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# MATERIALS MIND

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Institute of Materials, Malaysia

## HIGHLIGHT




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**Institute of Materials, Malaysia**





# NOTICE FOR RENEWAL OF ANNUAL MEMBERSHIP AND SUBSCRIPTION FEES 2025

| APPLICATION FOR RENEWAL OF MEMBERSHIP | | | | | | |
|---|---|---|---|---|---|---|
| **PARTICULARS OF MEMBER** (*update where necessary*) | | | | | | |
| **PERSONAL INFORMATION** | | | | | | |
| FULL NAME | : | | | | | |
| TITLE | : | | IC/PASSPORT NO. | : | | |
| DATE OF BIRTH | : | | AGE | : | | |
| CORRESPONDENCE ADDRESS | : | | | | | |
| MOBILE PHONE NO. | : | | HOUSE PHONE NO. | : | | |
| EMAIL ADDRESS | : | | | | | |
| IMM MEMBERSHIP NO. | : | | | | | |
| **CURRENT JOB INFORMATION** | | | | | | |
| NAME OF COMPANY | : | | | | | |
| DESIGNATION/POSITION | : | | | | | |
| ADDRESS OF COMPANY | : | | | | | |
| OFFICE PHONE NO. | : | | OFFICE FAX NO. | : | | |

| MEMBERSHIP SUBSCRIPTION AND PAYMENT | | | | | | |
|---|---|---|---|---|---|---|
| GRADE (Thick the appropriate box) | | SUBSCRIPTION PERIOD | | | | |
| | Fellow (F.I.M.M) | | 1-year | | | |
| | Professional (M.I.M.M) | | More than 1-year, please state | : | | years |
| | Associate (A.M.I.M.M) | | Amount paid | : | | |
| | Company | | | | | |
| | Ordinary | | | | | |

**MEMBERSHIP ANNUAL SUBSCRIPTION FEES SCHEDULE**

| Description | Amount (RM) | | | | |
|---|---|---|---|---|---|
| | Fellow (F.I.M.M.) | Professional (M.I.M.M.) | Associate (A.M.I.M.M.) | Company | Ordinary |
| **Annual Subscription** | 150.00 | 100.00 | 80.00 | 200.00 | 50.00 |

## PAYMENT

Payment can be made by cheque, telegraphic transfer, bank draft, cash deposit machine or via online/internet banking as follows:

| | | |
|---|---|---|
| Account Name | : | Institute of Materials, Malaysia |
| Account | : | 8009055156 |
| Bank | : | CIMB |
| Swift Code | : | CIBBMYKL |

## SUBMISSION OF DOCUMENTS

Send your completed form together with the proof of payment either via email to **secretariat@iomm.org.my** or WhatsApp to **018-9113480** or send by courier/post to:

The Secretariat
Institute of Materials, Malaysia
Suite 1006, Block A, Kelana Centre Point
No.3, Jalan SS3/17, Kelana Jaya
47301 Petaling Jaya, Selangor

The membership renewal online form can be accessed through IMM website at this link

https://www.iomm.org.my/membership-renewal/

INSTITUTE OF MATERIALS, MALAYSIA

## Background and History

**The Institute of Materials, Malaysia (IMM) is a professional society and certification body that promotes honorable practice, professional ethics and encourages education and skills in materials science, technology and engineering. Engineers, academicians, technologists and technicians, skilled workers and other professionals are amongst its members and number more than 6000.**

## Vision

**To be internationally recognized competency certification institution in Materials Science, Technology and Engineering**

## Mission

1. **To be the technical authority on Materials Science, Technology and Engineering**
2. **To positively contribute to society and quality of life**
3. **To become an internationally recognized certification body**
4. **To develop and enhance competency and skills for all categories and practitioners**
5. **To be the platform for industry and academia collaboration**

INSTITUTE OF MATERIALS, MALAYSIA

# IMM Membership Grade

## PROFESSIONAL

A person at least 25 years of age with approved academic qualifications and training, having at least 3 years responsible experience in Materials Science and Engineering, or A person at least 40 years of age, with at least 15 years of experience with practical responsibility, as demonstrated by thesis/dissertation or report and interview

📌 Note: Associate, Affiliate Ordinary and Ordinary grade members can apply to upgrade their membership status to Professional if they meet the criteria

## AFFILIATE

### Company Member

The Institute of Materials, Malaysia will recognize various professional institutions and societies for free membership at "Company Grade". Company Members of the recognized professional institutions, societies & associations can become Company Members of the IMM without any annual subscriptions.

### Ordinary Member

The Institute of Materials, Malaysia will recognize various professional institutions and societies for free membership at "Ordinary Grade". Members of the recognized professional institutions and societies can become Ordinary Members of the IMM without any annual subscriptions.

## COMPANY

Any company that involves or has interest in Materials Science and Engineering will be qualified to join as a Company Member

## FELLOW

A person at least 35 years of age with approved academic qualifications, training and 8 years relevant responsible experience of Materials Science and Engineering or has given distinguished service to industry or education

📌 Note: No direct application is allowed. Only upgrading of membership is allowed. Professional, Associate, Affiliate Ordinary and Ordinary grade members can apply to upgrade their membership status to Fellow if they meet the criteria.

## ASSOCIATE

A person at least 25 years of age, who possess an interest in Materials Science and Engineering but have not acquired the necessary experience or obtained the qualifications, governing entry to Member grade. An Associate Member, on obtaining the necessary qualifications, may apply for transfer to Member grade

## ORDINARY

Any Malaysian Citizen and above the age of 18 years engaged in activities related to research, development and application in Materials Science and Engineering shall qualify for Ordinary Membership. Only Ordinary Members who meet the necessary minimum requirements may apply for transfer to membership grades of Fellow, Member and Associate Member and may use the abbreviated titles upon transfer

## STUDENT

A student member shall be a person not under 17 years of age who at the time of application satisfies the Council that he has received a good general education and is studying subjects related to Materials Science or Engineering. A student member shall transfer to the grade of Ordinary Member after graduation provided he or she is suitably qualified and as soon as he or she is earning a full-time salary. A Student shall not become member of the IMM without the prior approval of the Vice-Chancellor or Head of Department of the university or relevant authority concerned

Jointly Organized by:

Institute of Materials Malaysia
Under Corrosion Committee

Materials Technology Institute

Event Organizer:

20 MTE YEARS Materials Technology Education Sdn Bhd

Supporting Media:

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# REGISTER NOW

## INSTITUTE OF MATERIALS, MALAYSIA (IMM)
## &
## MATERIALS TECHNOLOGY INSTITUTE (MTI)
## JOINT INTERNATIONAL CORROSION CONFERENCE & PLANT VISIT 2025

**Theme: Corrosion and Integrity Management In the Digital World**

**CONFERENCE**
**Date : 16 October 2025**
**Time : 8:00 am - 5:00 pm**
**Venue: DoubleTree by Hilton Kuala Lumpur Hotel**

**PLANT VISIT**
**Date : 17 October 2025**
**Time : 9:00am - 2:00pm**
**Venue: TBA**

## ABOUT THE CONFERENCE

The Institute of Materials, Malaysia (IMM) proudly announces its annual Corrosion Conference for the year of 2025. This conference is more than just an annual event; it's a catalyst for innovation. This year, we're pushing the boundaries of traditional corrosion and integrity management by embracing the power of digital technologies.

In partnership with Materials Technology Institute (MTI), we invite you for 1- day session of insightful presentations, engaging discussions, and a unique plant visit. This annual conference offers a platform for researchers, engineers, and industry professionals to share progressive knowledge, network with peers, and gain valuable insights into the challenges and opportunities in the field of corrosion and integrity management.

