



LEADING THE WAY
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AN INTERNATIONAL AWARD-WINNING INSTITUTION FOR SUSTAINABILITY

KULLIYAH OF ENGINEERING

CERTIFICATE OF PARTICIPATION

This is to certify that

DR. RUDI KURNIAWAN ARIEF

has presented a paper titled

ANALYSIS OF THE ADJUSTING BOLTS SYSTEM'S CONTRIBUTION TO LEVELLING ERROR OF THE HEATED BED IN FDM 3D PRINTER

at the

**5TH INTERNATIONAL CONFERENCE ON ADVANCES MANUFACTURING AND MATERIALS ENGINEERING
(ICAMME '22)**

9th – 10th August 2022,

International Islamic University Malaysia, Kuala Lumpur

ASST. PROF. DR. AHMAD ZAHIRANI AHMAD AZHAR
CHAIRMAN
ICAMME 2022

ASSOC. PROF. DR. SANY IZAN IHSAN
CHAIRMAN
IIUM ENGINEERING CONGRESS 2022



5th International Conference on Advances Manufacturing and Materials Engineering (ICAMME '22)

MESSAGE FROM THE CHAIRMAN

ICAMME 2022



Dr. Ahmad Zahirani Ahmad Azhar

Chairman

5th International Conference on Advances
Manufacturing and Materials Engineering
(ICAMME 2022)

Assalamualaikum warahmatullahi wabarakatuh,

On behalf of the organizing committees, I would like to extend a warm welcome and greeting to all participants attending ICAMME 2022. This conference is organized as a part of KOE IIUM Congress 2022 together with the 8th International Conference on Mechatronics Engineering (ICOM'22), 6th International Conference on Mathematical Application in Engineering (ICMAE'22), 5th International Conference on Engineering Professional Ethics and Education (ICEPEE'22) and 1st International Conference on Civil Engineering (ICCE'22).

The aim of this conference is to provide a platform for knowledge sharing and interchange among researchers, academicians and industrial expertise in terms of current research and development especially in the advancement of knowledge in Manufacturing Engineering and Materials Engineering.

I believe that this conference will lead to a broad discussion, generate new ideas scientifically and at the same time will create a strong 'ukhuwwah' among the participants.

I would like to express my deepest gratitude to our sponsors; Buildtest Laboratory Sdn Bhd and Deer Hills Publication for their generous contribution.

Last but not least, I would like to extend my special appreciation to all committee members who had worked so hard in making this conference a success. I do hope everyone will enjoy the conference, I believe this will be a fruitful experience and a rewarding opportunity.

Thank you.

Dr. Ahmad Zahirani Ahmad Azhar
Head of Manufacturing and Materials Engineering Department
Kulliyah of Engineering
Chairman of ICAMME 2022

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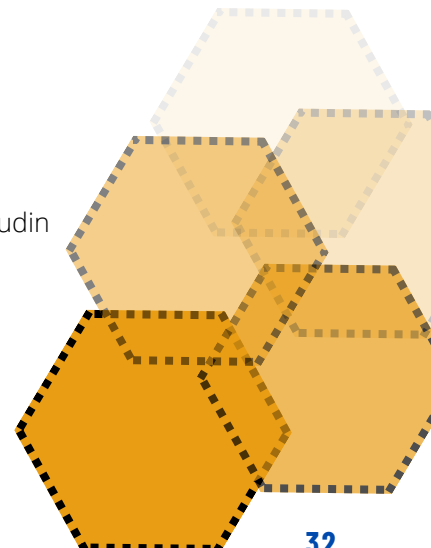
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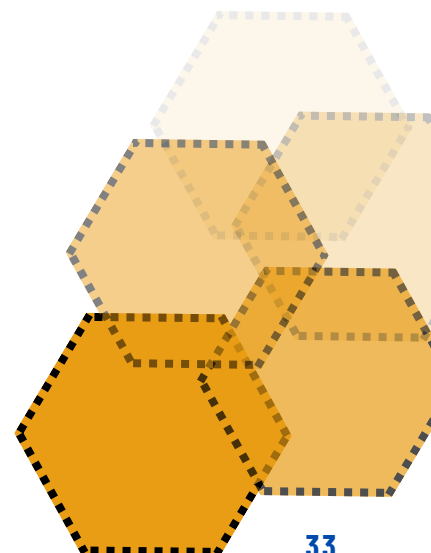
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Dr. Muataz Al Hazza, American University of Ras Al Khaimah (AURAK), UAE



TECHNICAL SESSION ICAMME 2022

Details at [ICAMME 2022](#)

Day 1: 9th August 2022				
8:00am - 9:00am	Online attendance to the Congress IEC 2022 - Zoom Room (ICAMME '22)			
9:00am - 10:00am	<p>Opening Ceremony of the IIUM Engineering Congress 2022 Welcoming Remarks by The Dean, The Rector and The President</p>			
10.00am - 10.15am	Welcoming Remarks by 5th ICAMME 2022 Chairman - Zoom Room (ICAMME '22)			
10:15am - 11:15am	ICAMME '22 Keynote Speaker Session - Zoom Room (ICAMME '22) Prof. Dr. Ihsan Efeoglu Synthesis of Nb and Zr Added TiCN: TiBN Composite Coatings with CFUBM - HiPIMS Technology and Investigation of Mechanical Properties Chairman: Prof. Dr. Maleque			
11:15am - 12:15pm	ICAMME '22 Keynote Speaker Session - Zoom Room (ICAMME '22) Prof. Dr. Mohd Nasir Tamin Characterization of Multifractal Fatigue Crack Propagation Chairman: Assoc. Prof. Dr. Norhashimah Shaffiar			
12:15pm - 2:00pm	Noon Break			
Time	Room 1	Room 2	Room 3	Room 4
2:00pm - 2:20pm	5	10	11	66
2:20pm - 2:40pm	16	18	19	71
2:40pm - 3:00pm	53	26	25	76
3:00pm - 3:20pm	55	50	31	77
3:20pm - 3:40pm	63	51	33	83
3:40pm - 4:00pm	68	57	36	87
4:00pm - 4:20pm	80	69	48	95
4:20pm - 4:40pm	109	75	62	96

