinc (Zn) doped nickel oxide (NiO) thin film. The main objective of this research is to investigate the electrical and structural properties of Zn-doped NiO thin film using sol-gel spin-coating method. Zn-doped NiO thin film was prepared by using spin-coating method. The samples were prepared at different doping parameters, which are undoped NiO, 0.5 at.% Zn-doped NiO, 1.0 at.% Zn-doped NiO, 1.5 at.% Zn-doped NiO and 2.0 at.% Zn-doped NiO. The studies of structural properties of the

samples were conducted by using an X-ray diffraction. The optical properties of the samples were characterized by using ultraviolet-visible spectroscopy. The spectra of transmittance and absorbance of the samples were studied. The humidity sensing properties of the samples were conducted using humidity chamber and sensor measurement system.

**085 USPs on Damage Reduction of  
Concrete Railway Sleepers**

Renga Rao Krishnamoorthy and Zobaer  
Saleheen

Ballast is the weakest among all of the railway track components due to its latent dynamic shifting and variation of stiffness along and across the track. Sharp Angular shape of the ballast components hinders evenly distribution of loads from sleeper to ballast, which in turn causes the sleepers to deteriorate over time resulting in higher frequency of railway track maintenance. Previous studies have shown that having an under-sleeper pad (USP) in between sleeper and ballast increases the contact area between them significantly. Which by itself reduces the long-term damage on sleepers by a substantial amount. However, concrete sleeper is subjected to cracking due to excessive dynamic load from rail wheels, this paper intends to numerically evaluate whether the cracking of concrete sleepers gets reduced due to installing of USPs in the railway track system. The foremost reason behind cracking of concrete sleepers is the induced dynamic loads due to track irregularities and imperfect wheel rail contact. The most affected portion is at the bottom of the rail seat

location of sleeper. Thus, two finite element models (one without USP and one with a 20mm thick USP attached at sleeper bottom) were analyzed while incorporating the concrete damage plasticity in the sleepers' material. Results have shown better performance of concrete sleepers with USPs. Sleeper pads have shown a tendency to minimize excessive stress from developing within naked concrete sleepers and substantial advantage of using USPs in terms of damage reduction among sleepers were also perceived during conducting this study consequential reduction of crack formation was observed after installation of USPs.

**086 Screening and Isolation of Effective Microbes for Decomposition Process Among Different of Organic Wastes**

Khairol Redzuan Mohamad and  
Muhammad Nuruddin Mohd Nor

Organic waste is the biodegradable material that comes from either plant or animal. It can be decomposed over time by microbes into carbon dioxide, water, methane and other simple organic molecules. Microorganism especially bacteria and fungus are able to decompose cellulose by an enzyme known as cellulase that produced by itself. Since plant are made up from cellulose, the study is focused on isolating and identifying the microbes that are responsible in decomposing the organic waste by screening for the microorganism that are able to produce cellulose enzyme. In this experiment, we isolate the bacteria from three different samples, which are; compost product, decayed wood and empty fruit bunch mix with oil palm frond. The

samples were collected from the fresh decomposing organic waste. The samples undergo serial dilution, screening of ability of the microorganism to solubilize phosphate by using National Botanical Research Institute's Phosphate (NBRIP), screening of ability of the microorganism to produce cellulose enzyme by using Carboxymethyl Cellulose Media (CMC) and treated with Congo Red and NaCl for confirmation of the targeted effective microbes. The result shows that the targeted effective microbes will produce the halo zone or clear zone formation after treated with Red Congo and NaCl solution on CMC media and producing halo zone on NBRIP media. In this experiment, we manage to isolate and identify the bacteria that responsible in producing cellulase enzyme and solubilizing phosphate and known as *Streptomyces sanglieri*. Application of effective microbes will promote the plant uptake due to its ability in converting the nutrient into available form to the plant.

**087 Influence of Location and Thickness Variations on Guided Waves in Defective Carbon/Epoxy Plate**

Noorfaten Asyikin Ibrahim and Bibi Intan Suraya Murat

This paper addresses the effects of plate thickness and defect location on guided wave propagation in carbon/epoxy plates. A three-dimensional (3D) finite element model (FEM) of the plate was developed using MATLAB program codes, and simulated in Abaqus/Explicit. Referring to experimental ultrasonic C-scan images, the complex impact damage was

modelled with irregular-shaped delamination and through-thickness matrix cracks. The simulated results show that a slower arrival time signal and amplitude drop of guided wave captured behind the defective region can be used as an indicator of the impact damage. A larger scattering occurred when delamination was located closer to the plate surface. The extent of scattering gets larger especially in the direction of 345° from the excitation point. It is also observed that the impact damage can still be detected through a line scan method across the impact damage, although the wave attenuation is greater in a thicker composite plate. By investigating these factors independently, the trends of the scattered guided ultrasonic waves can be classified and perhaps will revolutionize a smart non-destructive method for composite structure in the future.

**088 Structural And Optical Properties Of Sm<sup>3+</sup> Doped B-Site Ba<sub>0.5</sub>Rb<sub>0.5</sub>LaTeO<sub>6</sub> Double Perovskites**

Zakiah Mohamed, Norazila Ibrahim,  
Muhammad Zharfan Halizan and Nur  
Syakirah Abdullah

A double perovskites Ba<sub>0.5</sub>Rb<sub>0.5</sub>LaTeO<sub>6</sub> and Ba<sub>0.5</sub>Rb<sub>0.5</sub>La<sub>0.9</sub>Sm<sub>0.1</sub>TeO<sub>6</sub> were synthesized by a solid-state reaction method. The structural properties were studied by using the X-Ray powder diffraction (XRD) and fourier transform infrared spectroscopy (FTIR). Structural analysis of XRD based on Rietveld refinement indicates that the Ba<sub>0.5</sub>Rb<sub>0.5</sub>LaTeO<sub>6</sub> and Ba<sub>0.5</sub>Rb<sub>0.5</sub>La<sub>0.9</sub>Sm<sub>0.1</sub>TeO<sub>6</sub> have cubic symmetry with space group  $Fm\bar{3}m$ . The tolerance factor of the



sample also decreases with  $\text{Sm}^{3+}$  substitution. The value obtained from tolerance factor for  $\text{Ba}_{0.5}\text{Rb}_{0.5}\text{LaTeO}_6$  and  $\text{Ba}_{0.5}\text{Rb}_{0.5}\text{La}_{0.9}\text{Sm}_{0.1}\text{TeO}_6$  was 0.994 and 0.982 respectively. The optical properties were studied using the UV visible absorption spectroscopy (UV-vis). The  $\text{Ba}_{0.5}\text{Rb}_{0.5}\text{LaTeO}_6$  and  $\text{Ba}_{0.5}\text{Rb}_{0.5}\text{La}_{0.9}\text{Sm}_{0.1}\text{TeO}_6$  was assumed to be indirect band gap and the optical band gap obtained for  $\text{Ba}_{0.5}\text{Rb}_{0.5}\text{LaTeO}_6$  and  $\text{Ba}_{0.5}\text{Rb}_{0.5}\text{La}_{0.9}\text{Sm}_{0.1}\text{TeO}_6$  were 4.1 eV and 4.3 eV respectively.

**089 Analysis the Performance of Steam Absorption Chiller at Various Operating Conditions**

Rosnadiyah Bahsan, Nor Merlisa Ali and  
Syamsul Nor Azlan Mohamad

Steam Absorption Chiller (SAC) is the main component of Cogeneration Plant which provides chilled water by utilizing the steam as system input for the cooling purpose. In this paper, the performance of a double effect lithium bromide-water steam absorption chiller was analyzed by conducting the energy and exergy analysis. An excel spreadsheet program was developed to calculate the exergy destructions within the systems and total exergy loss of the system in guiding future improvement of the plant. Various operating conditions like steam inlet temperature, chilled water inlet temperature and load factor were analyzed in detail. The result showed that the highest exergy destruction occurred at the high temperature generator followed by the absorber. Increasing the load factor, steam and chilled water inlet temperature will increase the system

performance.

**090 Finite Element Investigation on the Effectiveness of Different Insoles on Plantar Pressure Distribution**

Rezchell Chame AlySION, Solehuddin  
Shuib and Nur Faiqa Ismail

Finite Element to investigate different insole was developed to predict insole behavioral when pressure is applied onto the insole surface. Insole is a shoe insert that provides a cushion and support to human body so that it relieves foot pain and readjust human bone structure into correct posture. People who are suffering foot pain such as foot ulcer and foot deformities were caused by physical activity like walking and running. FE simulation are the best clinical tools used to investigate the effectiveness of the insole before fabricate. The major factors that affect the effectiveness of insoles are the type of material and the thickness based on the shape of insole. Only few of researchers had studied material and the thickness but none of them were studied the basic insole which is flat insole that almost commonly use in our daily life. Thus, this research is to investigate which is the best effective flat insole with different material and thickness by using Finite Element (FE), which using ANSYS Workbench V19.2 for analysis purpose. This research focused on post processing result which are Equivalent (von Mises) Stress, Shear Stress and Deformation. This research requires one male person weighs 64 kg to investigate the maximum pressure contact between foot and Plantar-Pressure Distribution (F-Scan) which is TekscanTM. Based from F-scan data, it has been found that the highest pressure

occurs at calcaneus (heel part) which recorded 192KPa. The F-Scan result data has transferred into ANSYS Workbench V19.2 simulation Analysis for investigation. Based on the FE Analysis, it can be concluded that Polyurethane with 5mm thick flat insole is the most effective insole among all types of insoles.