## IMM-MTI JOINT CONFERENCE & PLANT VISIT 2025
## CONFERENCE ORGANIZING COMMITTEE

**Publicity Committee**
- Dr Yoga Sugama Salim *(CETIM-MATCOR)*
- Ms Karen Cheng *(Materials Technology Education Sdn Bhd)*
- Dr Maxine Yee Swee Li *(University of Nottingham Malaysia)*
- Mr Danny Tan Kim Chew *(Abadi Oil & Gas Sdn Bhd)*
- Mr Chia Kok Chua *(PTT Exploration and Production)*
- Ms CY Wee *(ChongWah-NTIA Sdn Bhd)*
- Mr Leow Chun Ho *(Sarawak Shell Bhd)*
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- Mr Dragon Hao *(MTI member)*
- Ir Chew King Vee *(MTI member)*
- Mr Paul Liu *(MTI member)*

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- Dr Maxine Yee Swee Li *(University of Nottingham Malaysia)*
- Dr Yoga Sugama Salim *(CETIM -MATCOR)*
- Mr Yip Han Wei *(Sarawak Shell Bhd)*
- Dr Azzura binti Ismail *(Universiti Tun Hussein Onn Malaysia)*
- Ts Kamila AB Hamid *(Wood Group PLC)*
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- Mr Mark Hew *(Kutar Malaysia Sdn Bhd)*
- Mr Kang Kim Ang *(Corrtrol Services Sdn Bhd)*
- Ms Karen Cheng *(Materials Technology Education Sdn Bhd)*
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- Mr Danny Tan Kim Chew *(Abadi Oil & Gas Sdn Bhd)*
- Mr Tariq Mehtab Mohd Ishaq *(T4 Energy Solutions Sdn Bhd)*

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Event Organizer:

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## ABOUT THE PROGRAM

| | |
|---|---|
| 08:00 am | Registration, Light Breakfast & Tour Exhibition |
| 09:00 am | Welcome Note by Emcee & Safety Briefing by hotel |
| 09:10 am | Opening Speech by Dr Chew Khoon Hee IMM President |
| 09:20 am | Opening Speech by Ms Heather Allain, MTI President |
| 09:30 am | Knowledge Management Strategies for the Process Industries by Mr Kirk Richardson, Materials Technology Institute |
| 09:50 am | A New Universal Alloy for Offshore O&G Production by Mr Dragon Hao, Alleima (Shanghai) Materials Technology |
| 10:10 am | Microscopic Investigation of Liquid Migration in Open-Cell Insulation and Its Impact on Heat Loss and Energy Efficiency in Piping by Mr David Chen Chin Liang, Aspen Aerogels, Inc |
| 10:30 am | Emerging Approaches in Equipment Reliability Management: Bridging Technology and Business Performance by Mr David Lim, Pluperfect Technology Sdn Bhd |
| 10:50 am | Tea Break/ Visit to Exhibition |
| 11:30 am | Full Cathodic Protection Survey for Subsea Buried Pipeline by Using Non-Contactable Field Gradient Sensor by Ts Lai Kok Leong, Sarawak Shell Bhd |
| 11:50 am | Digital Twins of Gas Transmission Pipelines by Mr Isya Muhajirin, BJ Services (M) Sdn Bhd |
| 12:10 pm | Enhancing Cathodic Protection with Modelling and Digital Twin Technology by Mr ShiLiang Johanthan Tan, Matcor Technology & Services Pte Ltd |
| 12:30 pm | TBA by H.Rosen Engineering Sdn Bhd |
| 12:50 pm | Group Photo |
| 13:00 pm | Lunch/ Visit to Exhibition |
| 14:30 pm | A Non-Conventional Coating and Insulation Repair Approach to Mitigate CUI In Pressure Vessels by Mr Raizal Azhar, PTTEP |
| 14:50 pm | Digitalizing Corrosion Under Insulation (CUI) Maintenance: A Data-Driven Approach to Predictive Maintenance & Sustainability by Mr Arve Martinsen, Kaefer blu AS |
| 15:10 pm | Corrosion Under Insulation: A Costly Problem with a Proven Solution by Ms Azanie Azmi, Rockwool Malaysia Sdn Bhd |
| 15:30 pm | Tea Break/ Visit to Exhibition |
| 16:00 pm | Digital Transformation in Corrosion Management: A Comparative Study of Manual and Online Thickness Measurement in CO2 Removal Systems by Dr Rao Guang Bin, BASF (China) Co. Ltd & Ir. Chew King Vee, BASF Petronas Chemicals Sdn Bhd |
| 16:20 pm | An Assessment of Microbiological Monitoring Techniques for Microbiologically Influenced Corrosion (MIC) in a Large Onshore Oilfield by Mr Douglas Bennet, Intertek CAPCIS |
| 16:40 pm | Advancements in Field Online Corrosion Monitoring Techniques- Its Data Integration for AI and ML Model Development by Mr Amish Gandhi, Progressive Impact Corrosion Sdn Bhd |
| 17:00 pm | Closing remarks by Ir Ong Hock Guan, Chairman of IMM Corrosion Committee |
| 17:15 pm | Adjourn |

## WHO SHOULD ATTEND

- *Corrosion Engineers*
- *Asset Integrity Managers*
- *Maintenance and Reliability Engineers*
- *Materials Engineers*
- *Software Engineers*
- *Digital Transformation Specialists*
- *Inspection Engineers*
- *Data Scientist and Analysts*

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# REGISTRATION FORM

| | | | |
|---|---|---|---|
| Name | ( Prof./ Dr./ Ir./ Ts./ Mr./ Ms. ) | | |
| Institution / Company Name | | | |
| | | | |
| Institution / Company Address | | | |
| Tel No (Office) | | Mobile No | |
| Email Address | | | |

| | | FEES (RM) | PLEASE TICK (✓) |
|---|---|---|---|
| **Delegates** | IMM/ MTI Member | 540.00 | |
| | Non Member | 648.00 | |

*Note: * Fee included 8% SST.*

**EVENT SPONSOR / EXHIBITOR ( Please Tick ✓ )**

☐ **EVENT SPONSOR - RM 5,500.00***

**Package** includes :

- 1 Technical presentation slot
- 1 Promotional table with 2 chairs
- 1 Free pass for Presenter
- 2 Free passes as Conference Delegates
- 2 Free passes for Exhibition Promoters

☐ **TABLE - TOP EXHIBITION STAND - RM 3,500.00***

**A. Package** includes :

- Promotional table with 2 chairs
- 2 Free passes Exhibition Promoters

**B.** Please reserve Table No _____ for us.
( Refer to Exhibition Layout Plan for Table - Top Exhibition stand number )

*Notes:*
*a) *Event Sponsor and Table - Top Exhibition Stand are subject to 8% SST.*
*b) Additional pass for exhibition promoter will be charged at RM 486.00 nett ( IMM/MTI Member ) and RM 594.00 nett ( Non-Member )*
*c) Exhibition stand does not come with a wall. Exhibitors are advised to bring in their own promotional materials.*

**PAYMENT** must be made by Electronic Transfer, Telegraphic Transfer, Cheque or Bank Draft to

**Account Name** : *Materials Technology Education Sdn Bhd*
**Account No** : *5621 0669 2397*
**Bank Name** : *Maybank Berhad*
**Bank Branch** : *Shah Alam Branch*
**Country** : *Malaysia*

***Note :**
1) Payment must be made at least two weeks before the conference
2) Onsite payment is not acceptable 3) Proof of payment to be sent via email to **asyuraa@mte.com.my**

For any enquiries, please contact :

Ms Asyura
03 5524 3704 or 014 377 3704
email : **asyuraa@mte.com.my** or **info@mte.com.my**

Materials Technology Education Sdn Bhd
13 - 2, Pusat Dagangan Shah Alam
Lot 13, Persiaran Damai
Seksyen 11, 40100 Shah Alam, Selangor
Tel : + 603 5524 3704

