INTERNATIONAL CONFERENCE ON SMART AND ADVANCED MANUFACTURING 2024

(ICSAM 2024)

in association with Asian Universities Alliance (AUA) Academic Conference

"ADVANCING SUSTAINABILITY, ENHANCING WELLBEING:
ENVISIONING TOMORROW'S GLOBAL ECOSYSTEM"

ABSTRACT BOOK

27th & 28th
November 2024

Aloft Kuala Lumpur Sentral &
Universiti Malaya, Kuala Lumpur,
MALAYSIA

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Conference Organizer

Centre of Advanced Manufacturing and Material Processing (AMMP Centre), Universiti Malaya, Kuala Lumpur

Conference Sponsors

Useful Information

Day 1 (27 November 2024): All sessions will take place in Ballroom B and Tactic 1 (Level 2) as well as Tactic 4 and Tactic 7 (Level 3) at Aloft Kuala Lumpur Sentral, Malaysia.

Day 2 (28 November 2024): All sessions will take place in the IR Cube, Block D, Faculty of Engineering, Universiti Malaya, Kuala Lumpur, Malaysia.

Registration / Help Desk
Registration will be conducted as follows:

Registration (Day 1)	27 November 2024 / Wednesday	08:00 – 16:30	Ballroom B, Level 2
Registration (Day 2)	28 November 2024 / Thursday	08:30 – 13:00	IR Cube, Ground Floor

At registration, you will receive your conference kit and lanyard. You may also liaise with the committee regarding registration fees or refunds, if applicable. Committee members will be available in every parallel session room and at the registration desk located in Ballroom B to assist with any inquiries.

Opening and launching ceremony
The opening and launching ceremony will be held in Ballroom B on Day 1.

- Physical participants are required to attend the ceremony in person.
- Online participants can stream the event via the link provided in the ICSAM 2024 Conference Programme.

Presentation Instructions
Oral Presentations

- Day 1: Hybrid/online presentations will be divided into two sessions:
  - Session 1: 10:50 AM – 12:35 PM
  - Session 2: 2:00 PM – 4:30 PM

  *Presentations will run in four parallel sub sessions, grouped by topic.
- Day 2: Physical presentations will take place from 10:00 AM – 12:15 PM.

Details of the schedule and venues can be found in the Oral Presentation Schedule available on the ICSAM 2024 conference website.

Timing:
Each oral presentation is limited to 13 minutes:

- 10 minutes for the presentation
- 3 minutes for Q&A

Please refer to the Presentation Guidelines on the conference website for detailed instructions on format and structure.

Oral Presentation (Physical)

Parallel session rooms are equipped with a laptop and projector. Presenters must:

- Bring their slides in PPT format on a USB stick.
- Upload the slides at the registration desk before their session.
- Arrive at their assigned venue at least 10 minutes before the session begins.

Oral Presentation (Online)

- Join the session via the provided link (refer to your presentation schedule) 10 minutes before the session starts.
- Online participants can also live-stream other presentations.

Poster Presentation (Physical)

- Posters must be displayed after registration.
- Staff members will assist with setup.
- Presenters are encouraged to stand by their posters during the scheduled presentation slots (refer to the program).

Poster Presentation (Online)

- Posters will be presented via Microsoft Teams.
- Presenters must be available during the assigned presentation slot.

Note: Papers should be presented in the order listed in the program for the convenience of attendees wishing to attend other presentations. The laptops in parallel rooms must be used for all presentations. The IT committee will be available throughout the conference to address any technical issues.

Welcoming Reception

The Welcoming Reception is included in the registration fee and will be held on:

- Date: 27 November 2024 (Day 1)
- Time: 5:00 PM – 7:00 PM
- Venue: Havana Dining, Top Floor, NU Sentral, Kuala Lumpur

This event provides an excellent opportunity to network with national and international researchers and collaborators.

Accommodation

Accommodation is not included in your conference registration and must be arranged and paid for directly with your chosen hotel.

Meals and Refreshments

Day 1

- Coffee Breaks: Served outside Ballroom B as per the program schedule.
- Lunch: Served at Nook Restaurant (Level 1), Aloft Kuala Lumpur Sentral.

Note: Please wear your name tag at all times. Only participants with name tags will be allowed entry to the luncheon area.

Day 2

- Breakfast, coffee breaks, and lunch will be provided at IR Cube, Block D, Faculty of Engineering, Universiti Malaya.

Welcome Message by ICSAM 2024 Chairman

Dear Esteemed Colleagues,

It is with great pleasure and anticipation that I extend a warm welcome to all participants attending physically and online, the International Conference on Smart and Advanced Manufacturing 2024 (ICSAM 2024). This prestigious event, taking place on November 27-28 in the vibrant city of Kuala Lumpur, Malaysia, promises to be a cornerstone meeting for individuals involved in the dynamic field of smart and advanced manufacturing.

Organized by the Centre of Advanced Manufacturing and Material Processing (AMMP Centre), Universiti Malaya, in concert with the Asian Universities Alliance (AUA), ICSAM 2024 will serve as a premier platform to gather, discuss, and share the groundbreaking innovations that are shaping the future of manufacturing.

Our conference features an impressive lineup of distinguished keynote speakers, including YBhg. Dato' Ts. V Valluvan A/L Veloo, who serves as Director of the Manufacturing Industry, Science, and Technology Section Division at Malaysia's Ministry of Economy. We are equally delighted to welcome Professor Andrew YC Nee, Emeritus Professor at the National University of Singapore, alongside Mr. Naguib Mohd Nor, President of the Malaysia Aerospace Industry Association (MAIA) and a Board Member at the Malaysian Investment Development Authority (MIDA). Their insights and expertise are sure to inspire and challenge us all.

Apart from enriching keynote sessions, ICSAM 2024 offers robust opportunities for networking. Engage with a global community of researchers and innovators, fostering collaborations that may spur future innovation and development.

Attendees will have the exceptional opportunity to present and discuss the latest research findings, with pathways for publication in esteemed, peer-reviewed indexed journals for excellent technical work. I encourage you all to seize this opportunity to contribute actively and expand your professional network.

I extend my heartfelt thanks to our partners, speakers, and participants who make this event possible. Your dedication not only enriches the conference but also ensures its success in driving innovation and collaboration in manufacturing.

With warm regards,

Professor Dato' Ir. Dr. Mohd Hamdi Abd Shukor
ICSAM 2024 Conference Chair

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Plenary Speaker

YBhg. Dato' Ts. V Valluvan A/L Veloo
Director, Manufacturing Industry, Science and Technology Section Division, Ministry of Economy Malaysia
Email: valluvan.veloo@epu.gov.my

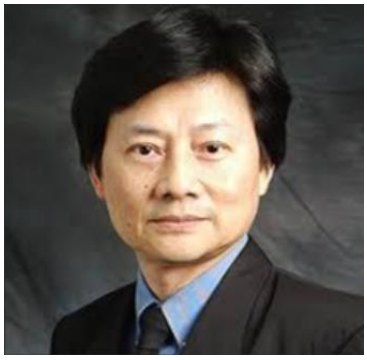
Driving Malaysia's Manufacturing Transformation - Policies, Strategies and Opportunities

ABSTRACT

Malaysia's manufacturing sector is at an important turning point, ready for significant growth through new policies and strategies. This presentation will discuss the plans set by the Ministry of Economy Malaysia to advance the manufacturing industry with modern technology and global competitiveness. Key topics will include the adoption of Industry 4.0 technologies, sustainable manufacturing practices, and the development of a skilled workforce. Attendees will learn about the opportunities and challenges in the sector, as well as the cooperation between government, industry, and academia to create a strong and dynamic manufacturing environment. This session aims to provide a clear path for stakeholders to navigate the changing landscape and take advantage of new opportunities to drive Malaysia's manufacturing transformation.

Keywords: Industry 4.0, sustainable manufacturing, skilled workforce**,** government-industry-academia cooperation, manufacturing transformation

Keynote Speaker 1



Prof. NEE Yeh Ching (Andrew)
Emeritus Professor
National University of Singapore
Email: mpeneeyc@nus.edu.sg

Strategy in Remanufacturing and Circular Economy

ABSTRACT

The transition towards a circular economy is essential for sustainable development, and remanufacturing plays a pivotal role in this transformation. This presentation will explore the strategic approaches necessary for effective remanufacturing within the framework of a circular economy. The key principles and practices that drive successful remanufacturing will be discussed, including the importance of design for remanufacturing, the integration of advanced technologies, and the development of robust supply chains. Attendees will gain insights into the economic and environmental benefits of remanufacturing, as well as the challenges and opportunities it presents. This session aims to provide a comprehensive understanding of how strategic remanufacturing can contribute to a more sustainable and resilient economy.

Keywords: Circular economy, sustainable development, remanufacturing, advanced technologies, supply chain management

Keynote Speaker 2

Mr. Naguib Mohd Nor
Chief Executive Officer (CEO)
Centre of Excellence for Advanced Manufacturing and Robotics Accelerator (AMRACE)
linkedin.com/in/naguib-mohd-nor-24757b13

The Role of Innovation in Shaping the Future of the Manufacturing Industry

ABSTRACT

Innovation is key to the future of the manufacturing industry. This presentation will discuss how new ideas and technologies can transform manufacturing industry. The importance of innovation in making manufacturing more efficient, sustainable, and competitive will be discussed. The topics covered include the use of advanced robotics, smart manufacturing techniques, and the development of new materials. Attendees will learn about the benefits of these innovations and how they can be applied in the industry. This session aims to provide a clear understanding of how innovation can drive the future of manufacturing.

Keywords: Innovation, manufacturing, advanced robotics, smart manufacturing, sustainable practices

ICSAM 2024 Conference Programme

Day 1: 27 November 2024 (Wednesday)
Venue: Aloft Kuala Lumpur Sentral

Time (GMT + 8)	Programme	Venue
08:00 – 08:20	Arrival, registration and breakfast	Ballroom B (Level 2)
08:20 – 08:25	VIPs Arrival	
08:25 – 08:30	Doa Recitation for Opening Ceremony	
08:30 – 08:40	Welcoming speech by ICSAM Chairman	
08:40 – 09:00	**Opening & Launching Ceremony** Speech by Prof Ir. Dr. Nik Nazri Nik Ghazali, Dean Faculty of Engineering, Universiti Malaya Link for streaming online: //shorturl.at/ZiAvA	
09:00 – 09:10	Photo session	
09:10 – 09:35	**Plenary Speaker Session** Speaker: YBhg. Dato' Ts. V Valluvan A/L Veloo Affiliation: Director, Manufacturing Industry, Science and Technology Section Division, Ministry of Economy Malaysia Topic: Driving Malaysia's Manufacturing Transformation - Policies, Strategies and Opportunities	
09:35 – 10:20	Morning Tea Break	
10:20 – 10:45	**Keynote Speaker 1** Speaker: Prof. NEE Yeh Ching (Andrew) Affiliation: Emeritus Professor at the National University of Singapore Topic: Strategy in Remanufacturing and Circular Economy	
10:45 – 16:30	**Poster session**	
(Parallel Oral Presentation Session 1)	**Session 1A** Topic: Public Health and Medical Device Innovation	Ballroom B (Level 2)

10:45 – 12:30	Link for online platform: https://shorturl.at/beulJ	
	Session 1B Topic: Advanced Manufacturing I Link for online platform: https://shorturl.at/kRMvY	Tactic 1 (Level 2)
	Session 1C Topic: [Online] Material Processing I Link for online platform: https://shorturl.at/gKmOx	Tactic 4 (Level 3)
	Session 1D Topic: [Online] Public Health and Medical Device Innovation, Advanced Manufacturing & STEM Education and Communication Science Link for online platform: https://shorturl.at/N1PLl	Tactic 7 (Level 3)
12:30 – 14:00	Lunch	Ballroom B (Level 2)
(Parallel Oral Presentation Session 2) 14:00 – 16:30 *Free flow tea and coffee from 15:00 – 16:30	**Session 2A** Topic: AR/VR Devices, Systems and Applications & Artificial Intelligence & Industrial Data Science	Tactic 1 (Level 2)
	Session 2B Topic: Advanced Manufacturing II & Manufacturing Management	Tactic 4 (level 3)
	Session 2C Topic: Material Processing II	Ballroom B (Level 2)
	Session 2D Topic: STEM Education and Communication Science	Tactic 7 (Level 3)
16:30 – 19:00	Dinner and Networking	Havana Dining Kuala Lumpur

Day 2: 28 November 2024 (Thursday)
Venue: Faculty of Engineering, Universiti Malaya

<table>
<tr><th>Time (GMT + 8)</th><th colspan="2">Programme</th><th>Venue</th></tr>
<tr><td>09.00-09.30</td><td colspan="2">Arrival & registration</td><td rowspan="7">Block D IR Cube, Faculty of Engineering</td></tr>
<tr><td>09:30 – 10:00</td><td colspan="2">Breakfast</td></tr>
<tr><td>10:00 – 12:15</td><td>Concurrent session: Friction Stir Welding Seminar for Vocational College Students</td><td>Session 3: Oral Presentations</td></tr>
<tr><td>12.15 – 12:40</td><td colspan="2">Keynote Speaker 2
Speaker: Mr. Naguib Mohd Nor
Affiliation: CEO at Centre of Excellence for Advanced Manufacturing and Robotics Accelerator
Topic: The Role of Innovation in Shaping the Future of the Manufacturing Industry</td></tr>
<tr><td>12:40 – 13:00</td><td colspan="2">Award Ceremony & Closing</td></tr>
<tr><td>13:00 – 14:00</td><td colspan="2">Lunch</td></tr>
<tr><td>14:00 – 16:00</td><td colspan="2">Visit Universiti Malaya
1. Museum of Asian Arts (MSA) & Malay Ethnographic Museum (APM)
2. Laboratory Visit</td><td>Universiti Malaya</td></tr>
</table>

- Subject to changes

Presentation Schedule for ICSAM 2024

Oral Presentation Day 1
27 November 2024 (Wednesday)

Session 1A *Venue: Ballroom B, Level 2*		**Topic: Public Health and Medical Device Innovation** *Link for online platform: https://shorturl.at/beulJ*	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:45 – 12:30	MedDev-71	**AUTOLOGOUS DRUG-LOADED ERYTHROCYTES FOR TARGETED DELIVERY OF ANTIBIOTICS FOR THE TREATMENT OF SURGICAL INFECTIONS** *Berikkhanova K., Gulyayev A., Daniyeva N., Zakirov E., Bikhanov N., Zhilkaidarov A., Zhakhina A. and Sultan E.*	**Physical**
	MedDev-74	**BIG DATA AND AI IN POPULATION HEALTH RESEARCH: NU EXPERIENCE** *Abduzhappar Gaipov, Temirgali Aimyshev, Gulnur Zhakhina and Ruslan Akhmedullin*	**Physical**
	MedDev-72	**PASSENGER RESPONSE AND FIELD EXPERIMENTS BASED THERMAL COMFORT AND AIR QUALITY STUDY OF SEMI-OUTDOOR CAMPUS BUS STATIONS IN THE TROPICS** *Yin Liu, Mohd Sayuti Bin Ab Karim, Wen Tong Chong, and Suihuai Yu*	**Physical**
	MedDev-75	**ADDITIVE MANUFACTURING OF PATIENT-SPECIFIC INTERVERTEBRAL DISC MODELS FOR SPINAL CORD COMPRESSION MANAGEMENT** *Rajan S. Vraitch, Xianghong Ma, Francesco Giorgio-Serchi, Eirini Theodosiou, Adrian Gardner and Jean-Baptiste R.G. Souppez*	**Online**
	MedDev-76	**TRENDS AND PATTERNS IN MORTALITY FROM NON-COMMUNICABLE DISEASES IN SRI LANKA** *Hansa Jayarathne Andradige and Liwan Liyanage*	**Online**