**091 Determination of Joint Load of Human Lower Limb by Using 2D Inverse Dynamics Modelling**

Muhamad Sharifudin Mat Intan, Mohd Afzan Mohd Anuar and Zulkifli Mohamed

Human lower limb is a major part of human body which exposed to high joint load during daily activities. The different lifestyles and cultural activities can affect the loading condition generated at the joint during motion. For instant, deep squatting is more frequently performed by Asian compared to European e.g. kneeling on tatami among Japanese and sitting position during prayer among Muslims. The aim of this research is to determine the joint load of the human lower limb during the squat lifting movement by using inverse dynamics of 2-dimensional (2D) human lower limb model. The 2D inverse dynamics modelling were used to describe and compute all the joint force reactions from the known ground reaction and lower limb kinematics. In this study, 2D human lower limb model was analysed during the squat lifting movement. Inverse dynamics computation were performed using MATLAB programming based on Newton-Euler equations to determine the joint forces and moments. The joint load at ankle, knee and hip joints for every knee

flexion angle were obtained and the maximum force at the ankle, knee and hip were 613.9, 614.1 and 596.1 N, respectively.

## **092 Additive Manufacturing of 316L Stainless Steel**

Jamaliah Md Said, Muhammad Hussain Ismail, Nurul Amilin Zainal Abidin, Nurul Ain Haris and Adila Nalisa Mohd Roslan

Additive manufacturing (AM) is a process of making parts by adding ultrathin layers of materials such as liquid, powder or sheet material layer by layer using 3D printing machine with the aid of a computer-aided design (CAD) software from 3D model data. Intricate, complex parts with graded material can be fabricated with ease. However, additively manufactured parts can vary in physical and mechanical properties with conventionally manufactured parts. In this final year project, AM was done using metal powder of 316L stainless steel alloy owing to good corrosion resistance, ductility and strength. The main objectives for this project are to fabricate 316L stainless steel using AM and to study the physical and mechanical properties of the additively manufactured specimens compared with electrical discharge machining (EDM) wire cut specimens. A standard specimen bone shaped were manufactured in accordance with ASTM E8 and followed by physical and mechanical testing. From the testing and analysis, 316L stainless steel samples manufactured via AM route have the ultimate tensile strength ranged from 514 to 520 MPa while EDM specimens ranged from 574 to 576 MPa, the yield strength of AM

specimens ranged from 385 to 390 MPa while EDM specimens ranged from 350 to 355 MPa, and the average elongation at failure of AM specimens are 45% while EDM specimens are 66%. From this project, it shows that AM specimens have comparable physical and mechanical properties with EDM specimens.

**093 Highly Porous NiO Nanoflower-based Humidity Sensor Grown on Seedless Glass Substrate via One-Step Simplistic Immersion Method**

Norfarariyanti Parimon, Mohamad  
Hafiz Mamat, Mohd Khairul Ahmad, I.  
B. Shameem Banu and Mohamad Rusop

A highly porous nickel oxide (NiO) nanoflower was deposited directly onto glass substrates by the simplistic immersion method. The nanostructural property of the NiO was studied by X-ray diffraction pattern and obtained high crystal quality after annealing at 500 °C with an average crystallite size of 15.5 nm. The optical characterization was measured by ultraviolet-visible spectroscopy with an average transmittance of 58 %. The value of 3.63 eV was estimated and confirmed as NiO bandgap energy. The current-voltage measurement result indicates that the NiO nanoflower has good electrical properties with resistance, resistivity, and conductivity value of 2.31 MΩ, 2.12 Ω.cm, and  $4.71 \times 10^{-1}$  S.cm<sup>-1</sup>, respectively. The NiO is capable of performing satisfactorily as humidity sensor with a sensitivity of 138 with the response and recovery time were estimated at 389 s and 172 s, respectively. Besides, this sensor has stability at a humidity level of 40 - 90% relative humidity.

**094 Inherent Safety in Offshore Drilling Operations**

Siti Rafidah Ab Rashid and Mohamad  
Amirul Mohamad Kamal

Inherent safety (IS) is a proactive approach for safety management during process plant design and operation. It has been proven that, considering the lifetime costs of a process and its operation, an inherently safer approach is an environmentally friendly and cost-optimal option. IS can be incorporated at any stage of design and operation. However, application of IS is highly effective at the early design stage. In this work, incorporation of IS in designing offshore oil and gas (O&G) drilling operations is successfully done to achieve risk reduction. Some of offshore hazards/concerns including highly flammable substances, possible harsh weather conditions, toxic gas i.e. hydrogen sulphide and congested platforms and rigs layout are challenging to overcome especially during emergency responses. Based on this knowledge, we intend to exploit the versatility of the principles of IS for the purpose of achieving risk reduction in relation to offshore O&G drilling operations. As for hazard identification, HAZID is chosen while relevant IS principles – “substitution”, “moderation” and “simplification” are recommended for risk reduction efforts.

**095 Blooming of Compounding Ingredients in Natural Rubber Compounds under Different Peroxide Loading**

Ummu Qani'ah Yasin, Dzaraini

Rubber compounds normally shows blooming phenomena whereby a thin layer of powdery material or films and oils formed on the surface. The blooms are usually low molecular weight compounding ingredients such as

Kamarun, Engu Zaharah Engku  
Zawawi, Noorazlina Adnan and Hairani  
Tahir

curing agents, accelerator, processing aids and activators that migrated to the surface. Excessive blooming can degrade the vulcanized rubber and reduced its quality. It is therefore necessary to determine the compounding ingredients that bloomed in an effort to reduce the effect of blooming. This study was aimed at identifying the compounding ingredients that dominate the blooming process. Sulphur, paraffin wax and zinc diethyldithiocarbamate (ZDEC) with specific functions were added as compounding ingredients in natural rubber (SMR L). Dicumyl peroxide were added as the curing agent at several loadings. The rubber compounds were cured at 150oC in the presence of dicumyl peroxide as curing agent at several loadings. They were stored under room temperature for blooming to take place. Blooms were analysed using FTIR and EDX. EDX analysis detected the major element present in the blooms to be carbon at 53.5% abundance. Similarly, FTIR results produced high intensity of C-H band at 2916 cm-1 and 722 cm-1 which are due to stretching and bending vibration of C-H paraffinic. It was concluded that paraffin wax preceded sulphur and ZDEC in blooming of SMR L.

**096 Vissim-based Simulation of Variable  
Slip Road Length Design**

Kamaruz Danial Kamaruzzaman and

Traffic congestion on highway is mainly the result of overcrowding. This phenomenon happens when a great number of vehicles storm the road,

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Siti Mariam Abdul Rahman

disrupting the smooth flow of traffic. In this study, traffic simulation using PTV Vissim software as a scenario planning tool were conducted to analyze slip road length as traffic congestion source at a selected intersection point. The intersection point was designed based on Federal Highway at KM14.8 until KM14.5 in Shah Alam. The VISSIM model was calibrated using traffic flow, delay time, average number of traffic and maximum queue length data obtained from one hour instances video recording of the respective intersection during evening peak period. Based on the field data, the average number of throughput is 1003 vehicles with an average speed of 40 m/s. The traffic condition in the area can be regarded as congested. One of the reason for congestion in this area is the proximity between in and out feed to the Federal Highway. Three different distance between in and out feed to the Federal Highway were simulated, which are 140m, 280m (baseline) and 420m. Based on the result obtained from the simulation, it can be gathered that the longer the slip road, the higher the amount of delay. However, the distance of the in/out feed has little to no effect in terms of vehicle throughput. While running the simulation, it can be observed that the delay mainly occurs due to merging and lane changing activities at the input. Nonetheless, further analysis is needed for different slip road settings to conclude congestion pattern based on road

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design.

**097 Preliminary result of development of monitoring system using the internet of things for industrial revolution 4.0**

Siti Aisyah Jaafar and Sukarnur Che Abdullah

The fourth industrial revolution represents smarter systems, faster and more optimized system of artificial intelligence, which involves control systems and sensors networks. In this paper, the concept of the Internet of Things (IoT) was applied preliminarily to create the connection between machine and the user, using a sensor, a processor such as Raspberry Pi, and IoT platform application such as Blynk in the smartphone. The simple IR 4.0 prototype system and IoT apps were developed in order to create a connection between sensors and user through the internet consisting of a temperature and humidity sensor, which is DHT11 and a Raspberry Pi 3 Model B. The smartphone application would be developed through the Blynk application for this simple prototype system. The graphical user interface GUI was built within the Blynk app and link it to the sensor which is already connected to the Raspberry Pi. The analysis that was done upon the system is by varying the stimuli to the sensors, which is a hairdryer with three levels of heat and observe the relative change of the reading of temperature and percentage of humidity on the apps. Therefore, the preliminary result shows an increase in temperature as the heat level increases. On the other hand, the percentage of humidity becomes lower as the temperature goes higher. Based on the results and the analysis, it had

shown that the IR 4.0 prototype system of IoT monitoring can connect between the sensor and the smartphone application with real-time monitoring through the internet.