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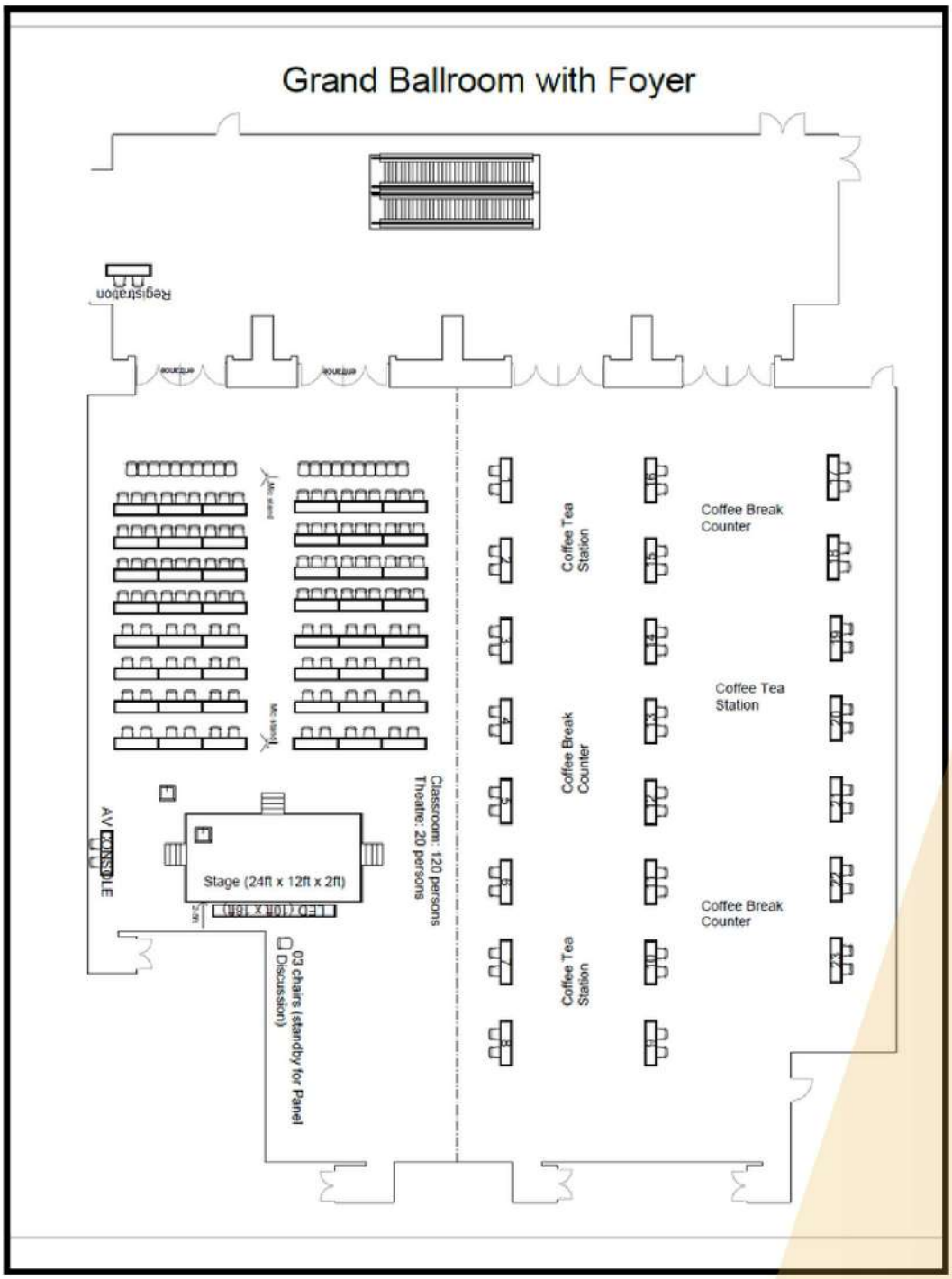
# EXHIBITION LAYOUT - PLAN

## DoubleTree by Hilton Kuala Lumpur Hotel



# COVER STORY

# CORROSION MANAGEMENT IN UPSTREAM OIL AND GAS ASSETS

*Ir. Eur-Ing. Ong Hock Guan*
*Institute of Materials, Malaysia (IMM)*
*IMM Honorary Treasurer and Chairperson, Corrosion Committee (2024-2026)*

The world is still a long way from relinquishing oil and gas assets from the global energy mix despite the recent year's significant shift towards renewable energy sources. Fossil fuels remain dominant in the overall global energy mix, with oil and gas demand still growing strongly, particularly in Asia. Hence, effective corrosion management is still pivotal to the successful operation of upstream oil and gas assets. (c.f. Figure 1.) This can not only prolong the life of assets, i.e., structures, facilities, wells, and pipelines, further it can also reduce the uncontrolled release of toxins and harmful by-products into the environment due to loss of containment (LOC).

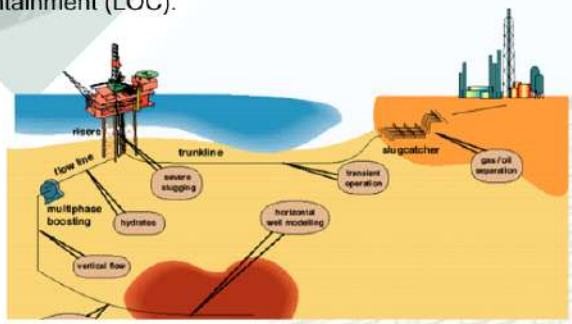



*Figure 1: Upstream oil and gas facilities, pipelines and wells.*

## 2. WHY EFFECTIVE CORROSION MANAGEMENT IS ESSENTIAL IN UPSTREAM OIL AND GAS ASSETS

Corrosion can lead to premature failures of oil and gas assets. The resulting loss of containment leading to gas leaks and oil spills can be dangerous to the environment, human health, and potential human fatalities. It can also increase the cost of operating upstream oil and gas assets by requiring frequent inspection, monitoring, repairs and replacement of corroded components and equipment.

Therefore, it is important to implement effective corrosion management strategies to ensure the long-term viability, safe and reliable operation of oil and gas assets. This will earn the "Licence to Operate" for the operators.

## 3. WHAT CAUSES CORROSION ATTACKS IN UPSTREAM OIL AND GAS ASSETS?

Corrosion in upstream oil and gas assets is caused by a combination of factors, including exposure to harsh hydrocarbon. The main causes of corrosion in these assets is the presence of high concentrations of water, hydrogen sulfide ($H_2S$), carbon dioxide ($CO_2$), mercury, High Pressure/High Temperature (HPHT) etc. in the upstream oil and gas assets.

High temperatures can accelerate the corrosion process, particularly in areas where $CO_2$ is in contact with water or other acids like organic acid which can lead to "Top of Line" (TOL) corrosion in a high temperature and high pressure (HTHP) pipeline. Additionally, high temperatures can cause metal components to expand and contract, which can lead to stress on the materials and accelerate corrosion.

Other factors that can contribute to corrosion in oil and gas assets include exposure to other contaminants, such as sulfur compounds, chlorides, $H_2S$, mercury, as well as the presence of microorganisms, such as bacteria leading to Microbial Induced Corrosion (MIC) in oil pipelines. Interaction with $CO_2$, $H_2S$, and water will create an environment that is corrosive to metal surface. i.e. carbonic acid.

## 4. EFFECTIVE CORROSION MANAGEMENT STRATEGIES IN UPSTREAM OIL AND GAS ASSETS

Currently, there are several strategies that can be used to manage corrosion in upstream oil and gas assets during operated phase. In project design phase, a proper material selection shall be thoroughly studied and a comprehensive Risk Based Inspection plan shall be established aligned with Corrosion Management Framework (CMF) and Corrosion Management Manual (CMM). Of course, regular inspection/monitoring and maintenance is crucial, as per the established Risk Based Inspection (RBI) plan for the assets.

### "Fit For Purpose" Material Selection

Material selection is a crucial aspect of corrosion management in oil and gas assets. The use of corrosion-resistant materials, such as stainless steel, can significantly reduce the risk of corrosion. However, it's important to note that no material is completely immune to corrosion, and other strategies such as coatings/cathodic protection, and corrosion inhibitors should be considered.

### Risk-Based Inspection (RBI)

RBI is a methodology used to prioritize inspections of equipment based on risks assessments, it assesses the Probability of Failure (POF) and the Consequences of Failure (COF) to rank equipment for inspection, focusing limited resources on high-risk items with specific corrosion mechanisms while minimizing inspections of low-risk assets. It is a best practice for a new project to deliver a baseline RBI plan to the assets operators as part of the project handover deliverable.

**Regular inspection/monitoring and maintenance**
Regular inspection/monitoring and maintenance are essential for the early identification and addressing of corrosion threats. This includes visual inspections, conventional and advanced non-destructive testing, and real-time remote monitoring of corrosion rates.

Advanced Non-Destructive Testing (NDT) techniques like phased array ultrasonic testing (PAUT) or advanced eddy current testing (EcT) become essential. The maintenance Planning will anticipate and address potential corrosion issues before they escalate, extending the life of aging assets.

Coatings/Cathodic protection (CP) and corrosion inhibitors. Coatings/CP and corrosion inhibitors can be used to protect metal surfaces from corrosion. Coatings, such as paint or epoxy, can provide a physical barrier to prevent external corrosion.

Inhibitors, such as corrosion inhibitors, can be added to slow down the corrosion process within acceptable limits. Corrosion inhibitors are generally preferred in closed systems where the presence of the inhibitor can be more easily maintained. These are commonly used in oil and gas assets and can be effective in slowing down corrosion, but it's important to note that the selection of the right coating or corrosion inhibitor depends on the specific conditions of the asset. The corrosion inhibitor selection may be subjected to a proper protocol laboratory testing. Regular monitoring and maintenance are still needed from the asset's operator.