Session 1B *Venue: Tactic 1, Level 2*		**Topic: Advanced Manufacturing I** *Link for online platform: https://shorturl.at/kRMvY*	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:45 – 12:30	AdvManuf-38	**MICROSTRUCTURAL AND MECHANICAL CHARACTERIZATION OF HIMN-HARDFACED WITH TWO TYPES OF BUFFER LAYER ON Q55 RAILROADS** *Defi Pramesti, Winarto Winarto and Sabandi Ismadi*	**Physical**
	AdvManuf-312	**MACHINE LEARNING APPROACH FOR DEFECT PREDICTION IN METAL 3D PRINTING FOR AEROSPACE APPLICATIONS** *Yerlik Gabdullaa, Md. Hazrat Ali and Essam Shehab*	**Physical**
	AdvManuf-33	**OPTIMISED PATH PLANNING AND PART IDENTIFICATION FOR AEROSPACE AUTOMATED PAINTING SYSTEMS** *Iqraq Kamal, Veronica Lestari Jauw, Ahmad Syazwan Mohd Hisaburi, Muhammad Nur Akmal Mohamad Razif and Sivadas Chandra Sekaran*	**Physical**
	AdvManuf-311	**REAL-TIME DEFECT DETECTION AND INTERVENTION SYSTEM FOR FDM 3D PRINTERS USING ACCELEROMETER DATA** *Kemel Shomenov, Md Hazrat Ali and Essam Shehab*	**Physical**
	AdvManuf-32	**DEVELOPING COST-EFFECTIVE INDIRECT MESO-COMPONENTS ADDITIVE MANUFACTURING USING ELECTROFORMING** *Farid Rabiei Motmaen, Seyed Morteza Mousavi and Javad Akbari*	**Online**
	AdvManuf-36	**IMPACT OF BEAM POWER AND SPEED ON TEMPERATURE DISTRIBUTION OF ADDITIVE MANUFACTURING PROCESS**	**Online**

		FOR ALSI10MG, TI6AL4V AND SS316 ALLOYS: NUMERICAL STUDY *Abdulaleem Mohammed Alobaisi, Nukman Yosuf, Mohd Sayuti Ab Karim and Khaled Ahmed*	

Session 1C *Venue: Tactic 4, Level 3*		**Topic: Material Processing I** *Link for online platform: https://shorturl.at/gKmOx*	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:45 – 12:30	MatProc-417	**FABRICATION OF MIXED TIO2/ZRO2 NANOTUBES ON ALUMINIUM AA3003-H14 FOR BIOMEDICAL APPLICATION** *M. Sarraf and A.R. Bushroa*	**Online**
	MatProc-47	**EFFECT OF FEMTOSECOND LASER MICROMACHINING ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF BIOMEDICAL TI ALLOYS** *Muhammad Farzik Ijaz and Tariq Ahmed Qashash*	**Online**
	MatProc-412	**MECHANICAL PROPERTIES OF FIBER METAL LAMINATES WITH UNSATURATED POLYESTER RESIN: EFFECTS OF FIBER ORIENTATIONS** *Awang Mohamad Ihsan Bin Awang Julaihi, Irina Wong Ming Ming, Sebastian Dayou and Ngu Heng Jong*	**Online**
	MatProc-43	**RECENT ADVANCES IN SUSTAINABLE COMPOSITE MATERIALS AND MANUFACTURING** *Jean-Baptiste R. G. Souppez*	**Online**
	MatProc-411	**DISENTANGLING CARBON NANOTUBES FOR REINFORCING POLYURETHANE ADHESIVE COMPOSITES USING A CHEMICAL-FREE APPROACH**	**Online**

		Ravil Ashirmametov, Abzal Aznabayev, Madeniyet Bespayev, Konstantinos V. Kostas and Sherif Araby	
	MatProc-413	**POLYURETHANE NANOCOMPOSITES WITH HIGH MECHANICAL PERFORMANCE AND DURABILITY USING MODIFIED A-ZIRCONIUM PHOSPHATE NANOSHEETS** *Tomiris Zhumagaliyeva, Azamat Malgazhdar, Umut Bakhbergen and Sherif Araby*	**Online**
	MatProc-418	**EFFECT OF INTERFACIAL LAYERS ON THE STRUCTURAL AND OPTICAL PROPERTIES OF MULTI-JUNCTION GE-TIO2 THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS** *Iqra Khalid, Khadeeja Ahsan, Abdul Faheem Khan and Bushroa Binti Abdul Razak*	**Online**
	Matproc-419	**INFLUENCES OF RICE HUSK ASH FORMULATED INTUMESCENT COATING ON CHARRING EFFECTS AND THERMAL PROTECTION AND FOR STEEL** *Syed Niaz Hossain, Faiz Ahmad, Muhammad Amirul and Kee Kok Eng*	**Online**

Session 1D *Venue: Tactic 7, Level 3*		**Topic: STEM Education and Communication Science, Artificial Intelligence & Industrial Data Science and Manufacturing Management** *Link for online platform: https://shorturl.at/N1PLl*	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:45 – 12:30	Edu-62	**LANGUAGE AND COMMUNICATION IN SCIENCE IN THE CONTEXT OF STEM EDUCATION** *Kalani Irosha Dharmasiri*	**Online**
	Edu-64	**DEVELOPMENT OF SCENARIO BASED COMPUTATIONAL MODELLING**	**Online**

		FRAMEWORK FOR ENGINEERING EDUCATION AND TRAINING: CASE STUDIES *Tammam Kaid, Vince Zevallos Herencia, Xiaoling Qing, Natthan Outterside, Jing Guo, Xiaoxiao Liu, Li Wang, Yuguo Zhuo, Fatih Ates, Qingxiang Yang and James Ren*	
	AI-17	**A DEEP FUSION OF MULTIPLE FEATURE INFORMATION FRAMEWORK FOR PREDICTING COLD-ROLLED STRIP FLATNESS** *Jinbo Zhou, Xiaochen Wang, Youzhao Sun, Quan Yang, Xianghong Ma, Yuchun Xu, Jiaqi Chen, Hainan He, Weijian Tong*	**Online**
	AI-15	**ARABIC SPEECH RECOGNITION WITH DIACRITICS USING DEEP LEARNING: HOLY QUR'AN RECITATION AS CASE STUDY** *Mohammed Baggash Ghaleb, Mohammed Abdo Hashem Ali, Aya Najeeb, Shaima Nasser, Zal-Alham Sadeq and Rawad Abdulghafor*	**Online**
	AI-16	**DEVELOPMENT OF AI-BASED MEASUREMENT SYSTEM TOWARDS INTELLIGENT AUTO-TRACKING UMBRELLA** *Mohammed Baggash Ghaleb, Mohammed A. H. Ali, Ayman Rafea, Wazir Khaled, Osamah Mohammed, Laith Abdulwahab and Rawad Abdulghafor*	**Online**
	ManufMgm-51	**HARVEST SMART: AN ERGONOMIC FRUIT HARVESTER FOR INCREASED PRODUCTIVITY AND WORKER WELL-BEING** *Dr.M.Rajesh, Shreya S, G Karthik Reddy, Vijay Adithya, Komal Kulkarni and Vindya R Kashyap[f]*	**Online**

Session 2A *Venue: Tactic 1, Level 2*		**Topic: AR/VR Devices, Systems and Applications & Artificial Intelligence & Industrial Data Science**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
14:00 – 16:30	AR-24	**PRINCIPLES OF AERIAL DISPLAY AND ITS APPLICATIONS FOR GLASSES-FREE AR AND STEAM EDUCATION MATERIALS** *Hirotsugu Yamamoto, Kei Horio, Mohd Ridha Muhamad, Shin Hara, Chiharu Ohga, and Shiro Suyama*	**Physical**
	AR-23	**SIMULATION OF WELD DEFECT DETECTION IN STEEL PIPES USING MAGNETIC INDUCTION TOMOGRAPHY SENSORS MODELING** *Kurnia Nugraha, Winarto Winarto, Didied Haryono, Amalia Sholehah, Wahyu Widada, Harisman Nugraha, Momon Sediyatmo, Imamul Muttakin and Radhi Ramadhan*	**Physical**
	AI-11	**ADVANCING NATURAL LANGUAGE PROCESSING: A COMPARATIVE STUDY OF TEXT REPRESENTATION AND WORD EMBEDDING TECHNIQUES** *Muhammad Iqbal Abu Latiffi, Mohd Ridzwan Yaakub and Azuraliza Abu Bakar*	**Physical**
	AI-12	**KHALIFAH: EXPLORING AI'S IMPACT THROUGH INTERACTIVE ART** *Hilman Nordin, Darween Reza and Syafiq Ali'am*	**Physical**
	AI-14	**MACHINE LEARNING-DRIVEN INSIGHTS INTO INDUSTRIAL LIGHTING ENERGY CONSUMPTION: ENHANCING ENERGY EFFICIENCY AND SUSTAINABILITY** *Anam Nawaz Khan, Qazi Waqas Khan, Misbah Bibi, Rashid Ahmad and Do Hyeun Kim*	**Physical**
Session 2B *Venue: Tactic 4,*		**Topic: Advanced Manufacturing II & Manufacturing Management**	

Level 3			
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
14:00 – 16:30	AdvManuf-39	**SIMULATION BASED DESIGN OF SIMULATED MOVING BED REACTOR FOR THE PRODUCTION OF ETHYL CHLORO ACETATE** *Chhavi Gupta and Sanjay M. Mahajani*	**Physical**
	AdvManuf-313	**OPTIMISED 3D MODELLING FOR ADDITIVE MANUFACTURING OF COPPER-10TIN OPEN-CELL METAL FOAM** *Robert Chukwuemeka, Nur Amirah Mohd Zahri, Tuan Zaharinie, Muhammad Farid Syazwan Hassan and Naqiuddin Wahab*	**Physical**
	AdvManuf-314	**OPTIMIZING FUSED DEPOSITION MODELLING: ENHANCING SUSTAINABILITY AND PROCESS EFFICIENCY** *Khairul F. M. and Faiz M. T.*	**Physical**
	ManufMgm-52	**OPTIMIZING MANUFACTURING OPERATIONS THROUGH DYNAMIC DATA VISUALIZATION WITH POWER BI DASHBOARDS** *Nur Shaliyana Ilias, Mohd Azraie Mohd Azmi and Cheong Yew Wee*	**Physical**
	ManufMgm-53	**INTEGRATION MODEL FOR EVALUATING COOLANT EFFECTS ON TOOL WEAR AND SURFACE QUALITY IN SUSTAINABLE BALL END MILLING** *Ahmad Saifuddin Azraie and Faiz Mohd Turan*	**Physical**

Session 2C	**Topic: Material Processing II**	

Venue: Ballroom B, Level 2			
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
14:00 – 16:30	MatProc-420	**OPTIMIZED POTASSIUM CHLORIDE ANODIZING PROCESS FOR ENHANCED AIPU INTERFACIAL ADHESION** *Madina Moldabayeva, Umut Bakhbergen and Sherif Araby*	**Physical**
	MatProc-415	**NANOMATERIAL AGGREGATION BY SMART CONTROL SUGGESTS A NOVEL BIO-MANUFACTURING IN ANTICANCER** *Yingqiu Xie*	**Physical**
	MatProc-41	**MEMBRANE GAS SEPARATION IMPROVEMENT FOR ACID GAS REMOVAL FROM NATURAL GAS PROCESSING** *Ratikorn Sornumpol, Prathana Nimmanterdwong, and Kreangkrai Maneeintr*	**Physical**
	MatProc-45	**EFFECT OF SOLUTION HEAT TREATMENT ON THE MICROSTRUCTURE AND DEGREE OF SENSITIZATION IN HEAT AFFECTED ZONE OF DISSIMILAR WELD TP304 STAINLESS STEEL JOINED WITH 335 P11** *Sabandi Ismadi, Winarto Winarto, B Suharno, Defi Pramesti and Namyrotu Fuada*	**Physical**
	MatProc-46	**A GENERALIZED AI SURROGATE MODEL FOR THE SIMULATION OF TEMPERATURE FIELDS OF CASTINGS** *Qichao Zhao and Jinwu Kang*	**Physical**
	MatProc-48	**OPTICAL FILM IMPROVEMENT FOR MEDICAL AND FOOD PACKAGING FILMS** *Abdulmohsen N Alqahtani and Maher A Alrashid*	**TBC**

Session 2D *Venue: Tactic 7, Level 3*		**Topic: STEM Education and Communication Science**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
14:00 – 16:30	Edu-65	**CHILDREN'S INTERNATIONAL PBL - PROGRAM CONSTRUCTION AND COMMUNICATION STRATEGY ANALYSIS** *Horio Kei, Yamamoto Hirotsugu, Mohd Ridha Muhamad and Ohga Chiharu*	**Physical**
	Edu-61	**EFFECT OF E-LEARNING ON ATTITUDE AND PERFORMANCE OF DIFFICULT CONCEPTS IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS IN ZARIA, NIGERIA** *Shitu Mohammeda and Ibrahim Abdullahi Inuwaa*	**TBC**
	Edu-63	**AN INVESTIGATION OF FACTORS ASSOCIATED WITH THE MENTAL HEALTH OF UNDERGRADUATES IN THE FAS, USJ** *Randi S. De Alwis and Dias P.*	**TBC**

Oral Presentation Day 2
28 November 2024 (Wednesday)

Session 3 *Venue: Block D IR Cube, Faculty of Engineering*		**Topic: Material Processing and Advanced Manufacturing**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:00 – 12:15	MatProc-49	**EFFECTS OF VARIOUS ENVIRONMENTAL CONDITIONS ON THE STABILITY OF SINGLE-LAYER ALGINATE MICROCAPSULES** *Nur Syazana Aziz, Muhamad Nizar Amir, Swee Seong Tang, Tuan Zaharinie and Suriani Ibrahim*	**Physical**
	MatProc-416	**FABRICATION OF TIO2 DOPED WITH SNO2 THIN FILM TO IMPROVE ANTIFOGGING AND SELF-CLEANING PROPERTIES FOR SOLAR CELL APPLICATION** *N.A. Ruzali, A.R. Bushroa and M.Z. Ibrahim*	**Physical**
	MatProc-410	**NONLINEAR EVALUATION OF RESIDUAL MECHANICAL CHARACTERISTICS OF HOT-ROLLED-DUPLEX STAINLESS-STEEL REINFORCEMENT BARS FOLLOWING HIGH-TEMPERATURE EXPOSURE** *Haitham Abdallah Khamis AL Adawani, Tuan Zaharinie and Muhammad Khairi Faiz bin Ahmad Hairuddin*	**Physical**
	MatProc-42	**MXENE 2D NANO-MATERIAL ADDITIVE EFFECTS ON FRICTION STIR WELDING OF AL-CU** *Naser Abdullah Al Anazi*	**Physical**
	AdvManuf-310	**DESIGN AND DEVELOPMENT OF A ROTATING NOZZLE FOR LARGE-SCALE CONSTRUCTION 3D PRINTER** *Akbota Uskembayeva, Bakhytgul Sarsenova, Ramazan Dursunov, Bakbergen Temirzakuly, Essam Shehab, and Md. Hazrat Ali*	**Physical**
	AdvManuf-34	**A PROCESS OF UTILIZATION OF THE NANO-GRAPHENE WATER-BASED CUTTING FLUID IN MACHINING ALUMINIUM 7075 ALLOY: PART**	**Physical**