**098 The use of plant-based surfactant in removal of oil from oily sludge via thermochemical cleaning method**

Siti Wahidah Puasa, Kamariah Noor Ismail, Siti Nur Sahira Daud,  
Muhammad Zamir Afiq Musman and Nur Amalina Sulong

The conventional physical treatment technologies is difficult to dewater most of water content in oily sludge during sludge dewatering process. Oily sludge removal by using surfactant via thermochemical cleaning method is recognized as one of potential method used to enhance the performance of sludge dewatering process. This study was designed to investigate the performance of anionic and cationic plant-based surfactant in removal of oil and enhanced the dewatering of oily sludge. The characterization study of raw oily sludge, SLSA and PBE surfactant were performed via TGA and FTIR. The effect of surfactant concentration was investigated based percentage of oil removal. FTIR spectra confirms the loss of transmission peak at 1636.11 cm<sup>-1</sup> for treated oily sludge was due to the loss of oil via solubilization of oil from oily sludge into surfactant solution. Results shows that the best condition for the percentage of oil removal for PBE and SLSA surfactant was 84.3% and 67.6%, respectively at PBE and SLSA concentration of 50 mg/L and 100 mg/L. It was observed that SLSA and PBE surfactant has potential to remove oil from oily sludge and subsequently contributed to enhance the oily sludge

dewatering process.

**099 Design and Analysis of a New Humanoid Robot Torso**

Norheliena Aziz, Nurul Syuhadah  
Khusaini and Zulkifli Mohamed

The development of a humanoid robot shows great significant in domestic, services and medical application. A humanoid robot is a robot with body shape resembles the human appearance so that they can adapt and aid the people to the living environment while harmonizing with people based on their similarity in appearance and size. In this project, a new torso structure design for a humanoid robot has been proposed for better performance. The humanoid robot torso design is based on the actual human-like proportion and human torso structure. A 3D model of the torso has been designed and simulated in SolidWorks software. Aluminium is used as the raw material for the humanoid robot torso. The design was analyzed using Finite Element Analysis (FEA). Simulation results show that the new humanoid robot torso structure design is more stable and stronger where the maximum displacement for previous torso design is  $9.715e-002$  mm while after improvement is  $6.783e-003$  mm. The humanoid robot parts are fabricated via Computer Numerical Control (CNC) Machining and Water Jet Cutting.

**100 The Effects of Intrinsic Parameters on the Formation of Electrospun Polycaprolactone Fibre**

Nur Aqilah Ibrahim, Nor Dalila Nor

Electrospinnig process involved strong deformations of polymer fluid at rapid fibrous structure formation within mili seconds by several influence from the distinctive spinning parameters. This

Affandi and Nurdiana Samsulrizal

study has been conducted to achieve a desirable flow rate and optimum tip-to-collector needle distance for the electrospinning of polycaprolactone (PCL). For this aim, the morphological structure of fibre spun from 10 wt% PCL solution dissolved in dichloromethane (DCM) at 0.05 – 0.20 ml/min flow rate and 10 – 15 cm tip-to-collector needle range were characterized by FESEM. The results obtained show that average diameter of electrospun PCL fibres decreases with increasing flow rate at any needle to collector distance. In addition, the tip-to-collector needle range at 15 cm produced more beads-on-string fibres compared to 10 cm distance. The fibre thickness is reduced as both of the flow and the distance of needle tip-to-collector increased. All of the obtained electrospun PCL fibres are in non-uniform, long, porous beaded fibrous structure for all flow rate and needle distance tip-to-collector values.

**101 Quantitative Risk Assessment For Two MeOH Process Route Production Plant Using Recycled CO<sub>2</sub> With HYSYS**

Zulkifli Abdul Rashid and Mohd Aizad Ahmad

A new technology of methanol (MeOH) production by using carbon dioxide CO<sub>2</sub> has changed world prospective regarding methanol production. These will contribute to the mitigation of CO<sub>2</sub> which become the major gas in greenhouse gas. The study of this paper is to use quantitative risk assessment (QRA) for this process route to determine the risk tolerance levels, its acceptability in methanol production region and comparing to the old process route which used synthesis of natural

gases. With the help of process simulators HYSYS, it can provide precise information regarding the process route at any given time. ALOHA software is implanted in this case study to help in identify the safe zone and vulnerability mapping of each of the process route. Lastly, by comparing the tolerance levels between new and old process route, it can determine which is more preferable to implemented in industrial production.

**102 Characterization of Mussel Inspired Surface Modified and Metal Chelated Polymer Membrane**

Azzah Nazihah Che Abdul Rahim and  
Muhammad Rifqi Hanif Hamzah

Modification of a membrane surface is critical to help further functional protein binding on the membrane. Mussel inspired modification and metal chelating agent grafting on the polyvinylidene fluoride (PVDF) is proposed to increase the hydrophilicity, stability, and functionality of the membrane. This study carried out a four steps modification including polymerization of dopamine, grafting with poly (ethyleneimine) (PEI) and metal chelating agent and finally metal (CuSO<sub>4</sub>) coupling. Characterization of the modified membrane was carried out using contact angle observation, permeate flux analysis, FT-IR spectrum and FESEM analysis. The results show that PDA and PEI were successfully deposited on PVDF membrane while the hydrophilicity and wettability of the modified membrane were greatly improved. Permeate flux analysis showed blockage on membrane surface due to the successful coating. Absorption peak increased slightly

showing the deposition of PDA/PEI. Successful  $\text{Zn}^{2+}$  ion coupling can be seen clearly from the FESEM analysis.

**103 Collection efficiency enhancement of cyclone filtration system**

Ahmad Hussein Abdul Hamid, Luqman  
Hakim Kamaruhen and Mohd Hafiz  
Mohd Noh

The present study focuses on improving the cyclone abatement device that is used in the agriculture and processing industries such as palm oil mill industry. The air flow trajectories are simulated and analyzed using the Computational Fluid Dynamics (CFD). Cyclones use the principle of inertia to remove particulate matter from flue gases. The current design of the cyclone is not able to collect particulate matter that is smaller than 10 micrometers effectively. This will result in negative effect to the environment as well as to the community. Thus, it is essential to modify the cyclone filters and study its effects on the overall performance of the cyclones. The principle idea of the geometrical modification is to alter the boundary layer adjacent to the inner wall of the cyclone in order to enhance the cyclone performance. The collection efficiency and pressure drop are the main factors that can affect the performance of the cyclone. The separator plates are designed in certain sizes to be placed inside the cyclone with different position. It is shown that the position of the plate inside the cyclone significantly effects the performance of the cyclone filter. The cyclone with 145 mm separator plate has shown to produce highest efficiency which is 45.23 % relative to the standard cyclone. In overall, the

separator plate significantly increases the cyclone performance.

#### **104 Characteristics Micro-plastic and Removal of Ammonia-Nitrogen in Batch Culture**

Nur Aliah Ahmad Tarmizi, Norhafezah Kasmuri and Nor Hazelah Kasmuri

Plastic waste has become a sensitive issue in the world since this material needs a longer time to degrade. This material will take a month to a thousand years to decompose. Thus, would contribute to the environment pollution, which will affect human health and aquatic life. This research study focused on the biodegradation process of micro-plastic (PE, PP, PET and PS) in the batch culture system using a colony of bacteria obtained from leachate in Ayer Hitam Landfill, Puchong. After the batch experiment of micro-plastic degradation, percentage removal of ammonia-nitrogen, chemical structure and percentage weight loss were examined and evaluated. Succeeding through the incubation of micro-plastic in batch culture for fourteen (14) days period, biodegradation was verified by the estimation of the dry weight loss. From the result obtained, dry weight loss of polypropylene (PP) is the highest (3.46%) in 14 days and polyethylene (PE) shows the greater removal of ammonia nitrogen ( $\text{NH}_3\text{-N}$ ) (44.17%). Besides that, PS micro-plastic showed a significant change in chemical structural which was obtained by Fourier Transform Infrared (FTIR). Here, two new absorption peak N-O symmetric stretch (nitro compound) and O-H bend (carboxylic acids) were present in PET micro-plastic.

Furthermore, polystyrene (PS) micro-plastic has a high percentage mass loss in the second stage of thermal degradation by Thermogravimetric (TGA) analysis. It can be concluded that; incubation time is needed to optimize the micro-plastic in the biodegradation process.