## 5. HOW DOES CORROSION ATTACKS OCCUR IN UPSTREAM OIL AND GAS ASSETS?

The corrosion of different materials used in upstream oil and gas assets can occur in different ways, depending on the specific properties of the materials used and the environmental conditions.
The common types of corrosion found in upstream Oil and Gas assets are as follows:

**Uniform Corrosion**
This is the most common type, occurring evenly across the metal surface, often due to chemical or electrochemical reactions. e.g. atmospheric corrosion on valves, tubular, equipment, etc. stored in open storage yard without preservation.

**Intergranular Corrosion (IGC)**
IGC is a type of corrosion that occurs along the boundaries of metal grain, rather than on the surface. It is often associated with local differences in compositions such as the precipitation of chromium carbides in stainless steels. This depletion creates anodic zones that are more susceptible to corrosion.

**Sulfide Stress Cracking (SSC)**
SSC is a form of hydrogen embrittlement that occurs in metals when exposed to $H_2S$ and other sulfide ions in humid environments and cracks under stress. In recent years, many new recovered fields in Malaysia have high contaminants of $H_2S$ which poses technical challenges in their field development.

**Hydrogen Induced Cracking (HIC)**
HIC is a form of material degradation that occurs when atomic hydrogen diffuses into a metal or alloy, often in an environment with hydrogen or $H_2S$. This process can lead to the formation of hydrogen molecules within the metal's crystal lattices, causing internal pressure build-up and cracking. This occurs when the hydrogen atoms diffuse into steel, leading to internal cracking.

**Stress Corrosion Cracking (SCC)**
Cracking under tensile stress in corrosive environment. e.g. stainless steel. SCC is difficult to detect early and can lead to catastrophic failures.

Pitting corrosion is the localized corrosion of a metal surface, resulting in small holes or pits. In upstream oil and gas assets, pitting corrosion can occur in pipelines, valves, and other components that come into contact with $CO_2$, especially in areas where the $CO_2$ is in contact with water or other liquids.

Crevice corrosion is a form of localized corrosion that occurs in tight spaces or crevices, such as the area between a gasket and a pipe flange. In upstream oil and gas assets, crevice corrosion can occur in joints and connections, such as pipe support contact points, flanges and gaskets, etc.

Galvanic corrosion is a type of corrosion that occurs when two dissimilar metals are in contact with an electrolyte, such as water or $CO_2$.. In upstream oil and gas assets, galvanic corrosion can occur in joints and connections where dissimilar metals, such as steel and aluminium, are used. This process accelerates the corrosion of the anodic metal (aluminium) and protects the cathodic metal (carbon steel).

**Microbiologically influenced Corrosion (MIC)**
MIC is perhaps the least understood corrosion phenomenon. It is a huge threat to oil and gas installation especially the pipeline assets. Sulphate Reducing Bacteria (SRB) are the best know corrosion causing microbes. It affects systems with traces of water and it is predominantly manifested in the form of localized corrosion pitting. MIC occurs when sessile microorganisms alter the physiochemical conditions on the metal internal surface of a carbon steel pipeline.

For example, carbon steel is a commonly used material in upstream oil and gas assets due to its lower costs and availability, but it is also highly susceptible to pitting, crevice and other types of corrosion in the presence of $CO_2$, $H_2S$, and water. Corrosion-resistant alloys (CRAs) such as Stainless steel, on the other hand, is more resistant to corrosion but can still be affected by high temperatures and the presence of other corrosive agents. e.g. $H_2S$ and chlorides.

## 6. THE FUTURE OF CORROSION MANAGEMENT IN UPSTREAM OIL AND GAS ASSETS

Managing corrosion in upstream oil and gas assets requires a multi-faceted and multi-disciplined approach, and the best strategy for a specific asset will depend on the specific conditions and materials used. For example:

- Material selection can significantly reduce the risk of corrosion, but it's important to note that no material is completely immune to corrosion. The challenge for the Materials and Corrosion Engineer is to select a "Fit For Purpose" material as a new project viability is based on its CAPEX costs and not on life cycle costs.
- Regular inspection and maintenance are essential for identifying and addressing corrosion threats early on, but they can be costly and time-consuming. Hence, Risk Based Inspection (RBI) plan shall be put in place prior to oil and gas assets actual production to prioritize risks.
- The maintenance Planning will anticipate and address potential corrosion issues before they escalate, extending the life of aging assets.
- Coatings and corrosion inhibitors can be effective in slowing down corrosion, but they can also be costly and require regular monitoring and maintenance.

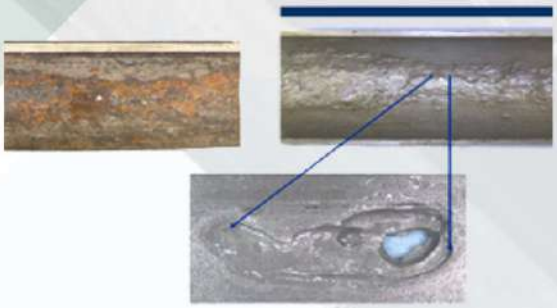


*Figure 2: MIC corrosion of carbon steel pipeline.*

Corrosion can lead to unsafe operation of upstream oil and gas assets, as well as increasing the cost of operating offshore assets by requiring frequent inspection/monitoring, repairs and replacement of corroded components and equipment.

While current corrosion management strategies are effective at controlling corrosion at upstream oil and gas assets, it is important to continue to research, experiment, and develop innovative techniques/new technologies for enhanced corrosion management. As the technologies and conditions in oil and gas assets evolve, the strategies used to manage corrosion must be adapted in the coming years.

Every improvement that we can make will improve the viability and safety of our oil and gas assets. The Institute of Materials, Malaysia (IMM) is in the perfect position to help industry and academia deliver these improvements.

# TECHNICAL TRAINING
AND CERTIFICATION PROGRAM

## CERTIFIED CATHODIC PROTECTION PRACTITIONER LEVEL 1 CODE : CPP1

This 4-days training and certification course consist of lectures, classroom practical, case studies and knowledge assessment.

### OBJECTIVES
This course is designed to train participants on understanding of supervision, installation, testing & commissionig of Cathodic Protection system, have sufficient troubleshooting skills, inspection & surveys and data interpretation .

### COURSE CONTENT
- Electricity relevant to CP applications and measurements
- Corrosion, electrochemistry and coatings relevant to CP
- Theory, principles and criteria of CP
- Requirements related to application of CP
- Application methods of CP, galvanic anodes, impressed current
- CP Measurements and test procedures
- Relevance of voltage gradient errors and influence on structure to electrolyte potential measurement
- Factors influencing the correct selection of reference electrodes for potential measurements
- Effects of excessive CP on coatings, high-yield strength steels and corrosion-resistant alloys
- Diagnostics of CP systems
- Interference conditions (alternating current and direct current)
- Standards and Codes of Practice relevant in CP practices.
- Health, Safety and Environmental issues relating to CP practices.
- Code of Ethics and Professional Conduct of all CP persons.
- Interpersonal communication skills.

### WHO SHOULD ATTEND
School-leavers, technicians, fresh graduate scientists and engineers having interest or already involved in cathodic protection systems and corrosion management and control, who have undergone sufficient basic training in this field.

### PRE-REQUISITE
- Minimum academic qualification - SPM or equivalent* OR
- Attended relevant academic Cathodic Protection Practitioner dedicated to the IMM Cathodic Protection Practitioner Level 1 Certification with at least 3 months of practical field experience in cathodic protection.

### CERTIFICATE
IMM Certified Cathodic Protection Practitioner Level 1

### LANGUAGE
English

### COURSE DURATION
4 Days

Eligible for MBOT CPD Points 20

HRD CORP CLAIMABLE

SCAN for FREE MTE Training Book

20 YEARS MTE Materials Technology Education Sdn Bhd

13-2, Pusat Dagangan Shah Alam, Lot 13, Persiaran Damai, Seksyen 11, 40100 Shah Alam, Selangor, MALAYSIA

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# TECHNICAL TRAINING
AND CERTIFICATION PROGRAM

CODE : CMP-1

# CERTIFIED CORROSION MONITORING PRACTITIONER LEVEL 1

This certification program will assess candidates who either have some experience, or have undergone training, in corrosion monitoring covering corrosion inhibition monitoring and cathodic protection monitoring.

## OBJECTIVES

This program will enable candidates to be assessed on their understanding of the key-points on corrosion inhibition and cathodic protection monitoring and process corrosion monitoring; to retrieve and change-out of coupons and probes; to carry out measurement and interpretation of corrosion rates; to use retrieval tools, service valves, back-pressure pumps and surge tubes; to conduct the cathodic protection monitoring and inspection techniques.