		QUALITY AND MORPHOLOGICAL ANALYSIS INVESTIGATION *Siti Zuliana Salleh, Erol Kilickap, Ahmed Aly Diaa Sarhan, Mohd Sayuti Ab Karim and Ahmet Yardimeden*	

Poster Presentation

Link for streaming online: http://shorturl.at/ZiAvA

Venue: Ballroom B, Level 2		**Topic: Artificial Intelligence & Industrial Data Science**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:00 – 12:15	AI-13	**MACHINE LEARNING SOLUTIONS FOR PREDICTING CO2 SOLUBILITY AND DIFFUSION IN WATER AND BRINE FOR CARBON SEQUESTRATION AND ENHANCED OIL RECOVERY** *Suleiman Hassan, Masoud Riazi and Peyman Pourafshary*	**Online**

Venue: Ballroom B, Level 2		**Topic: Advanced Manufacturing**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:00 – 12:15	AdvManuf-35	**LEARNING-BASED STAGE VERIFICATION SYSTEM IN MANUAL ASSEMBLY SCENARIOS** *Xingjian Zhang, Yutong Duan and Zaishu Chen*	**Physical**

Venue: Ballroom B, Level 2		**Topic: Material Processing**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:00 – 12:15	MatProc-421	**DEVELOPMENT OF BILAYER GATE DIELECTRICS OF ZRO2 AND HO2O3 ON 4H-SIC WIDE BANDGAP SEMICONDUCTOR** *Ahmad Hafiz Jafarul Tarek, Chin Wei Lai, Bushroa Abd Razak, Prastika Krisma Jiwanti, Hing Wah Lee and Yew Hoong Wong*	**Physical**
	MatProc-422	**EXPLORING THE RHEOLOGICAL PROPERTIES OF BIO WAX BINDERS AS POTENTIAL FOR BINDER IN METAL INJECTION PROCESSES**	**Physical**

		Azib Juri, Farazila Yusof, Mahmoud Zakaria, Nurhiwani Hapipi, Sufian Raja	

Venue: Ballroom B, Level 2		**Topic: Public Health and Medical Device Innovation**	
Time (GMT + 8)	**Abstract ID**	**Title & Authors**	**Physical/Online**
10:00 – 12:15	MedDev-73	**TRENDS IN CARDIOVASCULAR DISEASE MORTALITY IN KAZAKHSTAN 2014-2022: INSIGHTS FROM NATIONAL HEALTH DATA** *Ruslan Akhmedullin, Gulnur Zhakhina, Temirgali Aimyshev, Suran Yerdessov and Abduzhappar Gaipov*	**Physical**

1. Artificial Intelligence & Industrial Data Science

Abstract/Paper ID: AI

Abstract ID: AI-11

Advancing Natural Language Processing: A Comparative Study of Text Representation and Word Embedding Techniques

Muhammad Iqbal Abu Latiffi[1,a*] , Mohd Ridzwan Yaakub[1,b] and Azuraliza Abu Bakar[1,c]

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ABSTRACT

This paper provides a comprehensive exploration of the preprocessing and transformation of text data, which is essential for enabling computational analysis. The study underscores the importance of converting textual information into numerical representations, a critical step for applying machine learning algorithms that require input in the form of fixed-length feature vectors. By examining a range of word representation and embedding techniques, the paper contributes to the broader field of Natural Language Processing (NLP). The discussion begins with foundational methods such as one-hot encoding and progresses to more sophisticated approaches, including deep learning models like BERT. Each method is evaluated in terms of its computational complexity, scalability, and suitability for various NLP tasks. The paper also addresses the crucial consideration that the selection of an appropriate method should be guided by the specific nature of the task at hand, rather than a presumption that state-of-the-art techniques inherently yield superior results. By offering a structured comparison of these methods, the paper aims to provide researchers and practitioners with valuable insights into feature engineering for textual data, thereby enhancing the effectiveness and accuracy of machine learning applications in NLP.

Keywords: Natural Language Processing; Word Embedding; Word Representation; BERT; Feature Engineering; Transformer

Abstract ID: AI-12

Khalifah: Exploring AI's Impact through Interactive Art

Hilman Nordin[1,2,a*], Darween Reza[1,b] and Syafiq Ali'am[3,c]

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ABSTRACT

This paper presents "Khalifah", an interactive installation art exploring the complex relationship between artificial intelligence (AI) and human agency. The installation was presented to the public as part of ArtScience Prize 2022 Exhibition in June 2023, held at Balai Seni Maybank, Menara Maybank, Kuala Lumpur. The installation features a robotic arm controlled by the audience, tasked with a simple action: cutting manuscript which was stylised to show historical and cultural significance. Participants control movements of the robot directly to influence the robot's performance, blurring the lines between human intention and machine execution. Data collected from participant interactions – including speed, precision, and decisions made, whether to cut the manuscript, or not – is analysed to understand how individuals perceive and interact with AI-driven systems. Concurrently, GPT 3.5 Turbo provides personalized feedback to participants, commenting on their performance and prompting reflection on the nature of control, creativity and the evolving role of humans in an AI-powered world. This interactive artwork serves as a platform for engaging the ethical, social and artistic implications of AI, inviting critical dialogue about its impact on human experience.

Keywords: Artificial Intelligence, Communication Science, GPT 3.5 Turbo, Human-Robot Interaction, Interactive Installation Art

Abstract ID: AI-13

Machine Learning Solutions for Predicting CO_2 Solubility and Diffusion in Water and Brine for Carbon Sequestration and Enhanced Oil Recovery

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ABSTRACT

Prediction of the CO_2 solubility and diffusion coefficients in water and brine is essential for carbon sequestration and enhanced oil recovery (EOR)) operations. Common thermodynamic models are acceptable; however, they are characterized by great computational demands and moderate accuracy concerning complicated reservoir environments. This study uses over 500 experiment data points over a vast temperature (273 K to 423 K), pressure (up to 60 MPa), and salinity range to train and test four machine learning models: Artificial Neural Networks (ANN), Random Forest (RF), Support Vector Regression (SVR), and Gradient Boosting Machine (GBM). The maximum predictability was with ANN, with a combined R^2 of 0.9978; this was better than GBM (R^2 = 0.9947), RF (R^2 = 0.9939), and SVR (R^2 = 0.9947, though with slightly better error rates). Of course, ANN also showed a 0.9% lesser margin of error for RF and 0.3% in comparison to GBM, hence being the most dependable model under a range of conditions. Developed models demonstrated consistent and accurate predictions across a wide range of temperature, pressure, and salinity conditions, whereby results have very low levels of error. Such machine learning models offer an easy and effective way to develop a certain modification in CO_2 injection strategies and EOR operation means, with quick real-time predictions that may help in better decision-making. Going forward, the data set will be expanded to include more data from higher salinity and pressure conditions for further minimization of errors and an increase in model performance in tougher environments.

Keywords: Carbon Sequestration; CO_2 Solubility; Diffusion Coefficient; Enhanced Oil Recovery; Machine Learning.

Abstract ID: AI-14

Machine Learning-Driven Insights into Industrial Lighting Energy Consumption: Enhancing Energy Efficiency and Sustainability

Anam Nawaz Khan[1, a*], Qazi Waqas Khan[2, b], Misbah Bibi[2, b], Rashid Ahmad[3, c] and Do Hyeun Kim[4, d]

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ABSTRACT

Industrial lighting is a major contributor to global electricity consumption, driving the need for optimized energy management strategies. Traditional models for industrial energy consumption rely on static assumptions, which fail to capture the temporal and operational complexities that influence lighting energy use. This research aims to address this gap by leveraging machine learning techniques to analyze high-resolution empirical data from South Korean industrial facilities. Our methodology integrates advanced statistical techniques with machine learning models to identify inefficiencies and forecast energy consumption patterns with greater accuracy. The analysis provides precise, data-driven insights into consumption trends, enabling more accurate forecasting of energy demand and offering actionable strategies for optimizing industrial lighting systems. Moreover, deep learning models, particularly LSTM and RNN, yield accurate energy forecasts, resulting in improved energy efficiency and substantial reductions in operational costs. By uncovering operational-driven patterns and consumption anomalies, the proposed approach offers actionable insights for optimizing lighting systems in industrial settings. This research offers a scalable approach to energy efficiency, enhancing sustainable industrial practices and harmonizing with worldwide energy conservation initiatives. The results have significant significance for enhancing energy management in industrial settings, facilitating both economic and environmental sustainability objectives.

Keywords: AI Models; Energy Consumption; Exploratory Data Analysis; Industrial Lighting; Machine Learning

Abstract ID: AI-15

Arabic Speech Recognition with Diacritics Using Deep Learning: Holy Qur'an Recitation as Case Study

Muhammad Baggash[1,a*], Mohammed A. H. Ali[2,b], Aya Najeeb[1,c], Shaima Nasser[1,d], Zal-Alham Sadeq[1,e] and Rawad Abdulghafor[3,f]

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ABSTRACT

This research aims to recognize the speech of modern standard arabic language and convert it into a written text with considering the diacritical marks. The diacritical marks in the arabic language are of great importance, as they help to determine the correct meaning of the words and sentences. However, these marks are not mandatory written in text, making the task of Arabic speech recognition and analysis a major challenge in the field of natural language processing. The methodology for this research involves several processes for converting the speech into text, namely, data collection, data processing, construction of recognition model, testing and evaluation of the model. The audio clips were collected by recording three Yemeni reciters of the Holy Qur'an in the Sana'a style with a total number of audio clips that exceeds 10,000 clip, approaximetaly10 hours, which are saved in the wav format. The data processing is performed using Fast Fourier Transform (FFT) conversion, Filtration using Mel filter bank, and developing of Mel Frequency Cepstral Coefficients (MFCCs). The Arabic language recognition is accomplished using Deepspeech Model with Long Short-Term Memory (LSTM) and Recurrent neural networks (RNNs) techniques. It has been tested with Holy Qur'an recitation from Yemeni Reciters which is considered as the 1st study of its kind in Yemen. The results show that the model achieved a word error rate (WER) of 0.056551 and a character error rate (CER) of 0.039540.

Keywords: Arabic Speech Recognition; Arabic Diacritical marks; DeepSpeech; Fast Fourier Transform (FFT); Long Short-Term Memory (LSTM), Mel Frequency Cepstral Coefficients (MFCCs) and Recurrent Neural Networks (RNNs).

Abstract ID: AI-16

Development of AI-Based Measurement System Towards Intelligent Auto-Tracking Umbrella

Mohammed Baggash Ghaleb[1,a*], Mohammed A. H. Ali[2,b], Ayman Rafea [1,c], Wazir Khaled [1,d], Osamah Mohammed [1,e], Laith Abdulwahab [1,f] and Rawad Abdulghafor[3,g]

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ABSTRACT

The umbrella is widely used to protect the people during harm-sunny or raining days. Such situations require a person to hold the umbrella for long time and continuously use one or two hands for lifting. The intelligent auto-tracking umbrella deems to be an excellent solution for protecting people in such situations since it doesn't need to be held along a time and can track them intelligently without any physical contact. This can be achieved by integrating two systems, namely, auto-tracking and auto-closing/opening. First, the tracking system uses four ultrasonic sensors to determine a person position and fuzzy logic is used to give the output speeds and directions of umbrella. The directions and tracking movement of umbrella are simply simulated through LEDs in this project as there is no drone to hold the umbrella. Second, the automatic opening and closing umbrella system uses DC motor with lead screw mechanism to automatically open and close the umbrella based on the presence of the person or not. The Arduino Mega 2560 is used as the main controller and sends the appropriate command and signals .The experimental results show that the AI- based measurement system can effectively detect the directions of the persons by switching on the LEDs when they are moving towards one of ultrasonic sensors and the automatic opening and closing system opens and closes the umbrella based on the presence of the person or not. As a future work, the proposed measurement system can be integrated with the intelligent auto-tracking umbrella held by drone to track the person in indoor/outdoor environments.

Keywords:

Abstract ID: AI-17

A deep fusion of multiple feature information framework for predicting cold-rolled strip flatness

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ABSTRACT

Flatness is a crucial quality parameter for cold-rolled strip, which significantly impacts downstream processing and product performance. Data barriers between hot rolling and cold rolling production lines have traditionally limited the accuracy of predictions. To overcome this challenge, we developed a cross-process industrial big data platform that facilitates seamless integration of data from both hot and cold rolling production lines. Using this platform, we constructed a high-precision flatness prediction model based on the Bayesian Optimized-Light Gradient Boosting Machine (BO-LightGBM). The results indicate that incorporating hot-rolled data improves prediction accuracy over models using solely cold-rolled data. Specifically, with the inclusion of hot-rolled data, the BO-LightGBM model achieves a Mean Absolute Error (MAE) of 0.7545 and a Root Mean Square Error (RMSE) of 1.0077, corresponding to reductions of 14.9% and 10.6% when compared to models excluding hot-rolled data. The BO-LightGBM model outperforms conventional methods, including Back Propagation (BP) and Fully Connected Neural Networks (FCNN). The MAE and RMSE decrease by 38.6% and 36.9% in comparison to the BP model, and by 40.8% and 38.3% relative to the FCNN model. Furthermore, the R^2 value of the BO-LightGBM model reaches 0.9680, which represents improvements of 5.3% over the BP model and 5.7% over the FCNN model. Shapley Additive Explanations (SHAP) analysis provides insights into the key factors influencing flatness across both rolling stages. This study advances flatness prediction and establishes a robust foundation for the optimization of rolling processes.