TECHNICAL SESSION ICAMME 2022

Details at [ICAMME 2022](#)

Day 2: 10th August 2022				
Time	Room 1	Room 2	Room 3	Room 4
9:00am - 9:20am	29	4	7	72
9:20am - 9:40am	13	12	22	74
9:40am - 10:00am	14	21	30	78
10:00am - 10:20am	15	38	34	89
10:00am - 10:20am	17	40	41	90
10:40am - 11:00am	Break			
11:00am - 11:20am	9	44	43	65
11:20am - 11:40am	20	46	54	67
11:40am - 12:00pm	24	47	58	103
12:00pm - 12:20pm	27	49	59	104
12:20pm - 12:40pm	28	52	60	105
12:40pm - 1:00pm	32	56	61	110
1:00pm - 2:00pm	Break			
2:00pm - 2:20pm	35	64	81	93
2:20pm - 2:40pm	37	70	85	106
2:40pm - 3:00pm	79	82	88	111
3:00pm - 3:20pm	-	86	108	-
3:30pm - 4:00pm	Closing Ceremony			



INTERNATIONAL CONFERENCE ON ADVANCES IN MANUFACTURING AND MATERIALS ENGINEERING

ICAMME 2022

GREEN, HERITAGE AND PRESERVATION MATERIALS		
Chairperson: Prof. Ir. Dr. Zuraida Ahmad		Co-Chairperson: Rafiq Haikal
9 AUGUST 2022		
ROOM 1		
TIME	ID	TITLE
2.00 - 2.20	5	The Influence of Glycerol on Physical and Mechanical Properties of Mango Seed Starch Film <i>Nur'Aishah Ahmad Shahrim, Norshahida Sarifuddin, Farah Diana Mohd Daud, Hafizah Hanim Mohd Zaki</i>
2.20 - 2.40	16	Transforming Carbide Lime Waste into Marketable PCC: Effect of Carbon Dioxide Gas Flow Rate <i>Emee Marina Salleh, Rohaya Othman, Siti Noorzidah Mohd Sabri, Zawawi Mahim</i>
2.40 - 3.00	53	Enhancement of Fenton Process using High Entropy Alloy (HEA) Powder as Catalyst <i>Norhuda Hidayah Nordin*, Nurhudawiyah Abu Hassan, Mohammed Saedi Jami, Nur Ayuni Jamal, Farah Diana Mohd Daud, Nor Akmal Fadil</i>
3.00 - 3.20	55	Failure Mechanism On Ti-6AL-4V Material Processed Using Selective Laser Melting (SLM) <i>Sukri Mubarak, Poppy Puspitasari*, Lubis Andoko, Abdul Munir H.S., Avita Ayu Permasari, Muhammad Ilman Hakimi Chua Abdullah</i>
3.20 - 3.40	63	Experimental and thermal modeling of beeswax-filled extruder via Solidwork for batik printing <i>Sharifah Imihezri Syed*, Sharifah Nur Balqis Syed Azman, Norhashimah Shaffiar, Nor Khairusshima Muhamad Khairussaleh, Nor Aiman Sukindar</i>
3.40 - 4.00	68	Extrusion Temperature and Viscosity of Various Soy Wax/Beeswax Blends <i>Sharifah Imihezri Syed*, Nur Amalina Mustafa, Norhashimah Shaffiar, Nor Khairusshima Muhamad Khairussaleh, Nor Aiman Sukindar</i>
4.00 - 4.20	80	Effect of Oxygen Gas Exposure on T91 Alloy at High Temperature Oxidation of Steam Reformer <i>Rafiq Haikal*, Ahmad AM Ismail, Abd Malek Abdul Hamid, Hadi Purwanto, Suhaimi Illias, Syed Noh Syed Abu Bakar, Mohd. Hanafi Ani</i>
4.20 - 4.40	109	The Latching Performance of Soy Wax/Beeswax Prints in Various Solutions <i>Sharifah Imihezri Syed Shaharuddin*, Muhd Rizal Saidi; Norhashimah Shaffiar, Nor Khairusshima Muhamad Khairussaleh, Hazlina Md Yusof</i>

INDUSTRIAL DESIGN AND ENGINEERING MANAGEMENT		
Chairperson: Dr. Nor Aiman Sukindar		Co-Chairperson: Diah Septiyana
9 AUGUST 2022		
ROOM 2		
TIME	ID	TITLE
2.00 - 2.20	10	Modeling The Domestic Water Consumption Before and During Covid19 Pandemic in Tangerang District – Indonesia Using Fuzzy Anfis <i>Diah Septiyana*</i>
2.20 - 2.40	18	Linear Regression Model for Driving Comfort During Maneuvering Steering Wheel <i>Darlina Mohamad*, Baba Md Deros, Dian Darina Indah Daruis, Ahmad Rasdan Ismail</i>
2.40 - 3.00	26	The Future Directions of IBS Prefabrication Implementation in the Construction Industry <i>Suaathi Kaliannan*, Hassan Ismail, Mohd Ruzi Hamzah</i>
3.00 - 3.20	50	Enablers and Barriers of Lean Manufacturing Implementation in Indonesian Manufacturing Companies <i>Herry Agung Prabowo, Erry Yulian Triblas Adesta, Farida Farida, Avicenna Avicenna</i>
3.20 - 3.40	51	Investigation study on the Challenges of Implementing Industry 4.0 in UAE using AHP Method <i>Muataz Hazza Al Hazza*</i>
3.40 - 4.00	57	Lean Manufacturing and six sigma principles implementation in the industry: Case Study <i>Muataz Hazza Al Hazza*</i>
4.00 - 4.20	69	Investigation study on Risk Management Practices in Adding Value to The New Product Development <i>Muataz Hazza Al Hazza*</i>
4.20 - 4.40	75	Investigation of the Wear Behavior of Forging Tool by Ball on Disc and Impact Sliding Tribometer <i>Yasar Sert*, Tevfik Kucukomeroglu, Hucet Kahramanzade, Ihsan Efeoglu</i>