## WHO SHOULD ATTEND

School-leavers, technicians, scientists, engineers, metallurgists, inspectors and inspection supervisors interested in corrosion monitoring and inspection and who wish to pursue a career as an IMM Certified Corrosion Monitoring Practitioner.

## PRE-REQUISITES

- Minimum academic qualification - SPM or equivalent* OR
- Attended relevant academic Corrosion Monitoring Practitioner dedicated to the IMM Corrosion Monitoring Practitioner Level 1 Certification with at least 6 months of field experience in Corrosion Monitoring work-scope from employer
- The applicant must pass the Eye Acuity Examination, with or without corrective lenses, to prove near vision acuity on Jaeger J2 at 12″ or greater (⩾30.5 cm). All applicants shall take a colour perception test

## COURSE CONTENT

- Fundamental of corrosion
- Forms of corrosion
- Corrosion inhibition & preservation
- Corrosion control techniques (includes coatings)
- Corrosion monitoring techniques
- Corrosion monitoring probes & coupons
- Equipment installation & retrieval process
- Key points monitoring
- Ultrasonic thickness measurement - effectiveness and usage
- Cathodic protection principles
- Cathodic protection inspection techniques and surveys
- Standards and Codes of Practice
- Health, Safety & Environment considerations in corrosion monitoring activities
- Ethnic and Professional Conduct
- Interpersonal skills

## COURSE DURATION

4 days

## CERTIFICATE

IMM Certified Corrosion Monitoring Practitioner Level 1

Eligible for MBOT CPD Points 20

HRD CORP CLAIMABLE

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**IMM MATERIALS FAILURE INVESTIGATION PRACTITIONERS CERTIFICATION SCHEME**

20 YEARS 2004-2024 MTE Materials Technology Education Sdn Bhd

IMM

# CERTIFIED MATERIALS FAILURE INVESTIGATION PRACTITIONER - LEVEL 1

Materials Failure Investigation is a process that involves systematically inspecting and analysing a failed or malfunctioning material or component. The process entails a thorough investigation to determine the underlying causes and mechanisms that contributed to the failure. The goal of material failure investigation is to avoid similar failures in the future.

The MFIP training and certification courses are aimed classified candidates into different levels according to the required knowledge and competence. The IMM Certified Materials Failure Investigation Practitioner (MFIP) Level 1 Training and Certification Program will train and assess candidates who have the necessary experience in supporting Materials Failure Investigation in sample collection and testing, and undergone training in the field of Materials Failure Investigation.

## OBJECTIVES

- To appreciate and identify the most likely failure/damage mechanisms for common metals & their alloys used in the oil & gas, petrochemical and shipbuilding industries.
- To apprehend the appropriate use of engineering material requirements deemed necessary for safe design, construction and installation of pressurized components, piping, pipelines, and structures.
- To recognize fitness-for-service (FFS) concepts for evaluating in-service degradation of pressure containing components/equipments.
- To assess candidates who have the necessary experience in supporting Materials Failure Investigators in sample collection and testing, after having undergone the required technical training in the field of Materials Failure Investigation.

## COURSE CONTENT

- Determine When, Where & How the Failure occurred
- Collect Samples for Laboratory Examination
- Take on-site photographs
- Identify Defects Non-Destructively
- Conduct appropriate Chemical Analyses
- Confirm material composition & identify contaminants through EDS analysis
- Analyse via Fractography & Metallography
- Conduct Appropiate Mechanical & Materials Testing and Analysis
- Determine type of failure
- Linage of Design, Inspection & Assessment Codes
- Sequence in Materials Failure Analysis & Investigation
- Assessment Techniques for Materials Failure Analysis
- Case Studies on Selected Industrial Damage Mechanisms

## PREREQUISITE

- Technical vocational education (minimum Level 4), technician certificate or equivalent, plus specialized training and education in the field of materials
- SPM/STPM (requires basic mathematical skills) plus specialized training and education in the field of materials.

## WHO SHOULD ATTEND

School-leavers, technicians, laboratory personnel and anyone who have been involved in testing for Materials Failure Investigation activities.

## CERTIFICATE

IMM Certified Materials Failure Investigation Practitioner Level 1

## COURSE DURATION

3 days (training + assessment)

HRD CORP CLAIMABLE

***In-house Training available - Upon Request**
In order to meet the specific learning goals of your team, you can request IN-HOUSE TRAINING (also available online) to be organized for your company.

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# TECHNICAL ARTICLE 1

# Thermal Insulative Coating in Combating Corrosion Under-Insulation (CUI)

*Jason Yap Haw-Shin, Brain Lim Siong-Chung*
*Pluperfect Technology Sdn. Bhd. (PTSB)*

Corrosion Under Insulation (CUI) is a major common problem on a worldwide basis that is shared by all the refining, petrochemical, power, industrial, onshore and offshore. The term "Corrosion Under Insulation" describes the external corrosion of piping, vessels and other equipment that occurs beneath conventional insulation system follow water ingress. CUI tends to remain undetected until the insulation is removed for inspection or when corrosion damage progresses to the point of failure and leak occurs as a result of Loss of Containment (LOC). Figure 1 - A serious process fire safety incident.

*Figure 1: CUI failure on piping leading to a process fire safety incident*

Many studies have shown that the highest incidence of leaks in the petroleum industry is due to CUI failures and not due to process corrosion. This phenomenon is known to be highly random in nature and tends to remain undetected until complete removal of insulation to thoroughly inspect the condition of insulation/metal surfaces. Figure 2 - CUI exposed under insulation and Figure 3 - Grossly reduced wall thickness loss due to CUI after opening up insulation.

The best CUI mitigation measure is to avoid insulation on equipment and piping that does not require thermal insulation in the first place. This article discusses the general overview of corrosion under insulation (CUI), an environment that is often overlooked until a loss of containment occurs in the operated phase of facilities. Thermal insulation is usually employed due to process reasons:

- to minimize heat gain or loss, personnel protection – from heat or cold burns, acoustic reason
- to manage noise control and fire protection
- to protect equipment and piping from heat radiation.

Traditionally, conventional insulation system usually consists of insulating materials such as mineral wool, cellular glass, calcium silicate, phenolic foam, and etc. followed by an outer layer of jacketing or cladding.

Insulation system is designed with aims that water ingress and capillary action is not possible and that potential leaked product and water vapour or condensation can escape or drain off. Despite a carefully designed insulations and great emphasis given to sealing joints, termination system and protrusions during insulation, water ingress over time is inevitable and is a given. Mechanical damage such as personnel stepping on it (Figure 4) and degradation of sealants will contribute to the water ingress through the insulation system. CUI can also occur if equipment and piping sweat.

Once the insulation is breached, a highly aggressive environment beneath the insulation materials is created, in combination with the lack of visibility; CUI can lead eventually to catastrophic and expensive failures (Figure 1).

*Figure 2: CUI exposed under insulation*

*Figure 3: Wall thickness loss due to CUI*

## 2. DESIGN OF INSULATION SYSTEM

There are three combinations that lead to CUI, susceptible temperature, susceptible material and ineffective barrier (water ingress). Therefore, it is imperative to identify the needs for and the criteria in designing an insulation system as a good engineering practice. Typical considerations during the design stage are the application of the proper protective coating system, insulation system specific to the environment and proper insulation installation.

A high CUI corrosion rate is anticipated in the temperature region between 50 degrees Celsius to 110 degrees Celsius and a reasonably low corrosion rate as the temperature goes below 50 degrees Celsius or higher than 110 degrees Celsius. (c.f. Figure 5).

Other than technical requirements, economic consideration plays a vital role to ensure the insulation system is capable of remaining under the expected conditions of service life. There are numerous cases where insulation is designed on equipment and piping even though it is not required. This

will add to the maintenance cost for inspection activities which could be time-consuming and expensive. One of the reports shows that most piping leaks (81%) occur in a diameter smaller than 4" nominal pipe size. Hence, this goes back to the basis of design consideration; do the equipment or piping need thermal insulation in the first place.

*Figure 4: Personnel stepping on and damaging the cladding*

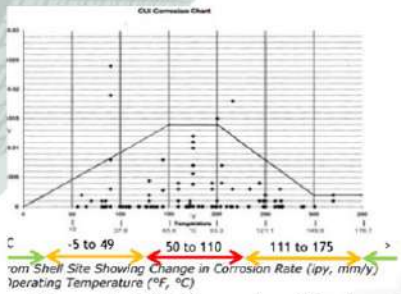


*Figure 5: CUI Corrosion Chart*

During the design stage, it is crucial to understand the potential risk and the barriers management associated with the failure of CUI. Risk management requires a systematic approach of analyses from various technical disciplines in order to support any decision. Meanwhile, barrier management is established to maintain barriers at any given time by preventing an undesirable incident from occurring or by limiting the consequences in case of unwanted incident happens.