Keywords: Flatness; Cold-rolled strip; Light gradient boosting machine; Shapley additive explanations

2. AR/VR Devices, Systems and Applications

Abstract/Paper ID: AR

Abstract ID: AR-21

WITHDRAW

Abstract ID: AR-22

WITHDRAW

Abstract ID: AR-23

Simulation of Weld Defect Detection in Steel Pipes Using Magnetic Induction Tomography Sensors Modeling

Kurnia Nugraha[1,a], Winarto Winarto[1,b*], Didied Haryono[2,c], Amalia Sholehah[2,d], Wahyu Widada[3,e], Harisman Nugraha[3,f], Momon Sediyatmo[3,g], Imamul Muttakin[4,h], Radhi Ramadhan[5,j]

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ABSTRACT

The quality of weld joints is a crucial aspect in the steel pipe manufacturing process, as defects in weld joints can lead to structural failure and reduce product quality. Non-destructive testing (NDT) methods are widely used to detect these defects and ensure the reliability of pipe products. However, conventional NDT techniques, such as ultrasonic testing and radiography, which are commonly used for defect inspection in pipes, have certain limitations. For example, radiography involves exposure to hazardous radiation, and ultrasonic testing may be less effective at high temperatures. Among the available NDT techniques, Magnetic Induction Tomography (MIT) presents an alternative method that addresses the limitations of both ultrasonic and radiographic testing in detecting weld defects. MIT provides a safer, non-invasive approach without radiation risks and offers greater efficiency in detecting flaws. This study utilizes a simulation-based approach to evaluate the effectiveness of MIT sensors in detecting weld defects. Simulations were carried out using Multiphysics software, modeling steel plates as pipe manufacturing materials embedded with artificial defects to assess the sensor's ability to detect both surface and subsurface flaws. The results demonstrate that MIT sensors are highly sensitive to changes in the electromagnetic field caused by defects, enabling accurate detection along the axial direction and effective identification of subsurface flaws. This research highlights the potential of MIT for improving weld quality inspections in the pipeline manufacturing and suggests further exploration to improve sensor resolution for more precise defect detection.

Keywords: Magnetic Induction Tomography; Weld Defects; Non-Destructive Testing; Multiphysics Simulation; Steel Plates.

Abstract ID: AR-24

Principles of Aerial Display and its Applications for Glasses-free AR and STEAM Education Materials

Hirotsugu Yamamoto[1,a*], Kei Horio[1,b] , Mohd Ridha Muhamad[2,c], Shin Hara[1,d], Chiharu Ohga[3,e], and Shiro Suyama[1,f]

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ABSTRACT

The pandemic of COVID-19 changed our daily life. It is important to keep hands clean to prevent the spread of new diseases. Aerial displays have gained attentions to realize such noncontact interfaces. This talk introduces our developments of aerial display based on aerial imaging by retro-reflection (AIRR) and our developments for glass-free non-contact AR interface. In order to accelerate the social implementations of aerial displays, international standardization of aerial display of which the speaker plays a role of a project leader at IEC/TC110 is undergoing. The prospective applications include noncontact interfaces for hospitals and other public spaces. Aerial interfaces are also expected to human-machine interfaces in next-generation vehicles and transportation system. Aerial displays have been utilized for a futuristic newspaper. Our optical see-through aerial display was installed as a public information media in front of a newspaper company in Tokyo. The audiences can handle the pages in mid-air without contact. Other applications include AR display of a life-scale CG dancer for opera and showing visual stimuli for fish for a behaviour biology experiment, which is called “VR biology”. Furthermore, aerial display with was utilized for STEAM education materials because AIRR can be realized with hand-crafts. AIRR optical system is composed of an LED light source, a transparent plastic plate, and a retro-reflective sheet. By combining these three elements, kids succeeded in forming an aerial image that was floating in mid-air.

Keywords: Aerial display; AIRR; Education material;

3. Advanced Manufacturing

Abstract/Paper ID: AdvManuf

Abstract ID: AdvManuf-31

Advanced Manufacturing of Proteus Software Based High Bridge Inverter for Incubators

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ABSTRACT

Advanced manufacturing is a strategic approach aimed at cutting-edge materials construction ensuring the optimization and growth of technological industries. Designing a high bridge inverter using Proteus software for cost-effective conversion of DC to AC power aligns with the principles of advanced manufacturing by enabling cost efficiency, customization, optimization, automation, integration with manufacturing systems, and quality control. Thus, we designed a high (H) bridge inverter using Proteus software to power an incubator for artificial egg hatching. The inverter was constructed to convert the 12-volt DC supply from a storage battery to an AC at a cheaper rate at the same potential difference (PD). For the circuit's safety as a whole reverse polarity was added to the design. The red LED in the design shows that the circuit is connected correctly to the power supply, while the green LED indicates that the circuit is working correctly. An incubator is an apparatus with a controlled environmental condition by which eggs are hatched artificially. Essentially, most of the incubators are powered by storage batteries, while the batteries are being charged by solar panels. An electric motor within the incubator operates on 12 volts of alternating current (AC); this obliges the use of 12-volt direct current (DC) to 12-volt AC inverter for the motor to operate. Moreover, replacement poses a financial constraint. The Materials and other construction components used herein are readily available in most electronics shops. It was tested and found to be suitable for use in an incubator; hence, the performance was satisfactory.

Keywords: Advanced manufacturing; High bridge inverter; Proteus software; Incubator.

Abstract ID: AdvManuf-32

Developing Cost-Effective Indirect Meso-Components Additive Manufacturing Using Electroforming

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ABSTRACT

Miniaturization of industrial equipment and products reduces dimensions, volume, and weight while enhancing production speed. Metallic micro and meso-components are increasingly utilized across various critical industries, including automotive, electronics, robotics, biomedical engineering, and aerospace. This study examines the impact of electric current density on the hardness and microstructure of meso-components fabricated using a rapid tooling and electroforming process, which is both cost-effective and relatively fast. A series of polymeric molds were created through vat polymerization, followed by electroforming to produce metallic meso-components replicating these molds. The metallic components, made from copper, were studied over a current density range of 1-9 A/dm^2. The results indicate that increasing the current density leads to higher hardness and reduced grain size, with significant microstructural changes occurring at higher current density values. This study highlights the crucial role of optimized current density in determining the hardness, quality, and manufacturing time of meso-components produced via electroforming. The findings of this study can be applied to further investigations of electroforming performance, aiming to minimize defects and identify the optimal current density for meso-component fabrication.

Keywords: Additive Manufacturing; Meso-Components; Rapid Tooling; Electroforming; Hardness.

Abstract ID: AdvManuf-33

Optimized Path Planning and Part Identification for Aerospace Automated Painting Systems

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ABSTRACT

Painting is crucial in the aerospace manufacturing industry, serving both protective and cosmetic purposes for components. However, the traditional manual painting method is time- consuming and labour-intensive, posing challenges for the sector in achieving higher efficiency. Additionally, the current automated robot path planning has been a bottleneck for spray painting processes, as typical manual teaching methods are time-consuming, error- prone, and skill-dependent. Therefore, it is essential to develop automated tool path planning methods to replace manual ones, reducing costs and improving product quality. Focusing on flat panel painting in aerospace manufacturing, this study aims to address issues related to unreliable part identification techniques caused by the high-mixture, low-volume nature of the industry. The proposed solution involves using a spray gun and a UR10 robotic arm with a vision system that utilizes one-shot object detection (OS2D) to identify parts accurately, achieving a part identification accuracy of 82.6%. Additionally, the research optimizes path planning by concentrating on the region of interest—specifically, the identified part, rather than uniformly covering the entire painting tray. This optimization is expected to reduce paint usage by 40% per cycle, significantly enhancing efficiency and reducing costs.

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Keywords: Aerospace Manufacturing, Few-Shot Object Detection, Automated Spray-Painting, Vision- Based Path Optimization, Deep Learning, Automation, Robotic Arm.

Abstract ID: AdvManuf-34

A process of utilization of the nano-graphene water-based cutting fluid in machining Aluminium 7075 alloy: part quality and morphological analysis investigation

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ABSTRACT

In metal machining, cutting fluid is one of the parameters necessary for increasing production efficiency. Instead of traditional flood lubrication, Minimum Quantity Lubrication has gained significant popularity as a preferred lubrication method for various processes, including metal cutting, owing to its capacity to minimize lubricant usage and reduce environmental hazards. Additionally, nano-cutting fluid (mixtures of conventional cutting fluid and nanoparticles) functions as a homogeneous nanoparticle suspension in the cutting fluid, has shown promise in improving cutting process efficiency. This work investigated the effect of nano-graphene cutting fluid on machining aluminium 7075 (AA7075) alloy at different machining conditions. This particular work focuses on part quality and morphological analysis. The findings show that incorporating nano-graphene into the cutting fluid improves the fluid's wetting and cooling properties, consequently leading to a remarkable improvement in cutting and part quality performance. Morphological analysis using a Scanning Electron Microscope equipped with an Energy Dispersive X-Ray analyser further validates these findings. The cost-effective nano-graphene cutting fluid presents a promising approach for optimizing the machining process of AA7075 alloys, offering enhanced performance and quality outcomes.

Keywords: Nanographene cutting fluid; Minimum Quality Lubrication (MQL); Aluminium 7075 alloys; Milling: Surface roughness; Cutting force

Abstract ID: AdvManuf-35

Learning-based Stage Verification System in Manual Assembly Scenarios

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ABSTRACT

In the context of Industry 4.0, effective monitoring of multiple targets and states during assembly processes is crucial, particularly when constrained to using only visual sensors. Traditional methods often rely on either multiple sensor types or complex hardware setups to achieve high accuracy in monitoring, which can be cost- prohibitive and difficult to implement in dynamic industrial environments. This study presents a novel approach that leverages multiple machine learning models to achieve precise monitoring under the limitation of using a minimal number of visual sensors. By integrating state information from identical timestamps, our method detects and confirms the current stage of the assembly process with an average accuracy exceeding 92%. Furthermore, our approach surpasses conventional methods by offering enhanced error detection and visualization capabilities, providing real-time, actionable guidance to operators. This not only improves the accuracy and efficiency of assembly monitoring but also reduces dependency on expensive hardware solutions, making it a more practical choice for modern industrial applications.

Keywords:

Abstract ID: AdvManuf-36

Impact of Beam Power and Speed on Temperature Distribution of Additive Manufacturing Process for AlSi10Mg, Ti6Al4V and SS316 Alloys: Numerical Study

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ABSTRACT

In the field of additive manufacturing (AM), understanding the effects of process parameters such as beam power and scanning speed on temperature distribution is crucial for optimizing component quality. This study presents a numerical analysis conducted using ANSYS Fluent to investigate the thermal behavior during the additive manufacturing of $AlSi_{10}Mg$, Ti_6Al_4V, and SS316 alloys. The numerical model was rigorously verified against published experimental data to ensure its accuracy and reliability. A range of laser powers between 100 and 300 watts and scanning speeds from 400 to 1500 mm/s were utilized to examine their effects on thermal profiles. To enhance the robustness of the study, a mesh sensitivity analysis was performed, confirming that the selected mesh configuration adequately captured critical thermal gradients while minimizing computational costs. The investigation utilized the full factorial design of experiments methodology, effectively reducing the number of simulations required while maintaining statistical significance in the results. Key findings demonstrate that variations in beam power significantly influence peak temperatures and cooling rates across the different alloys, directly impacting their mechanical properties and microstructure and improving products' mechanical integrity. At these process parameters, the hatch spacing, and layer thickness can be determined based on melt pool width and depth. This research highlights the interplay between thermal management and processing parameters, providing valuable insights into the optimization of additive manufacturing processes. By exploring these relationships, this study paves the way for improved designs and reliable part fabrication, setting a foundation for future advancements in additive manufacturing technologies.

Keywords: Additive Manufacturing; Temperature Distribution; $AlSi_{10}Mg$ Alloy; ANSYS Fluent; Melt Pool.

Abstract ID: AdvManuf-37

WITHDRAW

Abstract ID: AdvManuf-38

Microstructural and Mechanical Characterization of HiMn-hardfaced with Two Types of Buffer Layer on Q55 Railroads

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ABSTRACT

The study explored the effects of a double buffer layer on a railroads substrate made of Q55 steel using the manual welding (SMAW) method with Panalloy 312 MA and 307 MA for the buffer layer and HiMn for the surface. The welding technique used bead pattern string and weaving on a railroad substrate Q55. Various tests were performed, including Vickers Micro Hardness testing, Charpy impact testing, Ogoshi wear testing, and metallographic analysis using Optical Microscopy and Scanning Electron Microscopy (SEM-EDS). The findings indicate that the double buffer layer significantly increases the material's toughness. The average hardness value achieved was 467 HV, and impact testing with an average impact value of 46.05 J. Wear resistance exhibited an average abraded volume of 0.01667 mm^3. The results of the layers between layers show no delamination, meaning that fusion occurs in each layer. SEM-EDS analysis confirmed a uniform chemical distribution in the weld seams and demonstrated a ductile fracture mechanism in the impacted samples. This research aids in selecting the optimal buffer layer to enhance the performance and longevity of high-carbon steel used in railroads.

Keywords: hardfacing, buffer layer; wear resistance; toughness.

Abstract ID: AdvManuf-39

Simulation based design of Simulated Moving Bed Reactor for the production of Ethyl chloro acetate

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ABSTRACT

Simulated moving bed reactor (SMBR) is a single-unit operation apparatus with four sections, each with a set number of beds. In this process, the reaction and separation happen simultaneously with the adsorption and desorption. This makes achieving complete conversion of the limiting reactant in equilibrium-constrained reactions feasible. Its design is difficult because of the thirteen degrees of freedom, which include feed and desorbent concentrations and associated flow rates, raffinate and extract flow rates, four sections flow rates, switch time, and column dimensions. Desorption recovery from the extract and raffinate phases completes the SMBR process and primarily controls operational costs. Conversely, the capital cost is contingent upon production. Thus, the goal of this study is to use a streamlined strategy to obtain optimum output with the least amount of solvent required. Rather than combining computationally exhaustive simulation with mathematical optimization. We used a simplified approach and the reaction of interest undertaken is ethyl chloro acetate (ECA) synthesis by reacting mono-chloro acetic acid with ethanol, catalyst/adsorbent Amberlyst-15.

The solution methodology adopted is the triangle theory, a well-developed approach for simulated moving beds (SMBs) without reaction. The process employs the linear adsorption isotherm and maintains consistency on internal flow rate ratios (m1, m2, m3 and m4) to guarantee the full conversion of the limiting reaction, the purity of the extract, and the raffinate. This hypothesis is expanded to include SMB with reaction, or SMBR. Equation for the SMBR model was solved in MATLAB with appropriate boundary conditions.

The parameters m1 and m4 were chosen carefully but m2 and m3 had a range of values as per constraints. Therefore, the feasibility of m2 -m3 pairs were studied and they were plotted on triangle diagram. Further, the effect of various parameters was studied such as effect of residence time, flow rates of all four sections, pseudo solid velocity etc. The parameters were optimized for m2-m3 feasible pairs through different paths that gave minimum desorbent and maximum productivity.

Keywords: Esterification; Reactive chromatography; Adsorption isotherm; Multifunctional reactor; Heterogeneous catalysis

Abstract ID: AdvManuf-310

Design and Development of a Rotating Nozzle for Large-Scale Construction 3D Printer

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ABSTRACT

This paper focuses on the design and development of a rotating nozzle for 3D construction printers, particularly aiming for the improvement of interlayer strength of printed material, namely geopolymer. The existing 3D construction printer at Nazarbayev University is equipped with only a stationary nozzle with a circular cross-section, which limits the opportunity to effectively enhance mechanical properties such as tensile and compressive strengths. The proposed design includes a rotating nozzle with a rectangular shape because it allows to integration of side trowels on both sides of the rectangle nozzle. Trowels help to immediately shape the layers after they are printed, as a result, the value of interlayer strength increases. Besides the main motor of the 3D printer, there is an additional motor which will be installed next to the nozzle and controlled by a new axis (parameter), added into G-code. For the development of this new axis design, the cosine law is applied. The calculation is based on the three consecutive points in G-code to obtain an accurate degree of rotation for the nozzle. The new optimized nozzle design can be implemented in existing 3D printers, which allows it not only to develop its capability in the printing process but also to make sustainable contributions in 3D construction industries.