GREEN ENERGY AND SUSTAINABLE MANUFACTURING		
Chairperson: Ir. Dr. Yang Chuan Choong		Co-Chairperson: Bisma Parveez
9 AUGUST 2022		
ROOM 3		
TIME	ID	TITLE
2.00 - 2.20	11	Microstructure and Mechanical Properties of Porous Aluminium Composites Reinforced with Diamond Particles Bisma Parveez* , Nur Ayuni Jamal
2.20 - 2.40	19	Effect of Fuel Flow Analysis on a ECU Controlled MPFI Engine with IAA & IBA Blends DVVS B Reddy Saragada
2.40 - 3.00	25	Heterotrigona Itama Kelulut Honey Dehydration Process To Prolong Shelf Life Adibah Amir* , Mohd Amirul Ashraf Muhammad , Abdul Rahman Abdul Razak
3.00 - 3.20	31	Effect of Supercritical Carbon Dioxide Pressure on Foamed PolyLactic Acid Biocomposite Nurfarahin Mohd. Nordin* , Hazleen Anuar , Yose Fachmi Buys
3.20 - 3.40	33	Energy Cost Characteristics of a Micro-Wind Power System Based on Different Capacity Factor: A Case Study of Locations in Nigeria Bashir Isyaku Kunya , S.T. Auwal , S. Ramesh*
3.40 - 4.00	36	Electric vehicle Modeling: A review Ibraheem Alzehawi (Ibraheem)*
4.00 - 4.20	48	Structural, optical and photocatalytic performance of ZnO particles synthesized via direct heating technique for Rhodamine B removal Chee Meng Koe* , Swee Yong Pung , Sumiyyah Sabar
4.20 - 4.40	62	Tribology Properties of Titanium (Ti-6Al-4V) at Various Temperature on α/β Solution Treatment and Aging Condition Poppy Puspitasari* , Muhammad Raffli Putra Wardana , Avita Ayu Permanasari , Abdul Munir H.S. Lubis , Muhammad Ilman Hakimi Chua Abdullah , Puput Risdanareni

GREEN ENERGY AND SUSTAINABLE MANUFACTURING		
Chairperson: Assoc. Prof. Dr. Mohd Hanafi Ani		Co-Chairperson: Aiman Nazrin Ismail
9 AUGUST 2022		
ROOM 4		
TIME	ID	TITLE
2.00 - 2.20	66	Palladium / Lathanum/Cobalt-oxide Catalyst Polymer Exchange Membrane Fuel Cell for Electric Vehicle Mohammed Ataur Rahman* , Muhammad Abdullah , Ali Mahmoud
2.20 - 2.40	71	Potential of Polyvinyl Alcohol (PVA)-based Membrane for Direct Borohydride Fuel Cell Application Shaari, N.* , Siti Kartom Kamarudin , Ahmad Afnan Fahmi
2.40 - 3.00	76	Investigation of Whole Day Thermoelectric Energy Scavenging from Solar Heat Using Carbon Based Nanofluid Megat Muhammad Ikhsan Megat Hasnan* , Penzi Panguot , Nur Natasha Erna Herman , Abdah Nadhirah Khamis , Mohd Aszwan Jimal , Lily Yong
3.00 - 3.20	77	Seebeck and Diffusion of Spin Crossover Complexes Towards Ionic Thermoelectric Power Generation Megat Muhammad Ikhsan Megat Hasnan* , Chai Chang Yii , Nur Aqilah Mohamad , Ahmad Razani Haron , Pungut Ibrahim , Ismail Saad
3.20 - 3.40	83	Nano-structured Zinc Oxide/Silicon dioxide Thermoelectric Generator: A Waste Heat Harvesting Technology Mohammed Ataur Rahman* , Sany Ihsan
3.40 - 4.00	87	Producing blast furnace slag cement clinker by mixing limestone with hot blast furnace slag Ahmad AM Ismail* , Rafiq Haikal , Abd Malek Abdul Hamid , Hadi Purwanto , Muhamad Faiz Md Din , Mohd Fairus Mohd Yasin , Mohd. Hanafi Ani , Alya Rozhan
4.00 - 4.20	95	Perforation Size Effect on Lotus Leaf Based Oil/Water Separator Muhammad Hariz Ahat , Fethma M Nor , Ramesh, S. , Denni Kurniawan*
4.20 - 4.40	96	Investigation of Chip Formation During Turning of Aluminum Alloys 7075-T651 in Dry and Chilled Air Condition Muhammad Khoirul Amier Mohd Zamre* , Natasha A. Raof , Nor Khairussihma Muhamad Khairussaleh , Aishah Najiah Dahnel