## 3. NON-DESTRUCTIVE EXAMINATION METHODS

To date, there are numerous non-destructive methods available to inspect the presence of CUI without removing the insulation. Neutron backscatter, thermography, radiography (real-time or computed radiography), ultrasonic thickness measurement (guided-wave testing), pulse eddy current, magnetostrictive sensor technology to mention a few. However, none of them is 100% reliable.

## 4. SUSCEPTIBLE MATERIALS AND PROCESS SAFETY

CUI can occur in carbon steel, low nickel steels and low alloy steels. The primary consideration is temperature. External CL-SCC can occur in austenitic stainless steel typically SS304L, SS316L, SS321, SS347 and associated weldments. Alloys containing more than 32 % Ni are generally not susceptible to external CL-SCC. e.g. Alloy 825 CUI failure can often lead to process safety incidents where the management of hazards that covers major accidents involving the release of potential dangerous material, release of energy (such as fire and explosion) or both is not effective.

## 5. CUI MITIGATION - AN ALTERNATIVE OPTION

The most common CUI mitigation plans include one or more of the following: application of protective coating, periodic stripping of cladding for visual inspection and periodic Non-Destructive Evaluation (NDE) activity for maintenance. In recent years, with the availability of thermal insulative coatings in the market. One of the CUI mitigation approaches is through the application of protective thermal insulative coating (e.g. fluid-applied acrylic). Thermal insulative coating has additional advantages compared to conventional insulation systems as follows:

- Resistance to moisture infiltration which is a primary cause of CUI. The insulating value does not drop after exposure to water.
- Exceptional corrosion under insulation resistance. Most conventional forms of insulation are not bonded directly to the substrate, thus creating air gaps where moisture can collect to initiate corrosion under insulation.
- Excellent substrate bonding and durability. The durable, water resistant barrier effectively resists moisture infiltration.
- Trouble-free labour saving touch-up/repair via visual inspection on the conditions of the thermal insulative coating.

*Figure 6: Pictures of Aerolon thermal insulative coating application on vessel and piping.*

Until today, the key challenge with corrosion under insulation (CUI) mitigation programme is still to do with the issue that there is no cost effective and no 100% reliable non-destructive examination to inspect or detect corrosion under insulation. The most effective and lowest cost to prevent CUI is to avoid insulation on equipment and piping that does not require thermal insulation in the first place. The design consultant and the client engineer have to work closely together to ensure compliance.

Essentially, CUI cannot be entirely eliminated; however, it can be managed with the most cost effective mitigation approach depending on the situation. Hence, applying thermal insulative coating on vessels, tanks, valves, structural steel, and piping within the thermal insulative coating upper temperature limit is a cost effective alternative option to effectively mitigate and combat the risks of CUI in the plant facilities during project design phase where thermal insulative coating is specified upfront by client engineer and in operate phase where conventional insulation system is replaced by thermal insulative coating within its upper temperature limits during asset turn around.

## QUALITY OBJECTIVES AND POLICY

The Institute of Materials, Malaysia (IMM) which promotes honourable practice and professional ethics, and encourages education and skills in materials science, technology and engineering shall carry out its activities and services as a certification body with integrity and credibility.

IMM and its personnel are required to be totally committed to quality, and adopt a culture of impartiality and continuous improvement, and be responsible to uphold this policy and the related procedures established by IMM and in accordance with the requirements of ISO/IEC17024.

**Impartiality**
IMM fully acknowledges the importance of impartiality in carrying out its certification activities. The Management of IMM shall not compromise impartiality and be diligent on an ongoing basis against potential threats to the impartiality and abuse of its certification process.

**Integrity of Services**
All IMM certification services is undertaken professionally and honestly in accordance with agreed standards, policies and procedures. IMM maintains its independence of judgement in the delivery of its services and decision-making and does not surrender to pressure and inducements to misrepresent findings or after the results of its examination, certification and competency.

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IMM is devoted to conduct all certification and related services in an honest and ethical manner, which includes undertaking to behave responsibly in the personal and institutional management of conflicts of interest and will follow relevant procedures to ensure that the conflicts of interest be avoided.

**Confidentiality**
IMM respects and protects the confidentiality of information obtained or created during the process of certification, membership and related services and prohibits unauthorised disclosure of information.

**Security**
IMM as a certification body ensures examination materials are processed, stored and handled in a confidential and secured manner at all times to maintain a high level of integrity in the certification examinations.

**Environment, Health and Safety**
IMM is fully committed to ensure a safe environment and the health and safety of all personnel involved in IMM's activities and services so as to prevent accidents and loss/damage to assets or property.

**Intellectual Property**
IMM protects its own intellectual property and respects the intellectual property of others and shall prevent exploitation of intellectual property in its services.

**Bribery and Corruption**
IMM will not engage in bribery or corruption of any form. IMM do not allow the acceptance and/or offer of any personal gifts, hospitality or entertainment from/to external parties for the potentiality of creating any improper influence on its services and decision-making.

**Fraud and Deceit**
IMM protects the credibility of its certification and will not hesitate to suspend, withdraw or revoke certification if qualified persons are found to abuse through deceit, fraud or misrepresentation, or not in compliance with the certification ethics.

Ts. Dr. Chew Khoon Hee
President
Institute of Materials, Malaysia

29th March 2024

# INSTITUTE OF MATERIALS, MALAYSIA

## CONTINUING PROFESSIONAL DEVELOPMENT REPORT

**NAME:** ..... **YEAR:**.....
**IMM MEMBERSHIP NO:**..... **CERTIFICATION NO:**.....
**IMM CERTIFICATION:**.....

**CONTINUING PROFESSIONAL DEVELOPMENT (CPD) LOG**
**(Supporting documents to be submitted wherever applicable)**

| Date or Period | Professional Development Activity Code & Description | Role | No. of Activity Hours | Weightage | No. of CPD Points |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | TOTAL | |

| Professional Development Activity Code | Professional Development Activity Scope | Weightage Factor |
|---|---|---|
| A | Attending Online or Physical Training Courses/Workshops | 4 |
| B | Online or Physical Course Trainer/Facilitator/Examiner/ConferencePresenter | 3 |
| C | Attend Online or Physical Seminar/Conference/Webinar | 2 |
| D | Paper Author Main Author (max 30 hours/year)Co-author (max 10 hours/year) | 2 |
| E | Attend Online or Physical Committee Meeting | 1 |
| F | Fieldwork (max claimable 480 hours per year) ** | 0.1 |

** 1. Need to submit an endorsement from the superior/supervisor as evidence.
2. Calculated based on the assumption that the minimum project duration of 3 months and 8 hoursper day for 20 days.
3. The minimum number of CPD Points accumulated for 5 consecutive years shall be 100 points.

CPD Points per year : **10 points minimum.**
CPD Points per 5 year for re-certification : **100 points.**

| Year | | | | | | Total CPD Points |
|---|---|---|---|---|---|---|
| CPD Points | | | | | | |

I hereby declare that the information and particulars provided by me in this form is true and correct.

..... .....
(Signature) (Date)

# TECHNICAL ARTICLE 2

# Using Vapor Corrosion Inhibiting Oil Additives for the Corrosion Protection of Refurbished Equipment in Long-Term Storage

*Tom White*
*Marketing Manager, Northern Technologies International Corporation*

Corrosion is one of the most persistent and costly challenges faced by industries that rely on metal assets, especially in the heavy equipment, automotive, and energy sectors. When metal surfaces are exposed to moisture, oxygen, and contaminants such as chlorides, they undergo electrochemical reactions that lead to rust and degradation. This is particularly problematic for internal systems such as engines, gearboxes, and hydraulic components, which are challenging to inspect and costly to rework once corrosion sets in. Therefore, effective corrosion management is essential to extend equipment lifespan and reduce downtime, maintenance costs, and safety risks.

In one case, a heavy-duty equipment service center in the Pacific Northwest—known for high humidity and fluctuating temperatures—was tasked with rebuilding several large engines, axles, and hydraulic systems for a construction equipment fleet. After refurbishment, the equipment was to be stored for up to one year before being put back into service. This presented a significant corrosion risk, particularly to the internal surfaces of oil-filled components that could not be easily accessed once assembled. To address this, the maintenance team explored Vapor Corrosion Inhibiting (VCI) oil additives as a protective measure during storage (Figure 1).