Keywords: 3D printer; rotating nozzle; G-code; interlayer strength.

Abstract ID: AdvManuf-311

Real-Time Defect Detection and Intervention System for FDM 3D Printers Using Accelerometer Data

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ABSTRACT

Fused Deposition Modeling (FDM) 3D printers are widely used for prototyping and small-scale production; however they require continuous supervision to prevent defects, which can lead to materials and time wastage. Excessive vibrations during the printing process often cause such defects. Therefore, it is essential to develop vibration monitoring mechanism. Although prior research studies have focused on employing vibration data and machine learning to detect problem such as nozzle clogging and filament jams, little research attention has been given to real-time, automatic corrective measures.

This study focuses on developing an economical, autonomous defect detection system based on accelerometer data. The system monitors vibration patterns in real-time and applies the Fast Fourier Transform (FFT) to analyze frequency domain data. Upon detection of defects, the system which , implemented using Python, automatically pauses or stops the printer. The defect identification accuracy is enhanced using Cosine Similarity, which compares real-time data with the normal state of the printer. Experimental results indicate that the system can effectively detect changes in vibration patterns, such as those caused by loose belts, and implement immediate corrective actions. This autonomous approach significantly reduces material waste and improves the overall reliability of the 3D printing process. This research study contributes to the field by integrating defect detection with real-time interventions, providing a practical solution for improving the efficiency of FDM printing.

Keywords: Cosine Similarity; Defect Detection; Fast Fourier Transform; Fused Deposition Modeling; Vibration.

Abstract ID: AdvManuf-312

Machine Learning Approach for Defect Prediction in Metal 3D Printing for Aerospace Applications

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ABSTRACT

Additive manufacturing (AM) has revolutionized the aerospace industry by enabling the production of lightweight and high-strength components, such as aerospace engine components and structural elements. The ability to create complex geometries and reduce material waste is particularly beneficial for aerospace applications, where performance and weight reduction are paramount. However, ensuring the quality and reliability of these components remains a challenge, particularly in mass production, which is related to material quality, expensive processes, and longer computational times than conventional manufacturing methods. This paper proposes an approach utilizing a Decision Tree Classification Machine Learning Algorithm to predict the possibility of defect occurrence in additive metal manufacturing processes. The research aims to create a machine learning algorithm that provides a new pathway for printing defect-free parts eliminating the costs and time-consuming associated with trial-and-error testing typically required in Powder Bed Fusion (PBF). Correspondingly, the defect susceptibility index was developed to eliminate defect formation prior to the part's manufacturing process, and the hierarchical significance of mechanistic variables influencing defect formation was determined. The results demonstrate that a trained machine-learning algorithm enables the production of defect-free components without incurring costs or requiring time-intensive trials. This approach enhances the reliability of additive manufacturing in aerospace applications and paves the way for its broader adoption in mass production. By integrating CFD analysis, machine learning, and experimental validation, the proposed methodology ensures the production of high-quality, defect-free components, making additive manufacturing a viable option for the aerospace industry and beyond.

Keywords: Additive Manufacturing, Metal printing, Machine Learning, defect-free components, aerospace applications.

Abstract ID: AdvManuf-313

Optimised 3D Modelling for Additive Manufacturing of Copper-10Tin Open-Cell Metal Foam

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ABSTRACT

Metal open-cell foam (OCF) is rapidly growth in diverse application with its recognised of unique properties. Current research focusses on the optimisation of original OCF 3D model with pore density ranging 15-50 pore per inch (PPI) to overcome the challenges of small OCF struts for 3D printing. Software of Geomagic Wrap, Fusion 360 and Altair Inspire were utilised to optimise the OCF 3D model while maintaining its structural integrity. The optimised OCF 3D model of 15 PPI (O15), 25 PPI (O25) and 50 PPI (O50) were attempted to be used for additive manufacturing (AM) via selective laser melting (SLM). The copper-10tin (CuSn10) OCF 3D printed (POCF) for O15 (PO15) and O25 (PO25) were successfully achieved and undergone mechanical testing and microstructure characterisation. The maximum compressive strength of PO25 (305.5 MPa) was slightly higher than PO15 (304.9 MPa) suggest that the PO25 is stiffer and less prone to deformation due to high in strut's number. Similar to microhardness test, PO25 was recorded 214.75 ± 8.98 HV surpasses the PO15 (154.55 ± 1.48 HV). The backscattered images from scanning electron microscope (SEM) revealed the differences of strut diameter between the optimised OCF 3D model and POCF was less than 1% for PO15 and PO25. The POCF displays a structural integrity largely competent with the intended design, where the struts of POCF were in solid but own a rough surface without jeopardize the optimised design structure. The findings demonstrate that the optimisation process of OCF is a viable approach for POCF fabrication.

Keywords: Foam; Metal; Porous; SLM; 3D-Printing.

Abstract ID: AdvManuf-314

Optimizing Fused Deposition Modelling: Enhancing Sustainability and Process Efficiency

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ABSTRACT

Additive manufacturing (AM) refers to a process of making parts by adding materials layer by layer. In contrast with traditional subtractive manufacturing which removing materials from a block of stock, this technique requires no tools, hence no tool maintenance is needed. One of most widely used AM technique is Fused Deposition Modelling (FDM). The process uses extruded filament through a heated nozzle to a build plate. However, the main issue with this method is the accuracy. Selecting optimum printing parameters can affect the dimensional accuracy of the printed parts. It is important as the sustainability of the process is a function of dimensional accuracy of the printed part. Thus, this study is aiming to investigate and develop a physical understanding of the effect of print parameters and develop a design tool from the knowledge. The considered printing parameters are printing speed, extrusion rate, and nozzle temperature. From the preliminary experiment on straight lines, the printing speed is found to have a linear relationship with raster width, whereas nozzle temperature is directly proportional to the raster width. The influence of temperature on the viscoelasticity of the polymer is hypothesized and need further investigation. A similar trend also occurs with the extrusion rate, as increasing extrusion rate leads to increase in extruded volume, means higher raster width. Other than that, the effect of printing parameters on three-dimensional geometries also had been investigated.

Keywords: Additive manufacturing, Fused Deposition Modelling, Optical monitoring

4. Material Processing

Abstract/Paper ID: MatProc

Abstract ID: MatProc-41

Membrane Gas Separation Improvement for Acid Gas Removal from Natural Gas Processing

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ABSTRACT

Acid gas removal is one of the main parts in natural gas processing to remove impurities such as carbon dioxide (CO_2). It can cause corrosion of pipelines and equipment, reduce the heating value of natural gas, and pose environmental hazard like climate change. With the environmental concern, CO_2 is needed to remove and the store underground for net zero emission in the future. Membrane separation is the one of the most common technologies used for acid gas removal from natural gas processing. The objective of this study aims to investigate the acid gas removal processes by using membrane technology, leading to valuable insights and potential improvements for the offshore petroleum industry. A two-stage series membrane model process simulation is performed by using Aspen HYSYS software. The performance of the membrane separation process is evaluated under varying operating conditions such as feed gas composition, feed gas pressure and membrane area. The simulation results present that membranes with higher CO_2 content in the feed gas as well as the membrane area can achieve a better acid gas separation performance. The two-stage series membrane separation process is an effective option for achieving high CO_2 removal efficiency and higher methane recovery efficiency. The multistage membrane separation process can be applied to further improvement and contribution to acid gas separation performance especially in offshore area with more limitations or difficulties in the remote platform.

Keywords: Acid gas removal; Membrane gas separation; Natural gas processing; Process simulation.

Abstract ID: MatProc-42

Mxene 2D Nano-Material Additive Effects on Friction Stir Welding of Al-Cu

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ABSTRACT

The Electric Vehicle (EV) industry is expanding rapidly, driving up the demand for Li-ion batteries. These batteries typically contain hundreds to thousands of Li-ion cells connected in parallel or series, with Tab-to-busbar joints playing a critical role in efficient electricity transfer and power production. These joints must be mechanically and electrically robust to ensure long-term functionality and durability. Due to their excellent thermal and electrical conductivity, copper and aluminium are mostly used in these joints. However, joining these dissimilar materials is challenging due to the material's reactions with various types of welding. Additionally, when joining the dissimilar metals an Intermetallic compound (IMC) layer is formed in-between. This IMC hinders the movement of electrons which reduces the electrical conductivity, and it increases the contact resistance, affecting the overall joint strength and conductivity. Therefore, it is necessary to determine an effective welding technique that could overcome these challenges to have improved and more efficient joints to enhance the performance and durability of Li-ion batteries. Friction Stir Welding (FSW) with MXene nanomaterial additive can help in improving the performance of the joint. As a solid-state welding method, FSW is superior in joining dissimilar metals minimizing the defects that could occur during other methods of joining. Adding the MXene nanomaterial enhances the electrical conductivity as it is known for its excellent conductivity as well as its capabilities to improve mechanical properties. This method should produce a mechanically and electrically capable tab-to-busbar joint that could take the Li-ion batteries' performance to the next level.

Keywords: Aluminium; Copper; Friction Stir Welding; MXene

Abstract ID: MatProc-43

Recent Advances in Sustainable Composite Materials and Manufacturing

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ABSTRACT

The breadth of polymer-matrix composite materials and manufacturing methods available has led to their adoption across an array of industries, including automotive, aerospace, renewables and high-performance vehicles. However, composites remain characterised by a high carbon footprint and limited recyclability. Consequently, this work aims to identify suitable sustainable composite materials to support a reduction in emissions across the industries employing composite materials. A range of novel materials, including recycled, recyclable, non-wood cellulose and mineral fibers are investigated, quantifying their mechanical properties. This paper provides (i) the experimental characterisation of the ultimate flexural strength of vacuum bagged sustainable composite materials; (ii) supporting evidence that reductions in emissions can be achieved thanks to sustainable composite materials; and (iii) recommendations for where sustainable materials may be employed where they cannot compete with the mechanical properties of carbon fibre, for instance, using recycled carbon fibre as part of the moulds for high-performance parts in advanced manufacturing processes, owing to its coefficient of thermal expansion. These findings provide novel insights into sustainable composite materials and manufacturing to support the decarbonisation of the composite industry, and it is anticipated they may contribute to future regulations and international standards.

Keywords: Sustainability; Advanced Manufacturing; High-Performance Composites; Experimental Testing; Mechanical Characterisation.

Abstract ID: MatProc-44

WITHDRAW

Abstract ID: MatProc-45

Effect of Solution Heat Treatment on the Microstructure and Degree of Sensitization in Heat Affected Zone of Dissimilar Weld TP304 Stainless Steel Joined with 335 P11

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ABSTRACT

Dissimilar welding (DMW) of stainless steel with carbon steel has the problem of forming carbide precipitation at the heat-affected zone (HAZ) grain boundaries, thereby reducing the corrosion resistance of the joint. To overcome this problem, a post-weld treatment process such as solution heat treatment can be carried out. In this research, we will observe the effect of solution heat treatment on the microstructure and degree of sensitization of dissimilar welded joints between A312 Grade TP304 stainless steel and A335 P11 carbon steel welded using the tungsten inert gas (TIG) method. Tests on A312 Grade TP304 steel pipe sections include optical microscope observations, potentiodynamic polarization testing, immersion pitting testing, and electrochemical potentiokinetic reactivation testing. The analysis results from this research show that the solution heat treatment process can increase the corrosion resistance of joints by reducing the percentage of carbide precipitation formed at the HAZ grain boundaries by 44%. Apart from that, the controlled solution heat treatment process can help reduce the sensitization of dissimilar welded joints by 86%.

Keywords: Dissimilar Welding; Tungsten Inert Gas (TIG); Solution Heat Treatment; TP304 Stainless Steel; Microstructure; Degree of Sensitization.

Abstract ID: MatProc-46

A generalized AI surrogate model for the Simulation of Temperature Fields of Castings

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ABSTRACT

Due to its strong adaptability, deep learning has been widely applied to solve various engineering problems. This study proposes a temperature field prediction method for two-dimensional casting models based on deep learning. A convolutional neural network based on U-net is used to learn the variation law of temperature field in casting models. Images representing the geometric shape of castings and thermal performance parameters are added to appropriate positions in the network, and temperature fields at different time intervals with fixed time intervals are used as the training set. The trained network can predict the temperature field of castings of different shapes and materials at different times. This network has strong generalization ability, with an average prediction accuracy of 90%. At the same time, this network can make predictions quickly and has important application scenarios in areas such as casting processes.

Keywords: Deep learning; U-Net; Casting; Simulation.

Abstract ID: MatProc-47

Effect of Femtosecond Laser Micromachining on the Microstructure and Mechanical Properties of Biomedical Ti Alloys

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ABSTRACT

Biomaterial is a substance that has been engineered to interact with biological systems for a medical purpose, either therapeutic or diagnostic. Recently, numerous approaches for producing porous implants such as plasma sintering, additive manufacturing, and other methods that emphasize surface modification for generating fast bone ingrowth have been used. Surface micromachining by femtosecond laser is considered to be within the domain of advanced mechanical engineering, where micro-machining has become a powerful tool for controlling surface properties and sub-surface integrity of materials used in various applications. However, determining the tradeoff between structural and mechanical integrity is a significant difficulty. This is because designs with porosity of more than 80% result in a reduction in both strength and bone ingrowth. One approach to enhance stress shielding, strength, and bioactivity is to work on the topology of the surfaces for better biocompatibility. To accomplish these attributes novel methodology of femtosecond laser micromachining is utilized and corresponding mechanical and microstructural properties were evaluated by XRD, tensile testing characterization. The findings indicate a significant increase in both hardness and tensile strength of the Ti alloy by 26% and 16% respectively following FSL treatment. These improvements can be attributed to the phase transformation that occurs during FSL treatment, as evidenced by the XRD results.

Keywords: Femtosecond laser Micromachining, Microstructure, Mechanical Properties, Biomedical, Ti Alloys

Abstract ID: MatProc-48

Optical Film Improvement for Medical and Food Packaging Films

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ABSTRACT

Optical properties significantly influence the quality of products in medical and food packaging applications, with colour and gel specifications being particularly critical. Both industry and academia have investigated methods to enhance the stability of polyolefin film packaging to mitigate issues such as film yellowness and gel formation. This study aimed to improve the stability of polyethylene films by employing high-performance additives in reduced quantities. A product exhibiting yellow coloration and high gels is considered inferior to a transparent, clear product, making the production of such transparent films without colour and gel deterioration a priority. In this research, various high-performance additives were evaluated, and a twin-screw extruder was utilized to create different formulations of additive types and dosages, which were then compared to market standard SABIC® LLDPE film products. The formulated films were assessed for colour and gel count using the Hunt-B value and an optical control system cast film extruder (ME20, OCS, Germany). The degradation of antioxidants emerged as the primary cause of the yellow coloration observed in the films. Notably, the primary antioxidant Irganox® 1076 degrades into quinonemethide, which is unstable and, in the presence of oxygen and external energy (high shear and temperature), converts into stilbenquinone, a yellowish compound. A significant reduction in colour and gel content of 35-40% was achieved using half the quantity of the new additive compared to the reference, enhancing the sustainability score of the product. These findings are promising for the potential application of these films in medical and packaging industries. Nevertheless, further research is necessary to evaluate additive migration and biocompatibility for such applications.