**106 Knotty Tear Phenomena and Effect of Maturation Time on Knotty Tear in Filled NR Latex Films**

Siti Aisyah Jarkasi, Dzaraini Kamarun,  
Azemi Samsuri and Engku Zaharah  
Engku Zawawi

Knotty tearing is a phenomena normally observed in reinforced black-filled natural rubber (NR) vulcanizate but not in gum NR vulcanizate. Unfortunately the underlying cause of knotty tear is still not fully understood and need to be unraveled. Many factors contribute to knotty tear behavior which include suppression of strain-induce crystallization, protein content of latex, vulcanization temperature and pre-vulcanization and post-vulcanization of latex. In this study, we concentrate on varying the maturation time during compounding process in filled NR latex (NRL) to study knotty tear behavior. The maturation time were varied in the range (0 – 72) hrs; and the tear deviation were measured to determine the extent of knotty tear phenomena. It was found that at the optimum maturation time of 24 hrs, samples show highest tearing energy and show knotty tear phenomena with the least angle of tear deviation.



**108 Optimization of Resistance Spot Welding Parameters (Single Response) by using Taguchi Method**

Nor Atirah Mat Yasin, Anizahyati  
Alisibramulisi, Zuraidah Salleh, Farizah  
Adliza Ghazali and Anuar Pawan

This study was intended to optimize the resistance Spot Welding Parameters (RSW) of sheet metals joints. The variation parameters selected were electrode force, welding current and welding time of 1.2 mm thickness low carbon steel. The settings of process parameters were conducted according to the L9 Taguchi orthogonal array in randomized way. The optimum process parameter was then obtained by using signal to noise ratio and analyzed further on the significant level by using Analysis of Variance (ANOVA). The developed response has been found well fitted and can be effectively used for tensile shear strength prediction. The optimum parameters achieved were electrode force (2.3 kN), welding time (10 cycles) and welding current (8 kA). Based on the ANOVA, it was found that the electrode force is a vital parameter in controlling the tensile shear strength as compared to welding time and welding current.

**109 Removal of Ammonia-Nitrogen and Phosphate in Leachate using a Mixed of Algae and Bacteria Culture**

Muhammad Zaidi Misni and  
Norhafezah Kasmuri

Leachate is a liquid that has been produced by the waste, especially organic waste. It is compulsory to treat the leachate before the effluent can be released into the river. This effluent needs to comply with the standard set by the Department of Environment (DOE), Malaysia. The leachate contains the high number of contaminants such as ammonia-nitrogen, phosphorus, heavy metal, biochemical oxygen demand (BOD), chemical oxygen

demand (COD) and suspended solids. This study focused on the possibility of a cheaper way to treat leachate by manipulating the ability of algae and bacteria in removing ammonia-nitrogen and phosphate in leachate from Air Hitam Sanitary Landfill, Puchong. The method started by analyzing the characteristics of the leachate sample with the in-situ and laboratory tests which were used to quantify the contaminants in the leachate. In this research, the concentration of the leachate was varied between 10%, 30%, 50%, 80% and 100% (v/v) concentration, respectively. Then, the sample was aerated to make sure that the algae and bacteria were at a suitable condition to treat the contaminants in the leachate. The reading of ammonia-nitrogen, phosphorus, nitrite-nitrogen, and nitrate-nitrogen was taken for every 3 days for 15 days to study the percentage of the removal done by the algae and the bacteria. After 15 days period, the percentage of removal of the contaminants were being analyzed using factorial design. The result showed that 50% (v/v) leachate concentration has the highest removal percentage of ammonia-nitrogen with 96.95% ammonia-nitrogen being removed from the leachate. For phosphorus, 10% (v/v) leachate concentration has the highest percentage removal which is 94.92% has been removed from the leachate. Finally, the regression equation was produced to predict the rate of ammonia-nitrogen removal without

conducting extended experiments and to reduce the number of trial experiment.

**110 Permanent Deformation of Hot Mix Asphalt (HMA) using Dynamic Modulus Simple Performance Test**

Ekarizan Shaffie

Permanent deformation is one of the common premature pavement failure which contributed to lower riding comfort for road users and high maintenance costs. Dynamic modulus Simple Performance Test (SPT) test are considered important in describing the permanent deformation of hot mix asphalt. In this study, four asphalt mixtures comprising different content of Nanopolyacrylate (NP) polymer (0%NP, 2%NP, 4%NP and 6%NP) were prepared using the Marshall method of mix design. This study was aimed to investigate the influence of the NP modified mixture on the permanent deformation of the asphalt mixtures. The Performance Grade PG64-22 was obtained by mixing the conventional bitumen (PG64-22) with nanopolyacrylate. Dynamic Shear Rheometer (DSR) at different aging condition were conducted in order to characterise the bitumen performance. While, the Simple Performance Test (SPT) was used to characterize rutting and fatigue on Marshall HMA mixes. Results from the study revealed that, NP modified bitumen has a significant effect on the dynamic and rutting resistance. The addition of nanopolyacrylate significantly enhances the rheological properties of asphalt bitumen. The results revealed that 4%NP has high potential to improve

rutting and fatigue resistance.

**111 Electrospun nitrogen-doped TiO<sub>2</sub> nanofibrous thin film using electrospinning for photovoltaic application**

Hussain Mohamed Hasaan, Abu Bakar  
Noor Fitrah, Norman Wong Fareez  
Izwan, Lim Ying Pei, Lim Ying Chin  
and Naim Mohd Nazli

This research study aims at fabrication of fine size nitrogen doped TiO<sub>2</sub> nanofiber using electrospinning method and evaluation of the performance of TiO<sub>2</sub> in a photovoltaic cell under visible light irradiation. Undoped and N doped TiO<sub>2</sub> nanoparticles were synthesized by sol gel method where titanium isopropoxide was used as the source of TiO<sub>2</sub> and ammonium nitrate was used as the source of N dopant. TiO<sub>2</sub>/PVA composite material was prepared by stabilizing TiO<sub>2</sub> particle in to 10 wt % of PVA(aq) solution in order to prepare thin film that can be coated on photovoltaic (PV) cells. Coating of solid thin film PV cells by TiO<sub>2</sub>/PVA nanofibers was conducted using electrospinning and doctor blade method. In both systems, doping the TiO<sub>2</sub> with nitrogen improved its optical properties which it successfully lowered the band gap energy from 3.14 to 2.76 eV and shifted its optical response to the visible light region. The presence of O-H stretching vibration, O-H bending and vibration of the N-Ti bond contributed to an increased performance of the PV cells. The electrospun N-doped TiO<sub>2</sub> produced better power output than doctor blade method coated PV cells with power of 0.040 and 0.026 mW, respectively.

**112 Characterization of powdered Rhizophora Mucronata bark tannins**

The effect of different drying methods using spray dryer and rotary evaporator

## extractives using different drying methods

Muhammad Muhayyidin Ahmad  
Hafizan, Abu Bakar Noor Fitrah,  
Ghazali Nurul Aimi, Sauki Arina and  
Ibrahim Wan Asma

towards the physico-chemical properties and thermal stability of powdered tannin extractives from *Rhizophora Mucronata* bark was investigated. Prior to spray drying at 130°C and rotary evaporating at 80°C, tannin was extracted using water-based boiling extraction at temperature ranging from 80 to 90°C. Powdered tannin extractives obtained by spray dryer decomposed at higher temperature (at 270°C) than those using rotary evaporator (at 210°C). The powdered tannin extractives from spray dryer was higher in thermal stability due to the high crystallinity peak appeared from X-ray Powder Diffraction (XRD) analysis. Condensed and hydrolysable tannins were also quantified using Reverse-phase High Performance Liquid Chromatography (RP-HPLC) for both methods. Powdered tannins extractives using spray dryer contained 27.8% condensed tannins and 0.001% hydrolysable tannins, in which the condensed tannins are slightly higher in concentration than those formed using rotary evaporator which was 26.5%. The findings revealed that the used of spray dryer is more beneficial to obtain a stronger thermal stability and a higher concentration of powdered *Rhizophora Mucronata* bark tannins extractives.

## 113 Cost-Effective Vision based Obstacle Avoidance System integrated Multi Array Ultrasonic sensor for Smart

A smart wheelchair (SW) is a power wheelchair (PW) consist of microcontroller, actuators, sensor, and implement the assistive technology in

### **Wheelchair**

Mohd Nor Azmi Ab Patar

system architecture. Users with severe motor impairment may realize the difficulty to operate a wheelchair when they are in a tight space such as passing a doorway or when avoiding obstacles since, they are unable to control the wheelchair. This project embarked on an obstacle avoidance system of a wheelchair. This project developed a cost-effective system that alarmed the user to avoid obstacle on its path. The prototype includes a Kinect camera and ultrasonic sensors. Kinect camera was placed at the right side of the wheelchair for real time video obstacle detection. Four of the ultrasonic sensors was used to detect obstacle at the front and one ultrasonic sensor for rear obstacle detection. Any obstacle detected by the ultrasonic sensors triggered the buzzer. Obstacle detected by Kinect camera was displayed with specific command for the user in attempt for obstacle avoidance. The performance of the obstacle avoidance system was tested indoor to detect obstacles in a controlled environment. The accuracy of the ultrasonic system was tested at a specific distance of 20mm to 200mm at 20mm intervals. Real time video received from the Kinect Camera was used to analyse the depth of the environment and the location of the object.