*Figure 1: Refurbished Equipment in Long-Term Storage*

VCI technology releases corrosion-inhibiting molecules into enclosed spaces, forming an invisible, molecular-level shield on the metal surfaces that interrupts the corrosion process. Unlike surface-applied oils or coatings that require post-storage cleaning, VCI oil additives are designed to remain suspended in the host lubricant—such as engine oil, axle oil, or hydraulic fluid—providing ongoing protection without affecting the base fluid's performance. The additive is flushed out once the equipment is put back into service.

In this particular application, the VCI oil additive was introduced directly into the crankcase, rear axle, and hydraulic systems during the final stages of the rebuild. Initially, the additive was intended only for use in the engine crankcase. However, after consultation with a corrosion specialist, the team expanded its use to include other systems that presented similar corrosion risks. This approach allowed uniform protection across multiple critical components with minimal process changes or additional labor. Because the additive is delivered through existing oil circulation, it provides complete internal coverage without requiring additional coating or wrapping procedures.

Over the course of nearly a year in storage, the refurbished equipment remained in a climate-controlled facility. Periodic inspections revealed no signs of corrosion or degradation in the protected components. This outcome validated the VCI oil additive's performance and reinforced the importance of integrating corrosion protection into preventive maintenance and storage workflows. The success of this strategy has since encouraged the service center to adopt similar protective measures across other sites and equipment categories.

This case highlights how VCI oil additives can be an effective and efficient tool in comprehensive corrosion management plans. Their compatibility with standard lubricants, ease of application, and ability to protect complex internal geometries make them particularly useful for long-term storage scenarios, equipment mothballing, and intermodal shipping. As industries face increasing pressure to reduce waste, extend asset lifecycles, and optimize maintenance practices, adopting such protective technologies offers economic and operational benefits.

**ZERUST® VCI Oil Additive Protects Refurbished Engines While Left in Storage**

**Who?** A service center and dealer specializing in heavy-duty construction equipment.
What? Applied corrosion inhibiting oil additives to protect refurbished engine, axle, and hydraulic systems.

**Why?** To maintain the integrity of rebuilt components during extended indoor storage for up to one year.

**How?** A VCI oil additive was blended into the crankcase, axle, and hydraulic oil systems before storage to protect internal metal surfaces from rust and corrosion.

**Case Summary**

A heavy-duty equipment dealer located in a humid region of the Pacific Northwest was refurbishing several large engines for storage prior to reinstallation. Recognizing the risk of corrosion during downtime, the maintenance team sought an oil-based corrosion protection method that would integrate seamlessly into existing lubrication systems. After consulting with a corrosion specialist, they applied a VCI oil additive not only to the engines but also expanded its use to include rear axles and hydraulic systems. The use of the additive provided a protective vapor layer that inhibited corrosion without requiring component disassembly or additional cleaning steps post-storage.

**Results**

After nearly a year in storage, the refurbished equipment remained corrosion-free, demonstrating the effectiveness of VCI oil additives in preserving internal systems during idle periods. This approach highlights a practical corrosion management strategy that can be adapted for similar applications in equipment maintenance, refurbishment, and storage planning.

# NEW IMM PROFESSIONAL MEMBERS

## IR. NIK AMIRUDDIN SIRU BIN CHE MUSTAFFA

**Age:** 43 years old
**Organization:** SBM Offshore Group HSSE & CoE
**Position:** Group Technical Authority – Materials & Corrosion Protection
**Working experience(s):**
• 3 years as Group Technical Authority – Materials & Corrosion Protection at SBM Offshore Group HSSE & CoE
• 3 years as Principal Engineer/DLE for Material & Corrosion Protection (MCP) at SBM Schiedan, NL
• 2 years as DLE for Material & Corrosion Protection (MCP) at SBM Kuala Lumpur
• 1 year as DLE for Material & Fabrication Group at SBM Houston, USA
• 2 years as Deputy Lead/Senior Engineer for Material & Fabrication Group at SBM Houston, USA
• 6 years as Materials & Corrosion Protection (MCP) at SBM Kuala Lumpur
**Qualification(s):**
• Foundation in Science [Universiti Malaya]
• Bachelor Degree in Materials Engineering [Universiti Malaya]
**Professional membership(s):**
• Member of Institute of Engineers Malaysia (IEM)
• Member of National Association of Corrosion Engineers (NACE)
• Member of American Petroleum Institute (API)
**Involvement in IMM committees:** NIL

## DR. MUHAMMAD ZHARFAN BIN MOHD. HALIZAN

**Age:** 33 years
**Organization:** Universiti Teknologi MARA Arau, Perlis
**Position:** Senior Lecturer
**Working experience(s):**
• 1 year as Gas Engineer at Bumifocus Sendirian Berhad
• 4 months as Research Assistant at Universiti Malaya
• 3 years 8 months as Graduate Research Assistant at Universiti Teknologi MARA
• 1 year 5 months as Postdoctoral Researcher at Universiti Teknologi MARA
• 7 months as Senior Lecturer at Universiti Teknologi MARA Arau, Perlis
**Qualification(s):**
• Bachelor of Science (Physics) [Universiti Malaya]
• Master of Science (Physics) [Universiti Malaya]
• PhD (Science) [Universiti Teknologi MARA]
**Professional Membership:** NIL
**Involvement in IMM committees:**
• Student member (2020-2021) - Involved in the seminars or conferences held by the organization.

## DOUGLAS BENNET

**Age:** 41 years
**Organization:** Intertek Malaysia
**Position:** Country Business Line Leader
**Working experience(s):**
• 2 years as Field Scientist at Commercial Microbiology
• 1 year as Senior Field Scientist at Commercial Microbiology
• 3 years as Consultant at Intertek Commercial Microbiology
• 2 years as Bugtracker Account Manager at ExxonMobil and Wood Group
• 6 years as Manager Microbiology SE Asia at Intertek Malaysia
• 4 years 10 months as Country Business Line Leader at Intertek Malaysia
**Qualification(s):**
• Bachelor of Environmental Biology [Strathallan School Scotland]
**Professional Membership:**
• ICORR Member
• SPE Member
• NACE Member
**Involvement in IMM committees:** NIL

## DR. SHAHID BASHIR

**Age:** 39 years old
**Organization:** Universiti Malaya
**Position:** Senior Lecturer (Assistant Professor)
**Working experience(s):**
• 10 months as Quality Control Analyst at Premier Paper Industry
• 2 years 3 months as Chemistry Lecturer at KIPS College
• 3 years 10 months as Research Assistant at Universiti Malaya
• 4 years as Postdoctoral Research Fellow at Universiti Malaya
• 2 years 3 months as Senior Lecturer (Assistant Professor) at Universiti Malaya
**Qualification(s):**
• Bachelor of Science : Physics, Mathematics, Chemistry [Bahauddin Zakariya University]
• Master of Science : Analytical/Inorganic Chemistry [University of the Punjab]
• PhD : Physical Chemistry [Universiti Malaya]
**Professional Membership:**
• Member of Waste Management (UMPEDAC Universiti Malaya)
• Committee Member (International Journal of Renewable Energy Resources [UMPEDAC] Universiti Malaya)
**Involvement in IMM committees:** NIL

# TECHNICAL ARTICLE 3

# Technoeconomic of Repurposing Natural Gas Pipelines to Carry Carbon Dioxide: Malaysia Landscape

*Yoga Sugama SALIM, Robert SHANDRO*
*Cetim-Matcor, 3 Aerospace Link, 797550 Singapore*

Modern gas transmission pipelines are usually engineered to remain operational for the next 40 to 50 years or even more. Design considerations for transmission and distribution pipelines are different as the distribution pipelines goes through populated areas. With efficient maintenance and effective management practices, it is possible to extend the service life of the pipeline by an additional 25 to 30 years beyond its original design life. The natural gas pipelines account for about 70-80% of the global pipeline network, with the remaining shares primarily dedicated to the transportation of oil, refined petroleum and chemicals. Currently, the global network of natural gas transmission and distribution pipelines that are in operation spans about 1 million kilometres. As the global energy transition advances, the integration of renewable energy sources with existing gas systems offers a practical and efficient approach to reduce carbon footprints. Furthermore, the increasing focus on hydrogen and carbon capture, utilization, and storage (CCUS) technologies is driving the repurposing and modernization of existing natural gas pipelines.