CONTEMPORARY MATERIALS		
Chairperson: Dr. Alya Naili Rozhan		Co-Chairperson: Nur Izzah Nazurah
10 AUGUST 2022		
ROOM 1		
TIME	ID	TITLE
9.00 - 9.20	29	Properties of Alumina-Zirconia Composites Prepared by Slip-Casting Method <i>K.Y. Sara Lee, S. Ramesh*</i>
9.20 - 9.40	13	A Short Review on Diamond Reinforced Aluminium Composites <i>Nur Izzah Nazurah Kusuadi*, Nur Ayuni Jamal, Yusilawati Ahmad</i>
9.40 - 10.00	14	Amperometric Study of P3HT/Multi-Walled Carbon Nanotubes Composite for Malathion Sensing <i>Nurul Syahirah Nasuha*, Norhana Abdul Halim, Siti Zulaikha Ngah Demon, Norli Abdullah</i>
10.00 - 10.20	15	"Understanding the force deflection behavior of NiTi arch wire at different bending setting" A mini review <i>Asad Munir*, Muhammad Fauzinizam Razali</i>
10.20 - 10.40	17	Effect of Wettability of Treated Glass on Optical Characterization of Reduced Graphene Oxide Films <i>Nurul Farhana Abu Kasim*, Siti Zulaikha Ngah Demon, Norhana Abdul Halim, Ahmad Farid Azmi, Norli Abdullah</i>

SMART AND FUNCTIONING MATERIALS		
Chairperson: Dr. Nur Idayu Ayob		Co-Chairperson: Raqibah Najwa
10 AUGUST 2022		
ROOM 2		
TIME	ID	TITLE
9.00 - 9.20	4	Investigating the production of activated carbon from CFRP and durian skin wastes for the removal of methylene blue <i>Nor Farah Huda Abd Halim*, Ricca Rahman Nasaruddin, Farhah Rusya Fathi, Dzilal Amir</i>
9.20 - 9.40	12	Improving bending deformation behavior of superelastic NiTi archwire by ageing treatment <i>Nur Ainul Nurina Ishak Latiffi, Nurul Syifa' Shamsul Khairi, Muhammad Fauzinizam Razali*, Muhammad Hafiz Hassan</i>
9.40 - 10.00	21	Signal improvement on fibre optic evanescent wave sensor based polymeric sensitive coating of chitosan-agarose hydrogel <i>Muhammad Haziq Noor Akashah*, Siti Rabizah Makhsin, Rozina Abdul Rani, Nor Hayati Saad, Khairunisak Abdul Razak, Peter Gardner, Patricia J. Scully</i>
10.00 - 10.20	38	Linear Shrinkage of ZTA-TiO ₂ -Cr ₂ O ₃ Ceramic Cutting Tool <i>Raqibah Najwa Mudzaffar*, Ahmad Zahirani Ahmad Azhar, Hanisah Manshor, Nik Akmar Rejab, Afifah Mohd. Ali</i>
10.20 - 10.40	40	The Effect of LaB ₆ Target Current on Mechanical and Tribological Properties LaB ₆ doped TiBCN Based Films Deposited by CFUBMS-HiPIMS <i>Nuirye N Aksakalli</i>

MACHINING ADDITIVES & SMART MANUFACTURING		
Chairperson: Dr. Norhuda Hidayah Nordin		Co-Chairperson: Rakan Hatem
10 AUGUST 2022		
ROOM 3		
TIME	ID	TITLE
9.00 - 9.20	7	Influence of cutting edge radius (CER) and width of cut (WOC) on tool wear in milling SUS 316 stainless steel <i>Nor Farah Huda Abd Halim*</i>
9.20 - 9.40	22	Tribological Behavior of Cartilage Replacement with the Presence of Bio-lubrication Using pin-on-disc Tribometer <i>Farah Nabillah*, Mohamad Mazwan Mahat, Salmiah Kasolang</i>
9.40 - 10.00	30	Mechanical and Thermal Properties of 3D Printed Polylactic Acid Reinforced Alkaline Lignin with Epoxidized Palm Oil Bio-composites <i>Nurul Amirah Abd Rahman*, Hazleen Anuar, Fathilah Ali</i>
10.00 - 10.20	34	Parametric Study on Abrasive Wear of Reinforced Polytetrafluorethylene Composites Using Taguchi Model <i>Musa Alhaji Ibrahim, S.T. Auwal, S. Ramesh*</i>
10.20 - 10.40	41	Enhancing the Tool Life of Aluminium Oxide (Al ₂ O ₃) Inserts using Hybrid Microwave Energy in Dry Machining of High Strength Steel (KRUPP 6582) <i>Rakan Hatem Alawbali, Tasnim Firdaus Ariff*</i>

**INDUSTRIAL DESIGN AND ENGINEERING MANAGEMENT
MACHINING ADDITIVES & SMART MANUFACTURING**

Chairperson: Assoc. Prof. Dr. Mohamed Abd Rahman

Co-Chairperson: Romainor Manshor

10 AUGUST 2022

ROOM 4

TIME	ID	TITLE
9.00 - 9.20	72	Optimizing Tensile Strength of PLA-Lignin Bio-composites using Machine Learning Approaches Mohd Romainor Manshor*, Amjad Fakhri Kamarulzaman, Hazleen Anuar, Siti Fauziah Toha, Nursyam Dzuha Haris, Fathilah Ali, Suhr Jonghwan
9.20 - 9.40	74	Rapid Test Kit To Detect Honey Adulteration Nurul Zafiq Jefferi, Adibah Amir*, Hadi Purwanto
9.40 - 10.00	78	In Situ Measurement And Remediation Of Condensation Issue in Sarawak General Hospital Molecular Lab During COVID 19 Muhammad Syukri Imran*
10.00 - 10.20	89	Fabrication of plaque using hot press method for recycling plastic material Abu Kasim Haszeme*, Muhammad Hussain Ismail, Ab Aziz Mohd Yusof
10.20 - 10.40	90	A Case Study on Exploring the Benefits and Challenges Influencing the Implementation of Life Cycle Assessment as a Design Tool in The Manufacturing Industry Atiah Abdullah Sidek*