Keywords: Additives; Food Packaging; Gels; Medical Films; Yellowness.

Abstract ID: MatProc-49

Effects of Various Environmental Conditions on the Stability of Single-Layer Alginate Microcapsules

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ABSTRACT

Alginate, a naturally occurring biopolymer derived from the cell walls of brown algae, is widely utilized in biotechnology and biomedical fields due to its ability to encapsulate cells or enzymes within microcapsules. These microcapsules, which are small spherical particles ranging from a few micrometres to millimetres in size, offer protection and stabilization of their core substances under various environmental conditions. This study investigates the characterization of fabricated single-layer alginate microcapsules, focusing on their stability under varying environmental conditions, including temperature, pH, and relative humidity. The results indicate that the size of the microcapsules gradually increased as the temperature rose from 5°C to 85°C. The microcapsules remained stable at pH levels of 3, 5, and 7, showing no change in size, however higher pH levels led to an increase in size and eventual capsule rupture. Water absorption tests revealed that higher relative humidity levels increased water absorption within 120 hours, but at 90% relative humidity, the absorption pattern decreased, suggesting saturation of the microcapsules. These findings enhance the understanding of the physical and mechanical properties of single-layer alginate microcapsules, which is essential for optimizing their formulation to improve integrity and better control the release mechanisms of encapsulated components in practical applications.

Keywords: Alginate; biopolymer; environmental conditions; microcapsules; stability

Abstract ID: MatProc-410

Nonlinear evaluation of residual mechanical characteristics of hot-rolled- duplex stainless-steel reinforcement bars following high-temperature exposure

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ABSTRACT

The growing popularity of structural stainless steel can be attributed to its aesthetically pleasing and architecturally flexible characteristics, as well as its exceptional durability. Duplex stainless steel is extensively employed in concrete structures due to its exceptional corrosion resistance, structural integrity, and widespread availability. These materials generally exhibit greater strength, enhanced strain hardening, and superior ductility compared to conventional carbon steel reinforcement. This study concentrated on the finite element analysis of the residual mechanical properties of hot-rolled duplex stainless steel reinforcing bars, in comparison to experimental data. It involved evaluating user-defined material properties for an isotropic elasticity model and a multilinear isotropic hardening model across three distinct scenarios to validate with experimental data. The investigation discovered a close correspondence between the experimental results and the numerical simulations, and it revealed that the residual mechanical response of EN 1.4362H grade materials displayed relatively minor variations across the diverse cooling methods employed. The study found that total maximum strain(mm/mm) and user defined (the total elastic and total plastic strain) correlated strongly for the virgin temperature and across all examined heating temperatures and cooling modes. There was a relatively small difference percentage between experimental and numerical results which is (<1%) for ultimate tensile strength (f_u) and (<5%) for proof strength ($f_{0.2p}$) with the exception of six cases: 900°C-rapid cooling in water (7.44%), 700°C-intermediate cooling in air (10%), 800°C-intermediate cooling in air (9.5%), 900°C-intermediate cooling in air (12.5%), 600°C-slow cooling inside the furnace (11.9%), and 900°C-slow cooling in furnace(8.3%). The simulation data from the finite element analysis correlated very well with the input data used for the engineering analysis, both for the virgin material and across all investigated temperatures and cooling modes.

Keywords: Structural stainless steel; Residual mechanical properties; EN1.4362H Duplex stainless steel reinforcing bars; Finite element analysis (FEA); Proof strength ($f_{0.2p}$); Ultimate tensile strength (f_u)

Abstract ID: MatProc-411

Disentangling Carbon Nanotubes for Reinforcing Polyurethane Adhesive Composites Using a Chemical-Free Approach

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ABSTRACT

Polyurethane (PU) adhesives are widely used in industrial applications due to their versatility, strong bonding capabilities, and resistance to environmental factors. They play a vital role in automotive, aerospace, and construction industries, where they provide structural integrity and enhanced performance in bonded materials. However, despite these advantages, PU adhesives face limitations in their mechanical properties, particularly under extreme conditions, such as high stress or elevated temperatures. These limitations necessitate the exploration of reinforcement methods to improve the adhesive's mechanical strength and durability. One promising approach to address these limitations is the incorporation of Multi-Walled Carbon Nanotubes (MWCNTs) into PU adhesives. MWCNTs have been widely recognized for their exceptional mechanical, electrical, and thermal properties, which can significantly enhance the performance of polymer composites. Nevertheless, due to their large aspect ratio, MWCNTs tend to entangle and bundle, which diminishes their reinforcing potential by reducing effective load transfer between the matrix and the nanotubes.
This study investigates the integration of MWCNTs into PU adhesives, focusing on overcoming the MWCNTs' entanglement by reducing their aspect ratio using a solvent-free and industrially attractive method: ball milling. Commercially available MWCNTs are subjected to ultrasonication and ball milling for different time periods to untangle the bundles and ensure better dispersion in the matrix. Aspect ratio alterations were achieved by a series of solvent-free ball milling procedures of different time periods. This process is designed to break the bundles and nests of MWCNTs, ensuring a more uniform dispersion within the PU matrix and improving interfacial bonding with aluminium substrates. A series of experiments will be conducted to determine the optimal aspect ratio by measuring the interfacial shear strength of the PU/MWCNT adhesive. A comprehensive analysis of structure-property relationships will be performed through detailed morphological characterization using scanning electron microscopy and transmission electron microscopy. Mechanical properties, including tensile strength and fracture energy will also be evaluated to assess the performance of the PU/MWCNT composite adhesive. By systematically studying these properties, this research seeks to provide a deeper understanding of how MWCNT modifications via ball milling can enhance the overall performance of PU adhesives in practical applications.

Keywords: Adhesive joints; Fracture energy; Interlaminar shear strength; Morphology; MWCNTs.

Abstract ID: MatProc-412

Mechanical Properties of Fiber Metal Laminates with Unsaturated Polyester Resin: Effects of Fiber Orientations

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ABSTRACT

Composite materials, known for their tailored properties, find extensive applications across industries due to their lightweight and high-strength characteristics. Among these, fiber metal laminates (FML) stand out as innovative materials that combine metal layers with fiber reinforced plastics (FRP), offering unique benefits desirable in sectors such as aerospace, aviation and automotive. Nevertheless, conventional FML that typically produced under one fiber stacking sequence, often do not satisfy the strict ductility and strength requirements for structural application. Therefore, this study investigates the mechanical properties of FMLs, emphasising the impact of different fiber stacking sequences. A variety of FML specimens, including glass reinforced aluminum laminate (GLARE), carbon reinforced aluminum laminates (CARALL) and hybrid laminates (GCCG and CGCG, where C represents woven carbon fiber and G represents woven glass fiber), were fabricated using vacuum assisted resin transfer molding (VARTM). The mechanical properties of fabricated FML specimens were determine using burn-off tests, tensile tests and flexure tests, all of which followed the ASTM standard. The results showed that CARALL laminates exhibit a superior performance in term of tensile properties. Conversely, the hybrid CGCG laminate demonstrates an elevated flexure strength, attributed to the synergistic combination of woven glass and carbon fibers, which optimises the ability of laminates to resist bending loads. These findings provide valuable insights into optimising FMLs with tailored fiber orientations for high-performance applications, offering new possibilities in sectors where material performance is critical.

Keywords: Fiber Metal Laminates (FML); mechanical properties; unsaturated polyester resin; Vacuum-assisted resin transfer molding (VARTM)

Abstract ID: MatProc-413

Polyurethane Nanocomposites with High Mechanical Performance and Durability Using Modified α-Zirconium Phosphate Nanosheets

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ABSTRACT

α-Zirconium phosphate (α-ZrP) is a layered synthetic compound with crystalline structure. It has gained interest in academia for its potential in enhancing mechanical properties, flame retardancy and weather resistance of polymers. However, α-ZrP sheets tends to restack in the host matric due to van der Waals forces. Chemically modifying α-ZrP nanosheets endow uniform dispersion in the polymeric matrix, resulting nanocomposites with high mechanical performance. In this study, α-ZrP sheets are synthesized and modified via one-step route. Cetyltrimethylammonium bromide (CTAB) is used to modify the surface of α-ZrP nanosheets. Long hydrophobic hexadecyl chain in CTAB interacts with phosphate in α-ZrP and forms a hydrophobic modified–α-ZrP nanosheets. The modified α-ZrP nanosheets (m-α-ZrP) are characterized via Fourier transform infra-red (FTIR) spectroscopy, X-ray diffractometry (XRD), transmission electron microscopy (TEM), and scanning electron microscopy (SEM). The results from FTIR (Figure 4) show that modification is successful as the FTIR spectra of modified nanosheets displays bands characteristic to both α-ZrP (3593 cm^{-1}, 3510 cm^{-1}, 3150 cm^{-1}, 1619 cm^{-1}, 1250 cm^{-1}, 1012 cm^{-1} and 960 cm^{-1}) and CTAB (2614 cm^{-1}, 2543 cm^{-1}, and 1460 cm^{-1}). Moreover, the study investigates the reinforcing effect of pristine α-ZrP and m-α-ZrP on polyurethane (PU) elastomer. The morphology was studied by SEM, TEM and XRD. Mechanical properties such as tensile strength, Young's modulus, elongation at break and tear strength are defined. Swelling tests in various solvents for both nanocomposites are conducted. The SEM images show much less agglomeration after modifying α-ZrP sheets than that in unmodified α-ZrP. Preliminary results of tests showed that the tensile strength of PU showed increases after adding pristine α-ZrP, reaching a maximum value at 1 wt% of nanosheets, corresponding to the average value of 28.2 MPa (3.5 the strength of neat PU). The rest of the experiments and tests are on the process with an expectation of having increments in both durability and mechanical properties of PU. The study highlights the reinforcing effect and role of modification of α-ZrP sheets in elastomers.

Keywords: Hydrophobicity; Mechanical properties; Nanocomposite; α-Zirconium phosphate (α-ZrP).

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WITHDRAW

Abstract ID: MatProc-415

Nanomaterial Aggregation by Smart Control Suggests a Novel Bio-Manufacturing in Anticancer

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ABSTRACT

Different types of cells have different responses to nanomaterials, which play an important role in organ transplantation and biocompatibility of biomaterials. We recently reported that Cys nanozyme materials can repair tissue damage, and have continuously reported that carbon quantum dot nanomaterials can be used for anti-cancer therapy. Here we further investigated the response of cells to the nanomaterials and improvement by smart manufacturing. Comparing different cells including prostate cells, mammary gland cells, and seminal vesicle cells, it was found that prostate cells have a good anti-aggregation effect on Cys nanomaterials. Further treatment of breast cancer cells with the cell culture medium showed that the prostate cell culture medium could reduce the response of cells to the aggregation of nanomaterials, thereby smartly regulating the anticancer effect of the nanomaterials. In addition, we applied CO_2, and chlorophyll in other nanomaterials to use environmental CO_2 emission or light to smartly regulate the nanomaterial aggregation thereby fulfilling the goal of the smart control of the nanomaterials in anticancer. Our data suggests that through smart manufacturing aggregation, smart control of drug delivery could be achieved which is crucial in the function of orthopedic materials.

Keywords: Aggregation; Nanometer material; Carbon quantum dots; Anticancer; Smart control

Abstract ID: MatProc-416

Fabrication of TiO_2 Doped with SnO_2 Thin Film to Improve Antifogging and Self-cleaning Properties for Solar Cell Application

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ABSTRACT

Solar cell performance is often reduced by surface fogging and dirt accumulation, which decreases light transmission and energy output. This study addresses these issues by fabricating Titanium Dioxide (TiO_2) thin films doped with Tin Dioxide (SnO_2) to enhance antifogging and self-cleaning properties specifically for solar cell applications. These challenges are critical to improving solar cells' efficiency. Using advanced methods such as Powder Physical Vapor Deposition (PPVD) and Anodization, TiO_2:SnO_2 nanostructure coatings were developed to optimize transparency and prevent contamination buildup. The experimental results show that doping TiO_2 with 1.0% SnO_2 significantly enhances hydrophilicity, allowing water to spread rapidly across the surface and prevent fog formation. Furthermore, the self-cleaning properties of these coatings ensure easy removal of dirt and contaminants, maintaining high solar cell efficiency in various environmental conditions. These findings offer a practical solution to increase solar cell efficiency while minimizing maintenance costs, contributing to more sustainable and effective solar energy technologies. Additionally, this research opens potential applications for these coatings in other optical devices that require antifogging and self-cleaning functionalities.

Keywords: Antifogging; Self-cleaning; Solar cells; SnO_2 doping; Thin films.

Abstract ID: MatProc-417

Fabrication of Mixed TiO_2/ZrO_2 Nanotubes on Aluminium AA3003-H14 for Biomedical Application

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ABSTRACT

It is well-established that implants with nanotubular surfaces show a drastic improvement in new bone creation and gene expression compared to implants without nanotopography. Nevertheless, the scientific and clinical understanding of mixed oxide nanotubes (MONs) and their potential applications, especially in biomedical applications are still in the early stages of development. The mixed TiO_2/ZrO_2 nanotubular arrays (TiO_2/ZrO_2 NTs) has a high potential for application in bone and dental implants for their better mechanical and chemical behavior in the human body compared to single oxide nanotubes. Nevertheless, the biocompatibility and antibacterial activity of TiO_2/ZrO_2 NTs still need further improvement to meet the requirements of safe implants. In this research, TiO_2/ZrO_2 NTs coating was fabricated on aluminium alloys series AA3003-H14 via magnetron sputtering mixed Ti/Zr followed by an anodization, then heat treated for 1 h at 450 °C. The results show that highly ordered mixed nanotube structure was achieved with average diameter and length of ~55 nm, and ~1 µm. The findings demonstrated that the proposed TiO_2/ZrO_2 NTs promoted in-vitro bioactivity. It is illustrated that TiO_2/ZrO_2 NTs have promising biomedical properties to enhance the biofunctionality of aluminium alloys to use for dental implants.

Keywords: Aluminium Alloy, Dental implant, Mixed oxide nanotubes, TiO_2/ZrO_2 NTs; in-vitro bioactivity.