### **114 Verification Test of High Flap Macrofluidic Air Flow Sensor in Wind Tunnel**

This air sensor functioning to detect the speed of air surrounding while in motion or a sudden changes in its environment. The effect of fast

Mohamad Dzulhelmy Amari, Sukarnur  
Abdullah and Muhammad Imran Hafiz  
Ahmad Kamil

detection of a security sensor through the high sensitivity of the airflow sensor has enabled the system to identify and analyze the critical condition in higher accuracy compared to the conventional of any security system. Previous studies have developed the macrofluidic air flow sensor that observed the air flow in higher accuracy while the sensor in motion will be verified by detection of high sensitivity in the relative velocity of the airflow sensor compared to a conventional sensor. An experimental investigation was conducted to verify macrofluidic air flow sensor in wind tunnel by control velocity of range (30 to 110 km/h). The result shows the characterization of the changes in voltage reading with respect to the airflow speed in the wind tunnel. Sensors 1 to 4 have been placed at 0 to 360 degree of orientation with respective of 90 degree space interval.

#### **115 The Effect of the Ultrasound Transmission Across Solid-Nanocomposite Materials**

Najibah Ab Latif, Salmiah Kasolang,  
Mohamad Ali Ahmad and Mimi Azlina  
Abu Bakar

Ultrasound has been developed as a technique to determine the object and distance detected. It is quite challenging to identify and localise the defects, especially in mechanical parts. Nanocomposites namely multi-walled carbon nanotube (MWCNT), nanoclay and graphene for example which have not been explored using ultrasound method to determine better coupling performance with transducer. Ultrasonic equipment was set up to run the experiment with four main components, namely transducer, personal computer, oscilloscope and

indicator whereas to determine the reflection coefficient. Based on the result, graphene nanocomposite gave a lower value of reflection coefficient, which is 0.08299 compared to MWCNT and nanoclay. It is shown that graphene nanocomposite has better coupling performance. The differentiation of the values may be affected by roughness of the nanocomposites.

**116 The effect of condenser plate material on single slope solar still productivity under Malaysian climate**

Zainal Abidin Kamarul Baharin, Nik  
Rozlin Nik Mohd Masdek and Afandi  
Saputra Ady Santosa

Access to fresh water is a problem faced by both developed and under developed nations. Although seawater is plentiful, large amounts of energy is required to separate the potable water from the salts. Compared to other desalination processes utilising fossil fuels, solar distillation is inexpensive, environmentally friendly and employs clean and renewable energy. This paper aims to investigate the effect of the single slope solar still condenser plate material on the still production under Malaysian climate. Results showed that the still with 5 mm thickness extra clear float glass condenser plate yielded the highest amount of fresh water (63.9 ml) as compared to 2 mm thick clear float glass and 5 mm thick bronze glass.

**117 A Preliminary Study on the Effect of Natural Fiber (NF) Mix on Mechanical Strength of NF Plastic Composites (NFPC)**

Dzaraini Kamarun, Engku Zaharah

Natural fibers from plants such as kenaf, flax, jute, pineapple leaf, luffa, coconut coir and many others are gaining importance and may substitute wood in the production of wood plastic composites (WPC). As such WPC



Engku Zawawi, Nur Hikamah Seth,  
Norlaily Ahmad, Siti Rafedah Abdul  
Karim and Raja Roslan Raja Mohamed

would be replaced by Natural Fiber Plastic Composites (NFPC). Furthermore to ensure continuity of fiber supply and sustainability of NFPC industries, fibers of various types could be mixed together to obtain Mix NFPC. However, research need to be carried out to identify the contribution of different fiber type collectively to the mechanical properties of Mix NFPC. In this study, preliminary work on the use of kenaf, sugar palm and pineapple leaf fibers in the preparation of Mix NFPC were carried out. Four different fiber mix samples with different fiber ratio and size were formulated using polypropylene (PP) as the matrix polymer. MMT filler were added at constant amount for enhancement of composite properties. Samples were prepared via mini injection moulding. Generally, it was found that addition of fiber mix at 50% fiber loading enhance the tensile and flexural strength of the various NFPC with minimal exceptions. The impact strength of the composites were comparable to that of blank PP implying that addition of fiber gives additional advantage besides being eco-friendly. It was also found that higher kenaf loading and different size of fiber mix contribute positively to the various strengths measured. In addition to that, composition of individual fibers also contribute to the mechanical properties of the NFPCs.

**118 Thermogravimetric analysis of various ratio of blended phenolic and epoxy composites**

Mohammad Asim, M Jawaid, Paridah Tahir and M Nasir

Present research deals with the various ratio (0%, 40%, 50%, and 60% by wt%) of phenolic resin and epoxy resin blend composites. Phenolic resin/Epoxy resin blend composites were manufactured by hand lay-up technique and investigated the thermal properties (thermogravimetric analysis) of composites and evaluated optimum ratio of epoxy in phenolic composites. The residual content of pure phenolic was very high however the pure epoxy showed least thermal stable. After blending phenolic resin in epoxy resin, the thermal properties of epoxy/phenolic composite improved.

**119 Comparative study of thermal properties between nanocrystalline cellulose and cellulose nanowhisker**

Lau Kia Kian and Mohammad Jawaid

Nanocellulose is a renewable and sustainable biomass product which could be derived from natural fibers for various applications. At present study, nanocrystalline cellulose (NCC) and cellulose nanowhisker (CNW) are extracted from roselle fiber through different combination of acid hydrolysis and ultrasonication processes. The thermal properties of both types nanocellulose are compared in order to study their different decomposition behavior towards high temperature. From thermogravimetric analysis (TGA) results, NCCs (255.8°C-274.1°C) had significantly lower decomposition temperature than that of CNWs (318.3°C-326.8°C), particularly those extracted under mild condition of the combined processes. Meanwhile, the decomposed CNW product left high

amount of residue and low weight loss when comparing to the NCC product, signifying that the rigidity structure of CNWs are strong for heat tolerance. However, under harsh condition of the combined processes, the derivative thermogravimetric (DTG) curve revealed decrement in peak decomposition temperatures for both NCC and CNW products. This was in line with the sequential occurrence of endothermic and exothermic behaviors as presented in differential scanning calorimetry (DSC) curve analysis. Hence, optimal condition was necessary for extracting nanocellulose product that able resist to high temperature. As evaluated from the overall comparative results, CNW could be utilized as a promising reinforcing agent for composite materials fabrication.

**120 Polymerization of Lactide to Polylactic Acid by Using Homogenous and Heterogenous Catalysts**

Norliza Ibrahim and Alia Syazana  
Mohamed

Replacing non-biodegradable to degradable polymers are very much in concern due to reduction of petroleum supply, environment and economical related to waste disposal. Polylactic acid (PLA) shows a promising alternative to produce biodegradable plastic. The polymerization happened in homogenous phase where the catalyst, mostly used tin octoate, and the lactide are mixed in liquid phase to form PLA. However, this method become problematic for the product because the catalysts remain with the PLA and the degradation of catalyst occurred.

Therefore, this study aims to convert the homogeneous catalyst to heterogeneous using ceramic waste as the support and to characterize the PLA produced by using Ultraviolet Visible (UV-Vis) Spectrometer and Fourier Transform Infrared Spectroscopy (FTIR). The experiment was carried out at different temperatures which were 110°C, 120°C and 130°C. From the results obtained, the highest concentration of PLA produced is at temperature of 130°C by using heterogenous catalyst. Therefore, it can be concluded that heterogeneous catalyst can be a new method of producing PLA.

**121 Resistance Spot Weld assisted with Adhesive Bonding**

Farizah Adliza Ghazali, Zuraidah Salleh, Norazwani Mohd Zain, Ya'Kub Md Taib and Aidah Jumahat

This paper presents an experimental investigation of the weld bonding of low carbon steel (JIS G3141) together with adhesive layers to increase the mechanical properties of weld bonding. Epoxy adhesive was used in this research applied on the sheet thickness of 1.2 mm. The weld-bonding was carried out by applying layer of adhesive followed by resistance spot welding on surface samples. The relative properties and characteristics of the resulting weld-bonded-adhesive joints are evaluated and compared with the conventional spot-welding through tensile-shear, peel, hardness tests and macro-etching observations. The strength of weld bond joints were calculated and compared with those in

as-weld and adhesive-bond joints. Results showed that the strength of weld-bond adhesive is higher than as-weld specimen. The hardness distribution of weld bond adhesive joints were investigated, at three regions ie. base metal (BM), the heat-affected zone (HAZ), and the fusion zone (FZ) using micro-hardness Vickers machine. It can concluded that the presence of adhesive does not affect the hardness of weld-bonded. From macro- etching observation, the layer adhesive influenced the weld bond via the size nugget of weld-bonded which is smaller than as-weld. The introduction of adhesive layer in spot welding improves the joint strength and quality of spot weld.