CONTEMPORARY MATERIALS

Chairperson: Dr. Nur Ayuni Jamal

Co-Chairperson: Ahmad Abdul Mun'im

10 AUGUST 2022

ROOM 1

TIME	ID	TITLE
11.00 - 11.20	9	Influence of milling parameters on the characteristics of alumina-titania nanocomposite prepared by high-energy ball milling Mahani Yusoff*, Mohd Hasmizam Razali, Wan Mohd Norsani Wan Nik, Mohamad Najmi Masri, Hidayani Jaafar
11.20 - 11.40	20	Comparative study on performance characteristic of modified alloy steels by TIG and water jet peening processes Ahmed Nazrin Md Idriss*, Azmir Mohd Azhari, Md. Abdul Maleque
11.40 - 12.00	24	The Physical Activation and Chemical Activation Reaction during Synthesis of Activated Carbon from Empty Fruit Bunch Alya Rozhan*, Hasan Marzuki, Hadi Purwanto
12.00 - 12.20	27	Effect of Zirconia Doping on the Sintering and Mechanical Properties of Hydroxyapatite Bioceramic C.H.C. Alexander, S. Sivakumar, S. Ramesh*
12.20 - 12.40	28	Two-Stage Sintering of Zirconia Toughened Alumina Composite (ZTA) Doped with Copper Oxide S. Sivakumar, C.H.C. Alexander, S. Ramesh*
12.40 - 1.00	32	Characteristics of Zinc-Doped Hydroxyapatite Prepared Using Biogenic and Synthetic Calcium Precursor C.M. Mardziah, S. Ramesh*

SMART AND FUNCTIONING MATERIALS		
Chairperson: Dr. Hafizah Hanim Mohd Zaki		Co-Chairperson: Mohamad Ashraff Danial Abd Malek
10 AUGUST 2022		
ROOM 2		
TIME	ID	TITLE
11.00 - 11.20	44	The Structural, Mechanical and Tribological Properties of LaB6 Thin Films Deposited by Closed-Field Unbalanced Magnetron Sputtering Gokhan Gulten*, Mustafa Yesilyurt, Banu Yaylali, Yaşar Totik, İhsan Efeoglu
11.20 - 11.40	46	Deposition of Nb doped CrYN thin films: Investigation of structural, mechanical and tribological properties Furkan Yüksel*, Gokhan Gulten, Banu Yaylali, Yaşar Totik, İhsan Efeoglu
11.40 - 12.00	47	Annealing effect on Nb Additive CrYN thin films deposit-ed by magnetron sputtering Banu Yaylali*, Gokhan Gulten, Mustafa Yesilyurt, Furkan Yüksel , Muhammed Alperen Polat, İhsan Efeoglu
12.00 - 12.20	49	Synthesis of DLC-W Coatings with CFUBM-HIPIMS Technology and Investigation of Mechanical-Tribological Properties Muhammed Alperen Polat*, Gokhan Gulten, Yaşar Totik, Prof Md. Abdul A Maleque, Masjuki Haji Hassan, Safa Yusuf Çetin
12.20 - 12.40	52	Surface treatment of Polyethyleneterephthalate substrate by sodium hydroxide Najwa Ibrahim*, Mariatti Jaafar
12.40 - 1.00	56	Mechanical Properties of Magnesium Hydroxide/Halloysite Nanotubes Reinforced Polyamide 11 Nanocomposites Nur Najma Athirah Azahari*

MACHINING ADDITIVES & SMART MANUFACTURING		
Chairperson: Assoc. Prof. Dr. Mohd Radzi Che Daud		Co-Chairperson: Najlah Sakinah
10 AUGUST 2022		
ROOM 3		
TIME	ID	TITLE
11.00 - 11.20	43	A Comparative Study of Additively Manufactured Nickle Titanium (NiTi) Shape Memory Alloy (SMA) Sivasanghari Karunakaran*
11.20 - 11.40	54	Analysis of the Adjusting Bolts System's Contribution to Levelling Error of the Heated Bed in FDM 3D Printer Arief, Rudi Kurniawan*, Nor Aiman Sukindar, Irfan Hilmy, Erry Yulian Triblas Adesta
11.40 - 12.00	58	Study of Burrs in Milling of AISI 316 Stainless Steel with Minimum Quantity Lubrication Muhammad Haziq Awang Jaafar, Mohammad Y Ali*, Maziri Morsidi, Ramesh, S., Erry Yulian Triblas Adesta
12.00 - 12.20	59	Friction Welding of Similar and Dissimilar Materials: Analysis of Tensile Strength Ak Md Asyraf Aditya, Mohammad Y Ali*, Ramesh, S., Ahmad Shamil Abd Rahman, Muataz Hazza Al Hazza
12.20 - 12.40	60	Mechanical Grinding using Minimum Quantity Lubrication with Nanofluid Hasmizuan Rais, Mohammad Y Ali*, Ramesh, S., Serirahayu Yaakub, Zunaidi Ibrahim
12.40 - 1.00	61	Study of Surface Integrity of Ti-Alloy Using Optimal Depth of Cut on Lathe Turning Abdul Md Mazid, Neamul Khandoker, Mohammad Y Ali*