Abstract ID: MatProc-418

Effect of interfacial layers on the structural and optical properties of multi-junction Ge-TiO_2 thin films for photovoltaic applications

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ABSTRACT

Photovoltaics is an ever-growing field of research. The continuous emanating solar light and the ability to utilize this energy source for the escalating energy demands is indeed the most logical and innovative solution to it. However, the surge to maximize the solar irradiance can only be achieved by improving its efficiency through quantum confinement effects. In this research work we focused on utilizing this phenomenon to obtain a new class of solar cell material (Ge-TiO_2) with better performance and easy fabrication route. Thin film samples with multi-layer arrangement were fabricated with superstrate configuration. The interfacial layers exiting between each thin film was kept under focus to observe the enhancement and influence of quantum confinement effect. The structural properties of the thin films has been identified by using x-ray diffraction (XRD), raman spectroscopy, and field emission scanning electron microscopy (FESEM). The formation of interfacial layer with details of thicknesses and elemental concentration (depth profiling) was observed through Rutherford back-scattering spectroscopy (RBS). The optical properties were studied using UV-Visible (UV-Vis.) spectroscopy and Photo-luminescence (PL) spectroscopy. The research work has proven the influence of interfacial layers on the optical properties of the solar material and lays a ground work on utilizing the quantum confinement effect through a very feasible and easy approach, with a brief study into the physics of the interfacial layers (junctions).

Keywords: Depth profiling; Ge-TiO_2; Magnetron sputtering; multi-layer thin films; Quantum confinement effect

Abstract ID: MatProc-419

Influences of rice husk ash formulated intumescent coating on charring effects and thermal protection and for steel

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ABSTRACT

Rice husk ash (RHA), which is an agricultural waste was introduced in the intumescent fire coating as a bio-hybrid carbon source combining expandable graphite. The objective of this research was to reveal the effects of RHA-incorporated carbon source on the thermal performance and char structure of the intumescent coating. The novel bio-hybrid carbon source has shown improved char structure and fire retardance. The char formed more compact and fewer cracks after the inclusion of RHA in the coating. RHC-02 (EG 3.3%-RHA 2.2%) has shown good thermal resistance showing a final backside temperature of 235.7°C after the ASTM E-119 fire test. The char expansion was evaluated using a furnace test. The hybrid carbon source was observed to be more insulative and the highest expanded char was 14% higher than the reference sample. The SEM, FTIR, and XRD were done to study the char morphology. The TGA analysis showed a high residual mass of 42.7% for RHC-02. Char morphology showed a homogenous and cross-linked char structure. XRD and FTIR analysis revealed the presence of heat-resistant compounds in the degraded char.

Keywords: Bio-hybrid carbon source; rice husk ash (RHA); TGA; XRD; SEM

Abstract ID: MatProc-420

Optimized Potassium Chloride Anodizing Process for Enhanced Al/PU Interfacial Adhesion

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ABSTRACT

Laminated composites are widely utilized in high-demand industries, such as aerospace and automative, due to their exceptional mechanical characteristics, particularly their high strength-to-weight ratio, and high fatigue and impact resistance. However, the interfacial strength between metallic and polymeric layers continues to pose a constraint on their broader application. While surface treatment for the metal layers is a common approach to enhance interfacial strength, it is associated with limitations such as substantial costs and the use of hazardous chemicals posing environmental concerns. This highlights the need for safer and economical alternatives. In this regard, an innovative aluminium (Al2024) electrochemical surface treatment with cost-effective potassium chloride (KCl) electrolyte is developed in this study. The study comprehensively investigates the KCl anodizing process for aluminium surface before bonding with polyurethane. A full factorial experimental design was employed to systematically investigate the effects of electrolyte concentration (0.05, 0.075 and 0.1M) and applied voltage (8, 10 and 12V) on the surface topography (roughness) of the aluminium and lap shear strength of aluminium/polyurethane (Al-PU) joints. KCl-anodizing process increased the surface roughness of Al sheets at different levels informed by the KCl electrochemical parameters. Scanning electron microscopy and atomic force microscopy images showed the formation of a porous surface structure, supporting the penetration of PU into Al surface. Consequently, the lap shear strength of Al-PU joints significantly increased. For example, the lap shear strength increased by 3.5 folds upon KCl-treating the Al surface at 0.1M KCl at 12V. Fracture analysis is studied supported by SEM observation. KCl anodizing process for Al sheets is a novel approach to significantly enhance the interfacial strength in metal/adhesive joints. The results position the developed KCl-based anodizing process as a promising, cost-effective and safe alternative to traditional surface treatments methods; it offers substantial benefits in order to integrate anodizing process in manufacturing laminated composites.

Keywords: Laminated composites; Interfacial strength; Electrochemical treatment; Aluminium-polyurethane bonding.

Abstract ID: MatProc-421

Development of Bilayer Gate Dielectrics of ZrO_2 and Ho_2O_3 on 4H-SiC Wide Bandgap Semiconductor

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ABSTRACT

This study focuses on the performance evaluation of the structural and electrical characterization with various gas concentrations of bilayer oxide gate dielectric ZrO_2 and Ho_2O_3 thin films on a 4H-SiC substrate. The structural characterization of XRD, FTIR, and XPS indicated the formation of Zr–O, Ho–O, Zr–O–Si, and Ho–O–Si bonds. The cross-sections of oxide layers were examined through a high-resolution transmission electron microscope (HRTEM) with a physical thickness of 4.77 to 5.53 nm. The absence of interfacial layers (IL) has been reasoned due to nitrogen atoms affect causing blockage of charge movement and oxygen diffusion between oxide layers and 4H-SiC substrate. It was observed that, the ZrO_2 / Ho_2O_3/SiC sample underwent oxidation with a gas concentration ratio of 90% O_2: 10% N2 has the highest energy band alignment of conduction band offset ΔEv ~ 3.18 eV and valance band offset ΔEc ~ 5.38 eV with highest electrical hard breakdown field of 9.7 $MVcm^{-1}$. The effective dielectric constant (keff) ~ 33.54, effective oxide charge (Qeff), average interface trap density (Dit), and slow trap density (STD) has been obtained from the derivation of capacitance-voltage (C-V) plot. The analysis supports the conclusion that the bilayer thin film oxidized with a gas concentration ratio of 90% O_2: 10% N2 produced the optimal electrical performance. This may serve as a high-k gate dielectric application in metal-oxide-semiconductor (MOS)-based devices.

Keywords: Bilayer Gate Dielectrics, ZrO2, Ho2O3, 4H-SiC, High-k Gate Dielectric, Electrical Characterization, Capacitance-Voltage (C-V) Plot

Abstract ID: MatProc-422

Exploring the Rheological Properties of Bio Wax Binders as potential for binder in Metal Injection Processes

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ABSTRACT

In metal Injection, a binder functions to hold the powder particles together, facilitating the moulding process and ensuring the mixture can be injected into the Mold with the desired flow properties. This research investigates the feasibility of utilizing various bio waxes as binders in metal injection processes. The study focuses on the rheological properties of different bio waxes combined with metal powders at varying binder-to-metal powder ratios. The binder-to-metal powder ratios were kept below 20%, with a successful minimum ratio of 12% binder to 88% metal powder. Key parameters such as viscosity, shear-thinning behaviour, and thermal properties are analysed to determine the optimal binder composition for efficient metal injection and debinding. Preliminary results indicate that bio waxes offer promising flow characteristics and environmental benefits compared to traditional synthetic binders. The findings suggest that bio waxes could serve as a sustainable alternative in metal injection, potentially reducing the carbon footprint of the manufacturing process while maintaining high-quality standards in the final products. Future work will explore the long-term stability and performance of bio wax binders in various Metal injection applications. Additionally, the economic feasibility of large-scale implementation will be assessed to ensure practical viability.

Keywords: Sustainable Binders, Rheological Properties, Viscosity, Carbon Footprint Reduction, Environmental Benefits.

5. Manufacturing Management

Abstract/Paper ID: ManufMgm

Abstract ID: ManufMgm-51

Harvest Smart: An Ergonomic Fruit Harvester for Increased Productivity and Worker Well-Being

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ABSTRACT

Agriculture, often hailed as the backbone of human civilization, plays a pivotal role in providing sustenance, driving economic prosperity, and shaping cultural identities. Mango, the most ancient among tropical fruits, has found its roots in the Indo-Burma region. India, as the major mango producing country globally. Due to the labor crisis such with the seasonal nature of work and the labor shortages and the current mechanical and robot harvesters being priced high is not feasible for the farmer. The Smart Harvester a mechanical device aims to integrate ergonomics and technology that helps harvesters procure the mangoes in an efficient and productive manner. Additionally, the risk of Musco-Skeletal disorders in fruit harvesters are high, so the mechanical device tackles this problem with an ergonomic design and to minimize disorders. Integration of smart technology will help farmers accurately decide the viability of the fruit to be harvested which will make the process of harvesting more productive.

Keywords: Agriculture, Labour Crisis, Ergonomic Design, Musculo-skeletal Disorders, Productivity

Abstract ID: ManufMgm-52

Optimizing manufacturing operations through Dynamic Data Visualization with Power BI Dashboards

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ABSTRACT

This Manufacturing management plays a critical role in the success and sustainability of industrial operations. This field involves the strategic planning, coordination, and optimization of all aspects of the manufacturing process, from supply chain management and production planning to quality control and continuous improvement. In the current competitive industrial landscape, manufacturing management faces several critical challenges such lack of real-time data, change management and integration of advanced technologies (IoT and big data analytics tools). This paper highlights the significance of utilizing real-time big data visualization through Power BI dashboards to enhance manufacturing management and change control processes. The research focuses on developing a system for real-time data management to support change management, enabling the analysis of large data sets for informed decision-making, progress tracking, and timely communication. This study aims to improve manufacturing processes and product quality by integrating various data sources into a single Power BI system, enabling real-time monitoring, data analysis, and reporting. Furthermore, the development of a scalable and flexible manufacturing process system with Power BI is explored to reduce defects, ensure compliance with industry standards, and provide an intuitive interface for stakeholders at all levels. Utilizing Power BI's visualization tools alongside big data analytics, the research demonstrates how manufacturers can save time, streamline operations, and achieve precise change management, leading to higher adherence to production schedules. The key outcome was the enhancement of the change management dashboard, achieved by improving the on-time rate, applying corrective measures to overtime rate discrepancies, and refining KPIs to elevate overall process effectiveness. The outcome of this paper could provide insights into the practical benefits and strategic advantages of implementing these technologies in manufacturing environments.

Keywords: Quality Management System, Change Management, Business Intelligence, Process Enhancement, Key Performance Indicator Monitoring

Abstract ID: ManufMgm-53

Integration Model for Evaluating Coolant Effects on Tool Wear and Surface Quality in Sustainable Ball End Milling

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ABSTRACT

The role of cutting fluids in machining operations is crucial, impacting productivity, tool lifespan, and work quality. Previous research often falls short in integrating sustainability with machining parameters, focusing predominantly on technical aspects like efficiency and productivity without considering broader environmental and societal impacts. There is also a lack of comprehensive models that integrate sustainability attributes with machining conditions, with most studies assessing technical performance separately from sustainability considerations. An experimental investigation is planned to study the effects of various coolant conditions on ball end milling of AISI 1040 steel using uncoated HSS tools. The research will encompass four coolant conditions: dry, mist, 4% coolant concentration, and 8% coolant concentration, while maintaining constant cutting parameters. The investigation will assess machining performance based on tool wear and surface roughness, aiming to determine how these coolant conditions influence machining performance and surface quality. This approach overlooks the potential synergies between improved machining processes and sustainable practices. The proposed study aims to bridge this gap by developing a comprehensive interaction model that integrates sustainability parameters with machining conditions, offering valuable insights into optimising both performance and sustainability in machining practices. The research will also explore the integration of sustainability into the machining process, with a regression analysis developed to predict the interaction between sustainability and machining attributes, demonstrating the benefits of incorporating sustainability parameters into machining conditions and providing insights for optimising processes with environmental and societal considerations.

Keywords: Cutting Fluids; Ball End Milling; Coolant Conditions; Tool Wear; Sustainability Integration.

6. STEM Education and Communication Science

Abstract/Paper ID: Edu

Abstract ID: Edu-61

Effect of E-Learning on Attitude and Performance of Difficult Concepts in Physics Among Secondary School Students in Zaria, Nigeria

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ABSTRACT

This study was undertaken to investigate effect of computer-assisted instruction on attitude and performance in difficult concepts in physics among secondary school students in Zaria, Nigeria. The population for this study consist of all the physics Students from twenty five public secondary schools. The sample of the study consist of two schools with availabilities of equivalent Computer facilities and manpower. The research design for this study was quasi experimental design and a pretest/posttest control group design was used. The students were grouped into control and experimental groups equally. Both groups were pretested. Two methods were used in this study: CAI method and Lecture method. The experimental group was taught with CAI while the control group was taught with lecture method only. Three difficult concepts in physics were selected. Duration for each period of lesson was 45 minutes. The experiment was conducted for 6 weeks. the test scores obtained in both the experimental and control group was used in computing and analyzing the data to estimate the significant of the result at 0.05 alpha levels. The result of pre-test indicated that there was no significant difference in the performance of both the experimental and control group while the result of post-test revealed that there was a significant difference in the mean scores of experimental and control group. The result of the study indicated that the means scores of the experimental group were higher than the control group. It was concluded that CAI method can utilized in the teaching of difficult concepts in physics. The study recommended that the teacher may prepare teaching with CAI than lecture method.

Keywords: Computer-Assisted Instruction, Physics, Performance, Difficult, Lecture Method

Abstract ID: Edu-62

Language and Communication in Science in the Context of STEM Education

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ABSTRACT

Language and communication play pivotal roles in the dissemination and comprehension of scientific knowledge within STEM (Science, Technology, Engineering, and Mathematics) education. In STEM fields, where concepts are often abstract and highly technical, effective communication is essential for ensuring that ideas are clearly understood and accurately conveyed. The ability to articulate scientific ideas not only facilitates learning but also supports collaboration, critical thinking, and innovation. This study examined the critical relationship between language and communication skills in STEM education and explores how enhancing these abilities can improve educational outcomes. Research Question was How does the integration of language and communication skills in STEM education affect students' understanding of scientific concepts and their ability to engage with scientific content? The integration of targeted communication strategies within STEM education improved students' comprehension of complex scientific concepts, foster better collaboration, and enhance their ability to communicate scientific knowledge effectively. This study employed a mixed-methods approach, incorporating both qualitative and quantitative data. A sample of STEM students from various educational levels surveyed to assess their communication skills, confidence in scientific discourse, and comprehension of key scientific concepts. Focus groups and interviews with educators complemented the survey data, providing insight into teaching practices and the perceived impact of communication skills on students' learning outcomes. The study also included a content analysis of student scientific reports and presentations to evaluate the effectiveness of different communication techniques. The findings were expected to demonstrate that improved communication skills in STEM education had a positive impact on students' ability to grasp and articulate scientific concepts. The study anticipated that students who received structured communication training exhibited better problem-solving skills, higher confidence in collaborative environments, and stronger performance in scientific writing and presentations. Moreover, by promoting clearer scientific discourse, educators can create a more inclusive learning environment, where students from diverse backgrounds can engaged more meaningfully with the material. In conclusion, enhance communication in STEM education is not merely about improved verbal or written skills but about transforming the way students' approach, understand, and engage with scientific knowledge. The findings from this study informed best practices for educators and contribute to the broader

conversation about improving STEM education through interdisciplinary approaches that integrate language and communication training. Language and communication play pivotal roles in the dissemination and comprehension of scientific knowledge within STEM (Science, Technology, Engineering, and Mathematics) education. In STEM fields, where concepts are often abstract and highly technical, effective communication is essential for ensuring that ideas are clearly understood and accurately conveyed. The ability to articulate scientific ideas not only facilitates learning but also supports collaboration, critical thinking, and innovation. This study examines the critical relationship between language and communication skills in STEM education and explores how enhancing these abilities can improve educational outcomes.