**122 Mechanical characterization of Epoxy filled with seed shells as reinforcement**

Anizah Kalam, Fauziah Md Yusof,  
Zahurin Halim and Zuraida Ahmad

The use of natural fiber composite has been widely promoted in many industries such as construction, automotive and even aerospace. Natural fibers can be extracted from plants that are abundantly available in the form of waste such as sunflower seed shells (SSS) and groundnut shells (GNS). These fibers were chosen as the reinforcement in epoxy to form composites. The performance of composites was evaluated following the ASTM D3039 and ASTM D790 for tensile and flexural tests respectively. Eight types of composites were prepared using SSS and GNS fibers as reinforcement and epoxy as the matrix with the fiber content of 20wt %. The fibers were untreated and treated with

Sodium Hydroxide (NaOH) at various concentrations (6%, 10%, 15%, and 20%) and soaking time (24, 48 and 72 hours). The treatment has successfully enhanced the mechanical properties of both composites, namely SSS/epoxy and GNS/epoxy composites. The SSS/epoxy composite has the best mechanical properties when the fibers were treated for 48 hours using 6% of NaOH that produced 22 MPa and 13 MPa of tensile and flexural strength respectively. Meanwhile, the treatment on groundnut shells with 10% sodium Hydroxide for 24 hours has increased the Flexural strength tremendously (53%), however no significant effect on the tensile strength. The same trend was also observed on the tensile and flexural modulus. The increase of 41% in flexural modulus after treatment with 10% NaOH for 24 hours was also the evidence of mechanical properties enhancement. The evidence of improved fiber and matrix bonding after fiber treatment was also observed using a scanning electron microscope (SEM). The SSS/epoxy composites performed better in tensile application, meanwhile the GNS/epoxy composites are good in flexural application.

**123 Single Edge Notch Bend (SENB) of Kenaf/Fibreglass Hybrid Composites**

Syarifah Yunus, Zuraidah Salleh,  
Ya'Kub Md Taib, Nik Rozlin Nik Mohd  
Masdek and Zainal Abidin Kamarul

Kenaf has known for many years as a typical crop that can be used in various applications such as in automotive, building structure and etc. Along with the depletion and environmental issues raised nowadays by excessively use of man-made synthetic fibres make the

Baharin

natural fibre becoming popular and favourable to be implemented. This paper come out with the development of long kenaf fibre reinforced polyester matrix composite. Total weight of about 40% fibre fraction was selected. In this study, the addition of about 10% weight fraction of fibreglass in the composite system is needed in order to strengthen the composite materials and also to retain its reliability and robustly in the applications applied. Thus, preparation of two different layer arrangement of kenaf and fibreglass were conducted viz. (i) kenaf at inner layer and fibreglass at outer layer ([0o90o]K/FG2p/[90o0o]k[0o90o]K) (ii) kenaf at outer layer and fibreglass at inner layer (FG/[0o90o/90o0o]K/FG). All type configurations samples were fabricated by hand lay-up and cold press technique. Fracture toughness testing was carried out using single edge notched bend specimens at loading rate of 10mm/min. All samples prepared according to ASTM D5045 (Standard Test Methods for Plane-Strain Fracture Toughness and Strain Energy Release Rate of Plastic Materials). Results obtained from SENB test were then evaluated and discussed. It can be used as a guideline or reference for further research on this polymer composites.

**124 Post Impact Tensile and Single Edge Notch Bending Test of Kenaf Hybrid Composite**

Syarifah Yunus, Zuraidah Salleh,  
Ya'Kub Md Taib, Nik Rozlin Nik Mohd  
Masdek and Muhammad Faris Che  
Hassan

The improvement of elite building items produced using regular assets is expanding around the world due to renewable and ecological issues. Among the wide range of characteristic assets, kenaf plants have been broadly abused in the course of recent years. The aim of this research is to develop long kenaf composites and long kenaf with woven glass reinforced polyester resin composites. Tensile test helps to determine how the material will react to forces being applied in tension. The test that was conducted included Post Impact Tensile test and Single Edge Notch Bend. Tensile test determines strain-stress while single edge notch bend determines the fracture of the specimen. The experiment was conducted using Universal Testing Machine (UTM) to find the mechanical properties. The experiment considered ASTM D3039 for tensile test and ASTM D5045 for single edge notch bending. From there, the damage area of the composites could be predicted. Meanwhile, it showed the best configuration for the newly developed material in impact test. So, these hybrid composites are viable to be extended into a newly developed material for further investigation.



**125 Stress Analysis of a Patient-specific  
Socket Design during Gait Cycle**

Mohd Nor Azmi Ab Patar

Transibial amputation is one of the common surgical procedure involved removal of lower limbs specifically below the knee. The need of amputation was caused by major accidents or diseases. Prosthetic socket was an important part as it kept the residual limb in place. It should allow amputee to perform daily activities without caused any pains. Most amputees reviewed the socket's design caused pain on their residual limb. This project was purposed to analyse the pressure distribution on the prosthetic socket design. Design of the socket was based on stump's condition which verified from the hospitals. Autodesk Meshmixer software was used to remodel the socket design from 3D Computer Aided Design (CAD) data of real stump. Pressure sensors measured the pressure exerted due to contact between socket and stump. The measured pressure distribution was analysed according to the pressure tolerant and sensitive areas to avoid the uncomfortable pain. The simulation of socket design was simulated using Finite Element Method (FEM) in ANSYS Static Structural. FEM indicated the behaviour of the socket during static and dynamic condition. Then, prosthetic sockets were fabricated in-house manufacturing process based on Fused Deposition Modelling (FDM) technology using 2.85-mm filament of polyamide nylon (PA). Thus, the tensile properties of the nylon socket material were determined

according to ASTM D638. The evaluated stress was 11.30 MPa at the mid-stance that proved the material was highly strength to support the load. The structural integrity of the complete prosthesis socket should be investigated according to ISO 10328 for future improvement.

**126 Flexural and Izod Impact Properties of Sugarcane Powder Reinforced Epoxy Composite**

Siti Norazlini Abd Aziz, Muhaimin  
Kamarul Bahrain and Mimi Azlina Binti  
Abu Bakar

Currently, the studies of the mechanical behaviour of natural fibre composites have become influential among researchers due to its environmentally friendly, useful by-product and cheap. Due to this it becomes a potential material to be included in the composite materials as a reinforcement. The aim of this study is to investigate the mechanical properties of sugarcane powder reinforced epoxy composites under flexural and Izod impact tests. The sugarcane powder was processed using the crushing machine and planetary mono mill machine and it was added into the epoxy matrix with four different compositions (5 vol%, 10 vol%, 15 vol%, and 20 vol%). The morphological surfaces of the composite after the mechanical tests were observed using a Scanning Electron Microscope (SEM). It was found that the impact strength of the composites decreased with the increase of powder compositions with a range of between 5.7 kJ/m<sup>2</sup> to 2.7 kJ/m<sup>2</sup>. The flexure modulus, on the contrary, showed an increment trend with the increase in powder loading with a modulus ranged in between 757 MPa to

1208 MPa. The potential of this natural fiber have significant contribution on the properties of natural fibres polymer composites. Natural waste consumption of sugarcane fiber could decrease the usage of synthetic polymers and provide the environmental friendly material for further application.

**127 The Corrosion Behaviour of Co-Ni-Fe Coating in Different pH Environment**

Nik Rozlin Nik Mohd Masdek,  
Muhammad Naufal Othman, Zuraidah  
Salleh and Zainal Abidin Kamarul  
Baharin

This study aims to produce a Co-Ni-Fe alloy coating on a mild steel hollow cylinder shape by electrodeposition process and analyze the effect of different pH on the corrosion performance of the alloy coating. During the electrodeposition process, the temperature and time are set to 50°C and 30 minutes, respectively. Different pH value consisting of pH 2.1 (strong acid), 5.2 (weak acid), 6.9 (neutral), 8.4 (weak alkali) and 12.3 (strong alkali) are used. From the results obtained it was found that the deposited Co-Ni-Fe alloy has excellent corrosion performance. Corrosion rate obtained for strong acid, weak acid, neutral, weak alkali and strong alkali are 5.88 mmpy, 2.95 mmpy, 1.17 mmpy, 2.16 mmpy and 5.72 mmpy, respectively. Hence this studied showed that Co-Ni-Fe coating alloy could be used as an alternative to prevent against corrosion due to its high corrosion resistance as well as high microhardness.