MACHINING ADDITIVES & SMART MANUFACTURING		
Chairperson: Dr. Shafie Kamaruddin		Co-Chairperson: Aisyah Madihah Mustafa
10 AUGUST 2022		
ROOM 4		
TIME	ID	TITLE
11.00 - 11.20	65	An experimental study on friction stir welded AA5052 aluminum alloy Thanh Ky Ho*, Son Le, Tuan La, Do, Hoi Do, Thong Pham
11.20 - 11.40	67	Review on Fused Deposition Modelling Extruder Types with Their Specialities in Filament Extrusion Process Nor Aiman Sukindar*, Muhammad Afif Md Azhar
11.40 - 12.00	103	The Influence Of Cutting Parameters And Chilled Air On The Tool Wear Of Solid Uncoated Carbide Cutting Tool During Milling CFRP Muhammad Nabil Rosli, Nor Khairusshima Muhamad Khairussaleh*, Sharifah Imihezri Syed Shaharuddin
12.00 - 12.20	104	Study on the Hardness of Uncoated Carbide Cutting Tool at Difference Cutting Parameters Muhamad Irfan Khailuzman, Nor Khairusshima Muhamad Khairussaleh*, Natasha A. Raof, Suhaily Mokhtar, Aishah Najiah Dahnel
12.20 - 12.40	105	Cutting Temperatures and Their Effects on Drilling of NFRP Composites Using Taguchi Method Muhammad 'Izzudin Mohd Zaid, Suhaily Mokhtar,* Aishah Najiah Dahnel, Natasha A. Raof, Nor Khairusshima Muhamad Khairussaleh
12.40 - 1.00	110	Analysis and Optimum Machining Parameters on Surface Roughness and Material Removal Rate for Titanium Alloy in Milling Machining with MQL Siti Haryani Tomadi*, Nor Farah Huda Abd Halim

CONTEMPORARY MATERIALS		
Chairperson: Assoc. Prof. Dr. Noorasikin Samat		Co-Chairperson: Mudrikah Sofia
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ROOM 1		
TIME	ID	TITLE
2.00 - 2.20	35	Co-Precipitation of Indium Oxide Nanoparticles at Low Temperature K.W. Goh, S. Ramesh*
2.20 - 2.40	37	Wear and corrosion behavior of metallic coated surface under exposure to biodiesel Md. Abdul A Maleque*, H H Masjuki, S Y Cetin, İhsan Efeoglu
2.40 - 3.00	79	Cement-Based with Partial Replacement of Nano-Silica for Improvement in Compressive Strength Mudrikah Sofia Mudrikah, Aina Fadzeen Aadnan, Farah Diana Mohd Daud*, Norshahida Sarifuddin, Hafizah Hanim Mohd Zaki, Norhuda Hidayah Nordin, Nur Farahiyah Mohammad

SMART AND FUNCTIONING MATERIALS		
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TIME	ID	TITLE
2.00 - 2.20	64	Electrical Resistance of Fabric Immersed with PEDOT:PSS Doped Ag NPs and DMSO Solution Nur Aishah A Shahrim*, Zuraida Ahmad, Amelia Wong Azman, Norshahida Sarifuddin
2.20 - 2.40	70	A Comparison of the Thermal Conductivity of 3D Printed ABS and ABS/graphite at Various Infill Patterns and Densities. Ahmad Amri Nordin*
2.40 - 3.00	82	Effect of Pore Forming Agent on Phase Transformation Behavior of Porous NiTi Shape Memory Alloy Hafizah Hanim Mohd Zaki*, Nur Amanina Abd Kadir, Nur Ayuni Jamal, Md. Abdul A Maleque, Norshahida Sarifuddin, Farah Diana Mohd Daud, Jamaluddin Abdullah
3.00 - 3.20	86	Experimental Study of Biofluid Lubrication Characteristic for Artificial Joints Mohamad Mazwan Mahat*, Amira Atikah

<p style="text-align: center;">CONTEMPORARY MATERIALS</p> <p style="text-align: center;">Chairperson: Dr. Siti Haryani Tomadi Co-Chairperson: Nur Arifah Jamil</p> <p style="text-align: center;">10 AUGUST 2022</p> <p style="text-align: center;">ROOM 3</p>		
TIME	ID	TITLE
2.00 - 2.20	81	Effect of Zn Content on Biodegradable Mg Alloy Synthesized via Mechanical Alloying for Biomedical Application <i>Emee Marina Salleh*, Zuhailawati Hussain</i>
2.20 - 2.40	85	Mechanical and Structural Properties of Epoxy Bio-Composite using Fish Bones as Bio-Filler <i>Azriena Nathasa Zakaria, Tasnim Firdaus Ariff*</i>
2.40 - 3.00	88	A quad band negative permittivity microwave metamaterial design for satellite applications with wider bandwidth <i>Mohammad Rashed Iqbal Faruque*, Md. Bellal Hossain, Muhamad Roszaini Roslan</i>
3.00 - 3.20	108	Magnetic Properties of High Entropy Alloys as Electromagnetic Wave Absorber <i>Ain Najwa Md Saupi, Norhuda Hidayah Nordin, Muhammad Hanafi Azami*</i>

<p style="text-align: center;">SMART AND FUNCTIONING MATERIALS</p> <p style="text-align: center;">Chairperson: Dr. Aishah Najiah Dahnel Co-Chairperson: Raimi Nasrudin</p> <p style="text-align: center;">10 AUGUST 2022</p> <p style="text-align: center;">ROOM 4</p>		
TIME	ID	TITLE
2.00 - 2.20	93	Preparation of Poly(vinyl) Alcohol Based Aerogel Assisted by Cellulose Nanocrystal <i>Raimi Nasrudin*, Noorasikin Samat, Nurul Sakinah Engliman</i>
2.20 - 2.40	106	Investigation of Microgels and Double Crosslinked Microgels Containing 2-Carboxyethyl Acrylate <i>Syazwani Mohd Zaki, Muhamad Sharan Musa</i>
2.40 - 3.00	111	Thermoelectric Properties of β -FeSi ₂ Thermoelectric Module Utilizing Cast-Iron Scrap Chips <i>Assayidatul Laila Nor Hairin*, Muhammad Haziq Hakmal Jailani and Megat Muhammad Ikhsan Megat Hasnan</i>

Analysis of the Adjusting Bolts System's Contribution to Levelling Error of the Heated Bed in FDM 3D Printer

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Abstract. The 3D printer as one of the key technologies in industrial revolution 4.0 has developed rapidly to improve manufacturing efficiency. Various printing machines and methods have been invented and the Fused Deposition Modelling (FDM) 3D printer as one of it. It works by depositing melted polymer materials layer by layer to form a product. Difficulties in setting up the levelness of the heated bed is one of the difficulties faced by the users. A tiny bolts that used as the levelness adjuster of the heated bed's platform has contribution to the error of the levelness setup. This research analyzes how difficult is the levelling setup process and how the adjusting bolt might involve in leveling error of the heated bed. This research examines three levelling methods to adjust the levelness of a heated bed. Each method was performed three times then the results were checked using the Coordinate Measurement Machine (CMM). The experiment shows all levelling methods obtained levelness deviation that higher than the maximum allowance. The mathematical equation also explained that the adjusting bolts system may cause the levelness difficulties.