Keywords: Communication; Education; Language; STEM Education

Abstract ID: Edu-63

An Investigation of Factors Associated with the Mental Health of Undergraduates in the FAS, USJ

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ABSTRACT

The COVID-19 pandemic introduced an unfamiliar and challenging situation, making it crucial to focus on mental health. University students, particularly vulnerable due to disruptions in their academic and daily lives, are a key group affected by these changes. This study investigated the factors associated with the mental health of undergraduates in the Faculty of Applied Sciences at the University of Sri Jayewardenepura, Sri Lanka, during the pandemic. WHO Director-General Dr. Tedros Adhanom Ghebreyesus highlighted a 25% global increase in anxiety and depression during COVID-19, and this study examines these mental health concerns, filling a research gap by using statistical analysis to offer insights on undergraduates' mental health in Sri Lanka. A cross-sectional survey was conducted via a Google questionnaire, gathering data on socio-demographic characteristics, COVID-19 experiences, global stress, and mental health. The Generalized Anxiety Disorder Questionnaire (GAD-7) and Patient Health Questionnaire (PHQ-9) assessed anxiety and depression levels. Chi-square analysis explored associations between socio-demographic and mental health factors, while multivariate ordinal logistic regression identified the key factors influencing anxiety and depression. Among 252 participants, anxiety levels were minimal (31.7%), mild (31.0%), moderate (18.7%), and severe (18.7%). Depression levels were severe in 26.2%, with mild (25.8%), moderate (21.8%), moderately severe (11.9%), and severe (14.3%) cases. Gender and global COVID-19 stress were significant predictors of both anxiety and depression, with females more affected. The study recommends that universities implement comprehensive mental health support systems and develop gender-sensitive programs to address the specific needs of female students during crises, ensuring the wellbeing of students.

Keywords: anxiety; COVID-19; depression; mental health; ordinal logistic regression.

Abstract ID: Edu-64

Development of Scenario Based Computational Modelling Framework for Engineering Education and Training: Case Studies

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ABSTRACT

Modelling at different scales has been one of the most active areas for engineering development in both R&D and industrial practices within the drive of transformation to data-focused frameworks. The development of industry 5.0 also demands more competent work-forces in different industries and more flexible knowledge tools for general areas such as health and safety, and public engagements. However, the conventional research- focused framework of modelling is not able to fully meet these diverse needs. It is essential to explore transformation/improvement of the way modelling, data and knowledge is developed in order to make it more flexible and accommodating for users from general engineering backgrounds rather than those with specific modelling skills. In this work, we explored the development of flexible computational modelling frameworks and data system based on functional features and scenario analysis in order to balance the quantitative and qualitative aspects of problem solving. The work integrates experimental data, analytical models and engineering simulation to give the learner the flexibility of evaluating complex concepts through the capacity of isolating/simplifying different situations either quantitatively or qualitatively. The approach is applied to some typical cases in engineering design and materials data developments. The effect of such approach and limiting factors are discussed. Provisional analysis of the approach through case studies and reviews showed that the integrated approach provides the users with a flexible system to quickly visualise the results, analyse their ideas and make critical choices. The efficiency (time, cost, resources, flexibility) of such an approach in fostering data competence, interests and problem-solving capacity at different levels is discussed. The potential effect of such an approach on some human factors, such as sustained curiosity and interests, is also analysed. The potential and critical issues of using such an approach in engineering education and industrial is also discussed.

Keywords: Computational Modelling, education, training, Scenario-based, feature analysis

Abstract ID: Edu-65

Children's International PBL - Program Construction and Communication Strategy Analysis

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ABSTRACT

The low interest among students in Science, Technology, Engineering, Arts, and Mathematics (STEAM) subjects is a widespread issue affecting multiple countries, including Japan and Malaysia. This trend poses a significant challenge for future workforce development, as these fields are crucial for driving innovation and economic growth. In Japan, factors such as an aging population, declining birth rates, and a competitive educational system contribute to fewer students pursuing STEAM-related careers. In Malaysia, similar concerns arise due to limited exposure to STEAM fields in early education and a perception that STEAM careers lack stability or appeal compared to other fields. This study aims to understand the mechanism of interest development in STEAM among children at nursery and lower elementary age by problem-based learning activities. The children aged 3 to 10 years old from Malaysia and Japan were made into groups to study and solve several STEAM-related problems that were designed to learn these elements in fun and exciting way. A program on STEM activities was built for children, utilizing the knowledge we have accumulated through PBL for university students, and report on the implementation that were conducted.

Keywords: Problem-based learning; STEAM; non-verbal communication; international exchange; ASEAN children

7. Public Health and Medical Device Innovation

Abstract/Paper ID: MedDev

Abstract ID: MedDev-71

Autologous Drug-Loaded Erythrocytes for Targeted Delivery of Antibiotics for the Treatment of Surgical Infections

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ABSTRACT

Surgical infections represent a substantial global health challenge, with purulent-septic complications accounting for 20-40% of postoperative deaths. A key factor contributing to postoperative purulent-inflammatory complications is the rapid emergence of antibiotic-resistant microorganisms. One promising strategy to combat this issue is targeted drug delivery. By modifying the pharmacokinetics of antibiotics through targeted delivery, it may be possible to sustain high drug concentrations in blood plasma or specific tissues. The goal is to evaluate the effectiveness of using red blood cells (RBCs) as drug carriers for targeted delivery of antibiotics for treating surgical infections. The drug-loaded RBCs were obtained through the method of hypo-osmotic hemolysis. To study the distribution parameters of ceftriaxone with erythrocyte ghosts, the method of equilibrium dialysis using a semipermeable membrane was used. Quantitative determination of total and unbound drug was carried out on Thermo scientific “Evolution 201” spectrophotometer. Microphotographs illustrating the morphological alterations of erythrocytes during drug encapsulation have been captured through scanning and transmission electron microscopy. The calculated concentration of the antibiotic ceftriaxone in pharmacocytes was 200 µg/ml. Dialysis through a semi-permeable membrane during the 24 hours allows the release of almost all of the previously deposited antibiotics. Ceftriaxone is characterized by a high degree of inclusion in erythrocytes, a high degree of dissociation and as a consequence a low degree of irreversible binding. The use of targeted drug delivery systems based on autologous erythrocytes could provide a new opportunity for the treatment of purulent diseases.

Keywords: Surgical infections, targeted drug delivery systems, red blood cells, drug carriers, ceftriaxone, hypo-osmotic hemolysis.

Abstract ID: MedDev-72

Passenger Response and Field Experiments Based Thermal Comfort and Air Quality Study of Semi-Outdoor Campus Bus Stations in the Tropics

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ABSTRACT

Thermal comfort and air quality at bus stations are vital aspects of passenger waiting experience and health. From the perspective of user response and experimentation, this paper investigates the thermal sensation and experience of passengers at current bus stations through a questionnaire survey, while micrometeorological data such as air temperature, globe temperature, relative humidity, wind speed, and air quality data such as PM2.5 and other pollutants exposure in the bus station are collected. By analyzing thermal environment parameters and pollutant concentrations and passenger inhalation, the thermal comfort and air quality of semi-outdoor bus stations in the tropics were explored. It was found that users generally desired a cooler thermal environment at bus stops. A neutral temperature of 30.7°C was obtained based on the Physiological Equivalent Temperature (PET) index, with acceptable temperatures ranging from 28.45°C to 32.83°C. Compared to another local study that investigated outdoor and semi-outdoor campus spaces, respondents in this study perceived slightly lower neutral temperatures and narrower acceptable ranges, the difference indicating that higher bus station temperatures and different uses of the space affect perceived semi-outdoor thermal comfort. The average PM2.5 concentration at bus stations was 45.57 μg/m^3, which was more than 2 times higher than outdoors. There are also some differences in the cumulative inhalation of passengers during the morning, noon, and evening commuting hours due to the different average concentrations and exposure durations. These insights can help in the construction of bus stations in hot and humid areas to provide a better waiting environment.

Keywords: Bus station; Physiological equivalent temperature; PM2.5; Semi-outdoor; Thermal comfort

Abstract ID: MedDev-73

Trends in Cardiovascular Disease Mortality in Kazakhstan 2014-2022: Insights from National Health Data

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ABSTRACT

Background: Cardiovascular diseases (CVDs) are leading cause of death worldwide. While the impact of Covid-19 on trends is recognized, it is uncertain whether these patterns continued through the third pandemic year.
Objectives: The study sought to investigate the mortality trends for CVDs during 2014-2022.
Methods: This study utilized data from Kazakhstan's Unified National Electronic Health System (UNEHS) and performed descriptive data analysis. The authors employed Bayesian Structured Time Series, Bayesian regression analysis, and sensitivity analysis to excluding the impact of stroke on estimates.
Results: The study cohort included 240,036 CVD-related deaths during 2014-2022. Deaths were primarily caused by cerebrovascular disease (37.89%), ischemic heart disease (34.61%), and inflammatory heart disease (9.56%). The analysis identified that death patterns rose by 47% starting from 2020; however, during the third Covid-19 year, the trends decreased by 17% (95% CI: -26%; -4%) when compared to the preceding period (p = 0.008). Sensitivity analysis revealed a similar trend, declining by 20% (95% CI:-30%, -5%). Regression analysis for three different periods showed posterior mortality risks to be higher for 2020-2021 (IRR 1.42; 95% CrI: 1.34-1.50), and somewhat less in 2022 (IRR 1.14; 95% CrI: 1.08-1.21) when compared to pre-Covid-19 period.
Conclusions: This study examined CVDs-related death reports from to 2014-2022. Despite increasing trends in the early pandemic years, death rates declined significantly in the third year of the pandemic. Strengthened control of CVDs and stabilization of the emergency state are thought to explain such encouraging findings.

Keywords: Cardiovascular diseases; Epidemiology; Covid-19; Mortality; Cause-Specific Mortality;

Abstract ID: MedDev-74

Big Data and AI in Population Health Research: NU Experience

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ABSTRACT

Large numbers of medical data are generated through medical records, regulatory requirements, and medical research. Worldwide, the number of data are projected to double every two years, which will result in 50 times more data in 2020 than in 2011. The main advantages of re-using routinely collected data for research is that such studies can be conducted on a larger scale, at lower costs, and within shorter time frames than traditional studies. However, data management needs a lots of efforts from the researchers. Implementation of Artificial Intelligence (AI) including machine learning and deep learning tools in data management significantly impacts the productivity of research outputs. In this study, we aimed to use Big Data in population health research and implementation of AI as complementary tool to the epidemiological studies. During the 2020 and 2022, we have collected the Nationwide Electronic Healthcare Record from Ministry of Healthcare of Kazakhstan and conducted epidemiological studies for different communicable and non-communicable diseases. We used descriptive statistics to calculate prevalence, incidence and mortality rates of diseases over the country/region for the periods between 2014-2022. Survival analysis was performed using Kaplan Meyer curve as well Cox proportional regression models were used to identify the associations between the different demographic confounders and all-cause mortality. Different machine learning classifiers were used to set-up one-year predicted mortality in the cohort. ARIMA and SARIMA forecasting models were used to identify the 10 year trend of communicable and non-communicable diseases. This is the first large epidemiological study in Central Asia, utilising the real-world nationwide healthcare data for population research and implementing the AI tools in this research.

Keywords: Artificial Intelligence; Big Data; Epidemiology; Kazakhstan; Population Health.

Abstract ID: MedDev-75

Additive Manufacturing of Patient-Specific Intervertebral Disc Models for Spinal Cord Compression Management

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ABSTRACT

Over 90% of individuals over 50 years of age show signs of intervertebral disc degeneration, which can lead to spinal cord compression otherwise known as degenerative cervical myelopathy (DCM). DCM is a progressive condition, the leading cause of spinal cord injury, and affects patients' mobility and quality of life. To enhance surgical planning and long-term management, this research focuses on the development of anatomically and mechanically accurate cervical intervertebral discs (IVDs). Consequently, additive manufacturing technologies were employed, specifically fused deposition modelling using VarioShore thermoplastic polyurethane (TPU) and PolyJet printing with Stratasys Vero. TPU samples were printed at temperatures from 200 °C to 240 °C, with flow ratios from 0.60 to 0.90, while Stratasys Vero samples were produced with Shore hardnesses between 30A and 95A. Compression tests were performed on 10 mm diameter, 50 mm gauge length samples at 1 mm min^{-1} to assess the modulus using the least squares method, in line with the ISO 604:2003. Here we show that (i) TPU's compressive modulus aligns with existing literature for IVDs in the 31-80 age range, while Stratasys Vero fails to match the required modulus for ages 41-60; (ii) the increasing prevalence of DCM for individuals aged 40 years and above makes Stratasys Vero unsuitable; and (iii) TPU's overall greater customisability, lower mechanical property variance, and 12-times lower cost than Stratasys Vero, makes it a well-suited material for patient-specific IVD modelling. These findings offer valuable insights for the development of patient-specific spinal models, enhancing personalised treatment strategies and improving DCM management. It is anticipated this research could improve clinical outcomes, reduce healthcare costs, and decrease reliance on testing using animal models.

Keywords: Additive Manufacturing; Cervical Spine; Degenerative cervical myelopathy; Intervertebral discs; Thermoplastic Polyurethane

Abstract ID: MedDev-76

Trends and Patterns in Mortality from Non-Communicable Diseases in Sri Lanka

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ABSTRACT

Non-communicable diseases are the leading causes of morbidity and mortality around the world, revealing a huge public health issue. The trends and patterns of NCDs are very important due to their implications on the public health, healthcare systems and overall well-being. This study investigates the trends and patterns of NCDs with a focus on cancer, diabetes, and cardiovascular diseases in Sri Lanka. Given the rising global burden of NCDs and their impact on public health and healthcare systems, understanding these trends is crucial. The research examines hospital mortality data from 2004 to 2019 to identify gender differences and spatial distribution in NCD mortality rates. Data was collected by the Department of Health, Sri Lanka. The key findings include a steady increase in deaths due to heart diseases, from around 7,000 in 2002 to approximately 12,000 by 2020. Cancer deaths have shown an exponential rise since 2017, particularly among males. Mortality due to diabetes remains relatively stable, but with a high prevalence rate. Gender analysis indicates higher mortality in males across all three NCDs. Sub-disease analysis shows specific trends within cancer and heart diseases. This study emphasizes the importance of monitoring NCD trends to inform healthcare strategies and prioritize preventive measures for the management of Health in Sri Lanka to achieve SDG goal no 3; good health and wellbeing.

Keywords: non-communicable diseases; mortality; trends and patterns