**128 Flexural strength, fracture and impact toughness analysis of kenaf/woven fibreglass polyester composite**

Zuraidah Salleh, Sahril  
Khusairi, Syarifah Yunus, Yakub Md  
Taib and [Anizah Kalam](#)

Natural fibres may be obtained from plant, animal and mineral sources. They are becoming a promising high potential reinforcement material for composites and thus have drawn attention from many researchers. Apart from their well-known benefits such as environmental friendly, low cost and easily available compared to synthetic fibres, they also have low density, minimal abrasive wear to machinery, biodegradability, high specific strength and modulus and can be recycled thermally. In recent years, kenaf fibres have appeared as one of the outstanding materials being used in the textile, building, plastics and automotive industries. Since natural fibres cannot stand alone to suit in a heavy application, in this study, long kenaf fibres was hybridized with woven fibreglass. The fabrication of natural fibre kenaf/woven fibreglass unsaturated polyester composites was involved by using a combination of hand lay-up and cold-press methods. A sandwich configuration with the skin being glass fibre and the core made of kenaf fibre is used. The flexural strength, fracture and impact toughness were further analyzed and it was found that fibreglass is the dominant element which strengthens the composite and also enhanced the impact and fracture toughness of them.

**129 The Effect of The Jute Fabric Reinforced Vinyl Ester Composite Treated with Ammonium Polyphosphate on The Physical, Flammability and Thermal Properties**

Khairul Naseem Mohd Rodzi and Mohd Iqbal Misnon

Natural fibre composite is potentially used as low load bearing material in building infrastructure field (light weight application). Nevertheless, the ability of materials against thermal and fire must be good. In this work, the incorporation of the phosphorus based intumescent flame retardant (IFR), ammonium polyphosphate (APP) into the jute fabric composite (JC) with different formulations were fabricated to analyze its fire-retardant properties. The physical, flammability and thermal properties of the untreated and treated composites were investigated with the support by FESEM and EDX analysis. Based on the results, the density of treated JC was higher than untreated sample due to the impregnation of APP. In terms of fire-retardant properties, the JC samples treated by APP were able to improve the thermal and flammability of the composites. The enhancement of fire-retardant properties of JC can improve its potential to be used as low load bearing material in building infrastructure applications.

**130 Quantifying the Tensile Properties of Hevea brasiliensis – Silicone Biocomposite using Neo – Hookean Model**

Noorainol Faiz Noor Haris, Jamaluddin Mahmud and Mohd Azman Yahaya

Incorporation of natural fibers into composites have been continuously researched in moving towards a greener environment. As environmental issues such as climate change and global warming is becoming severe, green technology is one of the ways to reduce it. Hevea brasiliensis or commonly called rubber tree produced a lot of sawdust during the conversion of the

raw material into product. The sawdust is known as an agricultural waste which has no economic value. Therefore, this study for the first time attempts to utilize the *Hevea brasiliensis* sawdust by incorporating it with silicone rubber in the making of a new biocomposite material. The samples were prepared in two weight compositions, 0 wt% and 16 wt% in accordance to ASTM D412. Tensile properties of biocomposite was then determined using 3382 Universal Testing Machine 100kN (Instron, U.S.A., 2008). Neo Hookean hyperelastic model was employed where the material constant, C1 values were obtained. The graph plotted shows that the hyperelastic model used can mimic the deformation behavior of silicone biocomposites. The material constants are observed to increase as *Hevea brasiliensis* fiber are introduced into it. Hence, it can be concluded that pure silicone rubber has higher tensile strength compared to 16 wt% *hevea brasiliensis* – silicone biocomposite and the addition of fiber increase the stiffness properties of material produced.

**132 In Vitro Mutation of Capsicum annum L. var. Kulai by GammaRadiation**

Shamsiah Abdullah, Nur Amalina Farhana Shariffudin, Norumaimah Omar, Abdul Rahim Harun and Shuhaimi Shamsudin

The present work was carried out to study the effects of gamma radiation on in vitro regeneration of *Capsicum annum* L. var Kulai. Seeds of *C. annum* were irradiated with various doses of gamma ray (0, 20, 40, 60, 80, 100, 200, 300, 400, 500, and 600 Gy) and grown on MS medium without hormone to obtain hypocotyl and

cotyledon for in vitro regeneration. Seed germination rate revealed significant variation between treatment, and it started to germinate between 6 to 17 days. Seed exposed between 0-60 Gy were germinated in less than 10 days. A total of 50 explants including hypocotyl and cotyledon were cultured on MS medium with different concentrations of BAP in combination with AgNO<sub>3</sub> to observe the response of these explants to different hormones concentrations. Almost 90% of both explants in all treatments induced callus. Callus formed were greenish friable, greenish compact, yellowish watery, yellowish friable and yellowish compact. Callus in some treatments also produced unique colors such as purple, bright yellow and yellowish orange. Shoot regeneration was observed in treatment between 40-100 Gy. In conclusion, gamma radiation gave significant impact on germination, seedling growth and in vitro callus formation and shoot regeneration of *Capsicum annum* var. Kulai.

**134 The Effects of Dimethicone Crosspolymer on Porous Silicone and Biomaterial**

Nur Nabila Mohd Nazali, Farah Nur  
Aisha Mohammad Nasir and Nor Fazli  
Adull Manan

Bio pad wound dressing is one of the current material in wound healing technology. This aim of this paper is to study the effects of dimethicone cross polymer on the biomaterial and to investigate the mechanical properties of the bio pad by the integration of experimental and numerical approach. In vitro uniaxial tensile test was performed to compute the stress-stretch response of the materials using ASTM

D412 standard. The determination of material constants for the materials via numerical approach can be done by comparing with two hyper elastic constitutive models (Ogden and Neo-Hookean). The results show that Ogden's exponent and coefficient for the subject estimated to be ( $\mu = 0.434$  MPa,  $\alpha = 1.299$  MPa) for Sample 1, ( $\mu = 0.428$  MPa,  $\alpha = 1.424$  MPa) for Sample 2, ( $\mu = 0.463$  MPa,  $\alpha = 1.256$  MPa) for Sample 3 and ( $\mu = 0.633$  MPa,  $\alpha = 1.001$ ) for Sample 4 respectively. Meanwhile, value of material constants for Neo Hookeen were estimated to be ( $C = 0.00814$  MPa), ( $C = 0.0121$  MPa), ( $C = 0.00597$  MPa) and ( $C = 0.00739$  MPa) for Sample 1, Sample 2, Sample 3 and Sample 4 respectively. Therefore, this study could be useful in future studies in analysis of healing especially in dermatology area.

**136 Investigation On The Qausi-Static Indentation Behavior Of Nanoclay-Toughened Chopped Carbon Fibres Composites**

Aidah Jumahat, Adila Nalisa Mohd Roslan, Napisah Sapiai and Husna Zaemah Ramlan

This paper presents the Quasi Static Indentation (QSI) behavior of the chopped carbon fibres composites with 3 different loading of nanoclay. The composites, which are CF, 1NC-CF, 3NC-CF and 5NC-CF were prepared using hand lay-up method. While, the nanoclay was dispersed using three roll mill machine. The 10 wt% of chopped carbon fibres with 3-5 mm length were used in fabricating these composites. The QSI test was conducted using Universal Testing Machine according to



the ASTM standard D6264. The damage section was identified using optical microscopy. Results showed the energy absorb was increased with addition of nanoclay up to 81.42 %, 137.69 % and 202.95 % for 1NC-CF, 3NC-CF and 5NC-CF composites, respectively. It was concluded that the addition of the nanoclay enhanced the QSI of chopped carbon fibres composites.

**137 Slurry Pot Erosion Wear of  
Nanoclay-modified Short Fiber  
Reinforced Polymer (SFRP)  
Composites**

Aidah Jumahat, Nurul Ain Haris, Fatin  
Najwa Che Mohamad

The present study aims to investigate the influence of nanoclay modification on slurry pot erosion wear behavior of different types of short fiber reinforced polymer (SFRP) composites. Epoxy matrix modified with 5wt% nanoclay was fabricated using high shear three roll milling mixing system at 60°C and 12.7 m/s speed. Two short synthetic fibers and two short natural fibers were used as reinforcements, i.e. carbon, glass, basalt, and kenaf. Slurry pot erosion wear tests were conducted using mixture of sand and water as erosives, running at 300rpm speed for 10km sliding distance. The results showed that all fiber reinforcements have improved erosion wear behavior of epoxy polymer with basalt reinforced polymer composite showing the best performance among all SFRP composites. The addition of 5.0wt% nanoclay filler also had reduced the specific erosion wear rate of the SFRP composites. Nanoclay had significantly improved wear rate of glass fiber reinforced polymer composites up to

53.68% compared to its pure state. Basalt fiber was also found to be a potential alternative to synthetic fiber; i.e carbon and glass fiber, based on its lowest wear rate among all pure SFRP and nanoclay-modified SFRP composites.

**138 Impact Properties of Nanomodified Basalt Fiber Reinforced Polymer Composites**

Nurul Emi Nor Ain Mohammad, Aidah Jumahat, Anthony Arthur, Mohd Fadzli Bin Ismail

Basalt fibre reinforced polymer composite is a newly versatile material that has good potential to be used in many applications due to its high specific modulus and strength properties. This paper is aimed to evaluate the response and properties of BFRP composite when it is subjected to low-velocity impact loading. The BFRP laminates were fabricated using vacuum bagging method. The effect of 5, 10 and 15wt% nanosilica particles on density, impact load and energy absorbed was investigated using a drop weight impact test. The damage characteristics of the samples were examined using an optical microscope. The results show that the addition of 15wt% nanosilica significantly improved the energy absorption properties of the specimens. This suggests that the nanomodified BFRP composite has better damage resistance properties when compared to the pure system.