Keywords: FDM 3D Printer, Heated Bed, Surface Levelness, Rapid Prototyping.

1 Introduction

The 3D printing technology as one of the key technologies in industrial revolution 4.0 has developed rapidly [1] to improve manufacturing efficiency [2]. Products made by the 3D printing process are not only limited to prototype purposes but also can be used as final end-products [3]. Various printing machines and methods are invented and the Fused Deposition Modelling (FDM) process is one of them. The FDM process, works by depositing melted polymer materials layer by layer to form a product [4]. This type of printer has become the cheapest one that makes it possible for everyone to purchase [5].

Problems existed behind so much expose about the creation made by desktop FDM 3D printer. Plenty of problems still take place during the operation of the FDM 3D printer where one of them was the levelling of the heated bed. Failure caused by the lack of bed levelness [6] and human error is relatively high during the FDM 3D printing process [7]. Most FDM 3D printers are equipped with small bolts as bed levelness adjusters, this condition might contribute to the error during the bed levelling, therefore a new system is needed [8]. This research will analyze how the adjusting bolt is involved in leveling error of the heated bed.

2 Experiment Methods

This research was performed using a low-cost Desktop FDM 3D printer machine. The experiments examine three levelling methods to adjust the levelness of the heated bed. Each method was performed three times then the results were checked using the Coordinate Measurement Machine (CMM) as shown in Fig.1.

A common levelling method for FDM 3D printers is manual adjustment by using plain paper. This is a simple method where no equipment is required, therefore this method is widely used among the printer users. This method highly depends on the operator's sense during the setup. Secondly, a spirit level tool that widely used to detect the level surface condition was also observed. Lastly, a dial indicator tool was also used in this experiment. The experiment result were measured using CMM to evaluate the levelness of the heated bed's surface by comparing the height of each corner of the heated bed measured from the CMM table as a measurement datum. The measurement results then analysed to examine how big is the levelness deviation occurs in this method where this result should be less than 80% [9]. Maximum deviation for a standard 0,4mm nozzle hole should be 0,3mm.

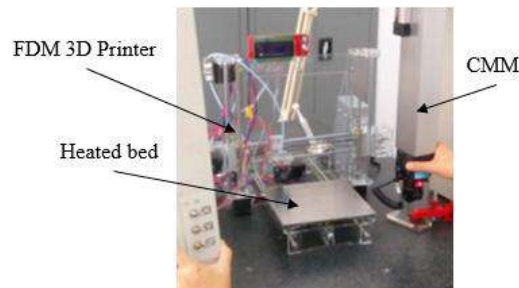


Fig. 1. Levelness examination using CMM

2.1 Manual Adjustment Method

A plain 70gsm white paper is used to adjust the gap between the nozzle and the heated bed's platform. as gap adjuster as shown in Fig.2 a. First, the nozzle position must be set to home all position (0,0,0), then move upward for 10mm (0,0,10). The setting

position is decided at 10mm from every side of the bed, therefore the position for the first corner should be; 10,10,10. The next step is to put the plain paper below the extrusion head then move the extrusion head down for 10mm (10,10,0) or use Home Z menu. The paper need to be pulled to check the gap, it should be easy to pull with light friction sensed. These activities were performed while adjusting the adjuster screw below the heated bed and applied to each corner of the heated bed.

2.2 Spirit Level Method

Another common tool to examine the surface levelness is a spirit level as shown in Fig.2 b. A feeler gauge is compulsory for this method where the hard materials could use to adjust the gap between the heated bed and nozzle. The first step of this method is to set the extrusion head to home all position (0,0,0), then move upward for 10mm (0,0,10) then move to the centre of the bed (100,100,10). The feeler gauge is placed exactly under the nozzle before lowering it down for 10mm (10,10,0) or selecting Home Z. The spirit level is placed to examine the levelness of each side of the heated bed while adjusting the adjuster bolts.

2.3 Dial Indicator Gauge Method

The dial gauge indicator is used as a quality control tool to precisely check the levelness of a surface as shown in Fig.2 c. A dial gauge with 0,01mm of accuracy is used for levelling and feeler gauge to adjust the gap. Firstly, the nozzle is set to home all position (0,0,0), then moved upward for 10mm (0,0,10), then moved to the centre of the bed (100,100,10). The feeler gauge is placed below the nozzle then select the Home Z menu. The dial indicator gauge dragged around on the edge side of the heated bed while adjusting the adjuster screw. A good and levelled surface indicated by a stand still needle although the dial is moving around.

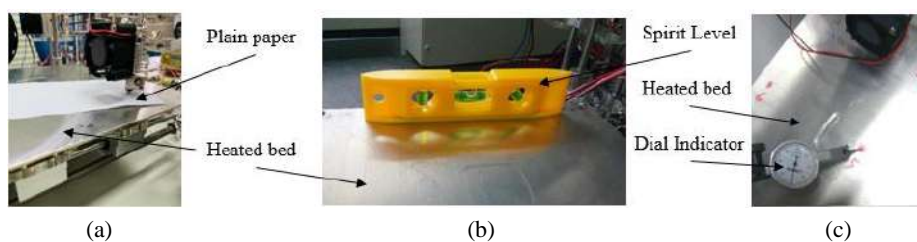


Fig. 2. (a) Levelling method using plain paper, (b) using sprit level tool, (c) using dial indicator

2.4 Bolts Adjustment Error

Another source of failure is the unprecise screwing of the small adjusting bolts. The M3 adjusting bolt works by converting the rotation movement into linear movement [10]. Different stop position on each bolt could result in the bed height differences that

lead to unlevel conditions. The movement's distance can be checked using the thread's lead angle (β) equation as follows:

$$\beta = \arctan((1 - P)/(d2. \Pi)) \quad (1)$$

Thread arch length equation is used to calculate length of travel;

$$L = \theta(\Pi/180).r \quad (2)$$

Height of translation calculated using trigonometry equation:

$$h = \tan \beta . L \quad (3)$$

Where:

β = Lead angle.

P = Pitch.

d = Nominal diameter of thread.

L = Length of travel.

h = Height of translation or movement.

The equations explain that the adjusting bolt move upward or downward if the adjusting nut is rotated. Errors in rotating the adjusting nut in opposite direction could double the distance and create huge unlevel surface's gap of the heated bed platform.

3 Experiment Results

3.1 Result of Experiment using Manual Levelling Method

In this method, the nozzle gap is adjusted by using plain paper to create levelness of the bed surface. The adjusting bolt adjusted to press the paper until it feels not too loose and not too tightly pressed. This method highly depends on the sense and experience of the operator.

Table 1. Levelling deviation using manual setup method

Check point	Height deviation from datum		
	1st	2nd	3rd
1	0.4870	1.7480	1.3623
2	0.8807	0.6437	1.1636
3	0.6584	1.6827	1.5701
4	1.3553	0.7104	1.4152

Table 1 shows the result, an average 0.8683mm differences were obtained from the first experiment, following 1.1043mm and 0,4065mm (Table 1). Total average deviation obtained is 0,793mm that exceed maximum nozzle distance which is 0,3mm [9]. In average one corner of the bed printer is lower or higher by 0,793mm from the others, this condition may cause difficulties of the filament to stick to the bed. The results still exceeded maximum allowance eventhough this setup performed by a experienced user and this shows the diffciulties of this task. This also explained the innacurate of this method and requires to developed further.

3.2 Result of Experiment using Sprit Level Gauge

The second experiment was using Spirit Level, one of the easiest tools for levelling, to maintain the levelness of a flat surface.

Table 2. Levelling deviation using spirit level setup method

Check-point	Height deviation from datum		
	1 st	2 nd	3 rd
1	-2.6259	-2.7187	0.8672
2	0.1205	0.0269	0.5673
3	-2.9059	-2.7397	1.0317
4	-1.9331	-1.7907	0.6067

The experiment resulting deviation's average of 3.0264mm from the first experiment, following 2.7666mm and 0.4644mm as shown in Table 2. Total average deviation obtained is 2.0858mm that exceed maximum nozzle distance which is 0,3mm. High deviation of the levelness could cause worst printing result. This method should produce better levelness but this experiment shown contrary result, this may cause by the adjusting system that could easily cause human error during adjusting the bed.

3.3 Result of Experiment using Dial Indicator Gauge

Dial indicator gauge is one of the precision levelness inspection tools to perform quality inspection and this tool is expected to evince better levelling setup results.

Table 3. Levelling deviation using dial indicator setup method

Checkpoint	Height deviation from datum		
	1st	2nd	3rd
1	0.8503	0.2616	0.8715
2	0.4858	-1.9196	0.5702
3	1.4752	0.3947	1.0330
4	0.5981	0.0519	0.6112

As a result, average 0.9894mm differences were obtained from the first experiment, following 2.3143mm and 0.4628mm (Table 3). Total average deviation obtained is 1.2555mm that exceed maximum nozzle distance which is 0,3mm. This method may not applicable to be used by the FDM 3D printer user since this tool relatively expensive and special skill is required. Theoretically this method should produce better levelness condition but this experiment shown contrary result, this may cause by the adjusting system that could easily cause human error during adjusting the bed, therefore chance for human error during the bolts adjustment should be analyzed.

3.4 Bolts Adjustment Error

To setup the heated bed levelness by screwing the adjusting nut is one of the trickiest works to perform. The height shall adjust by rotating the nut, and this relies on the operator's feelings. Too much or too less rotating degree may cause different translation movements resulting differenceness in the heated bed platform's height.

The theoretical calculation result of adjusting bolt movement found that:

$$\begin{aligned}\beta &= 3.38^\circ \\ L &= 0.026 \text{ mm} \\ h &= 0.0015 \text{ mm}\end{aligned}$$

This result explains that the adjusting bolt will move by 0,0015mm for each 1° of rotation. A full 360° of adjusting nut rotation will lift the heated bed platform for 0,54mm, this could create bigger gap than the maximum allowance and produce bad product, therefore the operator should perform this setup carefully. This experiment shows the tendency of the bolt and screw system to be the cause of difficulties experienced in levelling setup and might be the cause of failure of the levelling methods above.

4 Conclusion

Derived data from the experiments, with three manual methods conducted, shows the difficulties to obtain accurate and better levelness condition of the heated bed. Out of the 3 levelling methods, the manual method provides the best result, however, it is still over the maximum allowance of 0,3mm.

Theoretical analysis using the mathematical formula to adjusting the bolt's translation movements also indicated the difficulties in levelling the heated bed using the bolts system. The equation indicated the occurrence of a large gap deviation if the setup was performed carelessly by an inexperienced operator. These experiments confirmed the difficulties of obtaining a good levelness condition using the current bolt adjuster system. Even though further analysis and observation shall be conducted, this research provides the ground for further development of new adjustment tools to replace the bolts system.

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