**139 Chopped Carbon Fiber Reinforced Polymer Composites : Effect of Nanoclay on Adhesive and Abrasive Wear Properties**

Aidah Jumahat, Norhashidah Manap,  
Anis Adilah Abu Talib, Tg Faizuddin  
Tg Mohd Azmi

The present work investigates the wear properties of nanoclay-modified carbon fiber reinforced polymer (CFRP) composites when sliding under adhesive and abrasive wear. The specimens were fabricated using epoxy resin, short carbon fiber, and nanoclay filler of 1.0wt%, 3.0wt%, and 5.0wt% content. The wear test was conducted using pin-on-disc and abrasion resistance test rig for adhesive and abrasive wear condition respectively. Operating parameters were fixed at 30N load, 300rpm speed and 10km distance for both tests. Pure CFRP composite exhibited lower wear performance compared to pure epoxy in both test conditions. However, with nanoclay incorporation, the wear properties of CFRP composite have improved up to 55.68% and 44.03% under adhesive and abrasive wear respectively. Therefore, the composite reinforced polymer of carbon fiber and nanoclay filler in epoxy matrix provides a synergistic effect under adhesive and abrasive wear conditions. The experimental findings suggest that the CFRP composite has the potential for tribological components' application such as sliding-contact and rolling-contact bearings.

**140 Flexural Properties of Chopped Kenaf and Carbon Fibre Reinforced Polymer Composites Embedded with Carbon Nanotubes**

Ummu Raihanah Hashim, Aidah  
Jumahat, Nur Syarah Iffah Azizi

An experimental study was performed to investigate the flexural behaviour of chopped kenaf and carbon fibre reinforced polymer composites embedded with carbon nanotubes (CNT). The fibre content in the composites was 10 wt.% with three different CNT loadings, which were 0.5wt.%, 1.0wt.%, and 1.5wt.%. The CNT were dispersed in the epoxy resin using the mechanical stirrer and three-roll mill machine and mixed with the chopped fibres before being poured into the designated mould. Three-point bending tests were conducted with a specimen thickness and width of 4 mm and 10 mm, respectively, and a standard specimen length of 20% longer than the support span. The flexural test results showed that the chopped carbon fibre reinforced polymer (CFRP) with 0.5wt.% CNT exhibited the highest flexural strength and modulus (42 MPa and 2.9 GPa, respectively) compared to other composites with 1.0wt.% and 1.5wt.% CNT loading. The chopped kenaf fibre reinforced polymer (KFRP) composite with 0.5wt.% CNT loading showed the highest increase in the flexural strength and modulus, at 30 MPa and 2.8 GPa, respectively. Hence, it was concluded that the addition of CNT improved the flexural properties and 0.5 wt.% CNT was the ideal loading to enhance the flexural properties of chopped fibre-reinforced polymer composites.

**141 Wear Behavior of Short Glass Fiber Reinforced Polymer Composite With Nanoclay Modification**

Aidah Jumahat, Jamaliah Md Said,  
Tengku Faizuddin T Mohd Azmi,  
Mohamed Adzummar Hakim Abdull  
Adziz

This study is aimed to evaluate the effect of nanoclay incorporation on wear properties of short glass fiber reinforced polymer (GFRP) composite. 1.0, 3.0 and 5.0wt% of nanoclay were dispersed into the epoxy resin using a three-roll mill machine. The fibers were dispersed using mechanical mixer machine. Dry sliding and abrasive wear test were conducted using pin-on-disc and abrasive resistance tribometer. The tests were conducted at 30N load and 300rpm speed for 10000m sliding distance. The addition of nanoclay filler in epoxy polymer has shown improvements towards wear properties of GFRP composite, up to 65% and 45% under dry sliding and abrasive wear respectively. The nanoclay is believed to improve the microstructural strength leading to better load carrying capacity of the composite, advancing its effect as secondary reinforcement to the polymer composite.

**142 Enhancing The Mechanical Properties Of Chopped Basalt Composites By Incorporating Of Multiwall Carbon Nanotubes**

Aidah Jumahat, Ilya Izyan Shahrul  
Azhar, Napisah Sapiai, Noor Farizza  
Romli and Mohamad Aizat Aminuldin

This study aims to develop and determine the mechanical properties of chopped basalt composites modified with multiwall carbon nanotubes (CNT). Chopped basalt composite modified with CNT was fabricated by a combination of mechanical stirring and hand layup process. Three different weight percentages of CNT i.e. 0.5, 1, 1.5wt. % were modified into epoxy resin before mixing with chopped basalt fiber. The mechanical performance such as tensile properties and fracture

toughness behaviour of chopped basalt composites were conducted using Universal Testing Machine in accordance to ASTM standard D368 and D695, respectively. The results show that the incorporating CNT enhanced tensile and fracture toughness properties of the CBFRP composites. However, a higher amount of CNT incorporated (1.5CNT- CBFRP), the tensile strength, tensile modulus and Gic were decreased by 4.40%, 2.46% and 30.36 % as compared to 1.0CNT-CBFRP

**143 Impact Response of Glass-Aluminium  
Fibres Metal Laminates: Effect of  
Fibre Architecture**

Masaki Hozumi, Aidah Jumahat,  
Napisah Sapiai

This paper investigates the drop weight impact behavior of glass fibre-aluminum (GFRP-AL FML) composites. The purpose of the research is to study the effect of different type glass fibres i.e woven and unidirectional with existence Al sheet in the middle of the glass fibre reinforced polymer composites (GFRP).The impact behaviour of these GFRP and GFRP-AL FMLs was conducted using a drop-weight impact tower at three different energy level, which are 10J, 20J and 30J. The Load - deflection curves were used to obtain the absorbed energy. The results showed that the woven type of GFRP exhibited higher peak load but lowest deflection thus reducing the total energy absorbed. In contrast, the unidirectional types of GFRP possessed lowest peak load and higher deflection, which make them the highest energy absorbed. In GFRP-AL FML

composites, the energy absorbed obtained almost similar for both woven and unidirectional types. This is believed due to poor adhesion between the GFRP and Al sheet, thus make both materials separated when subjected to impact load. The optical analysis showed that the GFRP-AL debonding, fibres breakage, fibres delamination and matrix cracking as the main impact energy –absorption mechanism.

**144 Quasi-Static Indentation Properties of Woven and Unidirectional Glass-Aluminium Fibre Metal Laminates**

Aidah Jumahat, Muhammad Naim Najib and Napisah Sapiai

In this study, the effect of fibre arrangement and aluminium thin sheet on quasi-static indentation properties of fibre metal laminates (FML) based on glass fibre reinforced polymer composite (GFRP) and Aluminium (Al) was investigated. The woven and unidirectional types of glass fibre prepreg and 0.5mm, 1mm and 2 mm of Al sheet thickness were used in fabrication of Glass fibre- Al FML systems. The GFRP and FML samples were produced using combination of hand lay –up and hot press methods. Quasi-static indentation test were performed according to ASTM D6264. The results show that the woven type of GFRP and FMLs had highest energy absorb as compared to unidirectional of GFRP and FMLs. It was observed that the in woven type of GFRP and FMLs, the matrix cracking and fibre breakage/delamination triggered in weft and wrap direction, which showed diamond-shaped damage. While the surface damage of unidirectional GFRP and FMLs were constructed only in

single axis orientation which lateral with the direction of the fibre. The FML2 systems for both woven and unidirectional, which used 2mm thickness of Al exhibited the highest energy absorbed among the FMLs. The FMLs absorbed more energy when the thicker Al sheet was used.

**145 Effects of kenaf and basalt face sheets modified nanosilica of closed cell aluminium sandwich panel**

Nurul Emi Nor Ain Mohammad, Aidah  
Jumahat, Napisah Sapiai

Sandwich structure made of metal sheet and foam core is widely used in various industries due to its excellent energy absorption and impact resistance properties. Recently, fiber reinforced polymers (FRP) such as carbon fiber reinforced polymer and glass fiber reinforced polymer have been used in sandwich panel as a face sheet. The addition of filler into FRP system are expected to enhance the mechanical properties and improve the specific strength of the resulted FRP. This paper presents the impact response of silica nanoparticles filled kenaf fiber reinforced polymer (KFRP) and basalt fiber reinforced polymer (BFRP) as a facesheet in sandwich structure. A series of nanocomposites, with 5wt%, 13wt% and 25wt% of silica nanoparticles were fabricated using mechanical stirrer. KFRP and BFRP as a facesheet were fabricated using vacuum bagging method. The impact response of closed cell aluminium foam and natural FRP sandwich panel haf been investigated. The damage modes observed are fiber fractures at upper and lower face sheets, delamination between kenaf-nanomodified epoxy



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layers, basalt-nanomodified epoxy  
layers and aluminium core shear  
fractures.

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