By repurposing the existing natural gas pipelines, the costs for the activities above can be significantly minimized by leveraging the existing infrastructures that are already in place. This approach not only extends the operational relevance of the pipelines but also aligns with global decarbonization goals. The objective of this report aims to assess the techno-economic and environmental challenges that can be considered when repurposing natural gas transmission pipelines to carry $CO_2$.

## 2. Technical Feasibility

$CO_2$ exhibits unique phase behavior transitioning between gas, liquid, and supercritical states depending on pressure and temperature. The phase behavior significantly impacts its flow characteristics within pipelines. At low pressures and high temperatures, $CO_2$ exists as a gas. In this state, it behaves similarly to natural gas, with relatively low density and high compressibility. At high pressures and low temperatures, $CO_2$ exists as a liquid. This phase has a higher density and lower compressibility compared to the gas phase, affecting flow rates and pressure drops. Above the critical point (73.8 bar and 31.1°C), $CO_2$ exists in a supercritical state. This phase has properties intermediate between those of a gas and a liquid, with high density and low viscosity. The supercritical $CO_2$ can exhibit complex flow behavior, including density stratification and phase separation, which can lead to operational challenges.

The maintenance of $CO_2$ pressure and temperature within the desired phase range is crucial for efficient and safe transportation to ensure continuous flow of $CO_2$. If not controlled properly, the $CO_2$ can undergo phase separation leading to the formation of liquid and gas slugs and eventually lead to significant fluctuations in pressure and flow rates. The choice of pipeline material must consider the corrosive nature of $CO_2$. The requalification process of the pipeline for $CO_2$ transport has been proposed and documented in DNV-RP-F104 [1]. The integrity of the pipeline needs to be first assessed for its condition. Supervisory Control and Data Acquisition (SCADA) system was suggested to be identified and applied as a basis for identifying gaps towards the requirements for $CO_2$ pipelines. Following the integrity assessment, a flow assessment should be conducted to identify the feasibility of refurbished pipelines. Based on flow assessment, the requirement for modifications can be identified and evaluated. Other requirements such as additional block valves, leak detection upgrades etc. can be identified along the way.

### 2.1 Materials

All materials should withstand the operating pressure of $CO_2$. The $CO_2$ pipelines operate at pressure ranges from 1250-2200 psi (Type II and Type III pipelines), while the NG pipelines operate at pressure ranges 1200 psi and below (Type I pipelines). The specific requirements for each parameter vary depending on the type of $CO_2$ stream [2]. The choice of pipeline material has evolved over the years, which is driven by factors such as increasing pressure requirements, safety concerns, and technological advancements. Grade A and Grade B carbon steel have limited pressure-bearing capacity compared to higher-grade steels. As the natural gas industry has progressed over the years, there has been a demand for higher-pressure pipelines to transport larger volumes of gas efficiently. Higher-grade steels, such as X65 and X70, offer significantly higher yield strength and tensile strength, making them suitable for high-pressure applications. The high toughness of API 5L grades also helps resist cracking under pressure, which is crucial when transporting NG at high velocities or in regions with significant pressure fluctuations.

Low-carbon steels, like those used in NG pipelines, have an additional advantage in their weldability, making them easier to join during pipeline construction and repair. Welding is a common method used to connect pipeline segments, and materials that are highly weldable, like API 5L grades, help ensure the structural integrity of the system.

DNV-RP-F104 stated that carbon-manganese steel pipelines can be used for $CO_2$ pipelines where the water content in the $CO_2$ stream is controlled.

### 2.2 Degradation resistance

NG pipelines generally contain $H_2S$ moisture and other impurities. Impurities in $CO_2$ transport such as water vapor, oxygen, and sulfur compounds can react with the steel surface, forming corrosive compounds that weaken the material. The combined effect of $CO_2$ and its impurities can be more severe than either factor alone. The pipelines are often coated with external protective layers or internal liners to minimize corrosion. While carbon steel grades are generally suitable for NG transport, certain steel grades and materials are not compatible due to their susceptibility to corrosion failure. For example, low-alloy steels that contain higher amounts of sulfur, sulphide inclusions or phosphorus can be prone to embrittlement or stress corrosion cracking, especially in sour gas environments where $H_2S$ is present. Steels with poor resistance to hydrogen embrittlement, such as some high-strength, low-ductility alloys, would also be unsuitable for NG pipelines, as they could develop microcracks that lead to failure over time.

The welding area is considered the weakest point in the entire pipeline due to a higher possibility for the presence of defects and inconsistency. Some evidence suggested that robotic welding can achieve an overall high quality and consistency of the welds; however the human welding has the edge to possibly identify the errors straightaway during the welding, unlike robotic welding. Regardless of the welding process used, if a pipeline weld in a specific area requires rework, both the weld material and the existing pipeline material must be compatible and free of contaminants. Higher levels of sulfur (more than 0.05%) and phosphorus (more than 0.04%) in steel give a negative impact to the mechanical properties.

Another concern for old pipelines is fatigue, which is classified as mechanical failure. After numerous stress cycles during operation, fatigue in the pipeline would have been initiated and developed. If both fracture initial control and fracture propagation control cannot be ensured, fracture arrestors can be considered. The proportion of fatigue severity is linked to the stress-concentration features.

### 2.3 Pipeline integrity

Several factors must be considered when repurposing pipelines for $CO_2$ transportation. The primary concern is the pipeline's current condition. Some key questions to address include:

- What existing defects are present, where are they located,and how severe are they?
- Can the existing corrosion management plan be adapted to accommodate $CO_2$ transportation, or will modifications be necessary?

To answer these questions, a comprehensive inspection is necessary to identify any existing defects or damages on the pipelines, such as corrosion, dents, or cracks. The inspection program typically begins with a desktop review of all available information including pipeline records, material specifications, and operating history. Following the review, a visual inspection is required to identify any external damage on the above-ground components as well as the right-of-way.

Advanced inspection techniques such as in-line inspection (ILI) are then employed to assess the internal condition of the pipeline. Before ILI is performed, the pipeline needs to be thoroughly cleaned of debris and ensured that it is free of obstructions. As ILI tool (smart pigs) travels through the pipeline, simultaneous data such as wall thickness, metal loss, geometric deformations, internal corrosion, and external corrosion are collected.

Besides ILI techniques, there are some other Non-Destructive Testing (NDT) that are employed such as magnetic flux leakage (MFL), ultrasonic testing (UT), Eddy current testing (ECT), and radiographic testing (RT). Different tools have varying sensitivities to debris. For instance, ultrasonic tools are more susceptible to soft materials like wax and paraffin, while magnetic flux leakage tools are relatively robust against most types of debris. Additionally, fluid density and pipe wall thickness can affect tool performance. Heavy crudes and thick-walled pipes pose specific challenges, requiring specialized tools and techniques. A summary of NDT techniques used to inspect pipelines is shown in Table 1.

*Table 1: Summary of NDT techniques used to inspect pipelines*

| NDT Technique | Detection of Defects | Requires Access to Both Sides | | Material Type | Disadvantages |
|---|---|---|---|---|---|
| | | Surface | Subsurface | | |
| In-Line Inspection (ILI) | Yes | Yes | No | Most materials | Requires pipeline preparation Can be costly |
| Magnetic Flux Leakage (MFL) | Yes | Limited to near-surface | No | Ferromagnetic materials | May not detect deep subsurface defects |
| Ultrasonic Testing (UT) | Yes | Yes | No | Most materials | Requires skill operators Time-consuming for large-scale inspections |
| Eddy Current Testing (ECT) | Yes | Yes | No | Conductive materials | Not suitable for thick-walled pipelines |
| Radiographic Testing (RT) | Yes | Yes | Yes/No (depends on technique) | Most materials | Requires skill operators Time-consuming for large-scale inspections Expensive |

The data collected from various inspection and testing methods is analyzed to identify potential risks and prioritize areas for maintenance or repair. A comprehensive maintenance and repair plan needs to be developed to address the identified issues and ensure the continued integrity of the pipeline. Pressure testing and hydrostatic testing are then employed to identify leaks or weak points in the pipeline after NDT test (Figure 1). After the inspection program, laboratory testing can be sought. It provides essential insights into the material's mechanical properties (e.g., tensile strength, yield strength, and ductility) and its compatibility with $CO_2$.

### 3. Economic viability in Malaysia

Table 2 provides an estimated breakdown of costs associated with pipeline repurposing by assuming that the project is performed in Malaysia. If we look past the historical report about the capital expenditure (CAPEX) of building new pipelines in Malaysia, it was reported that NG allocated RM 1.4 billion to build an 800-km pipelines [3]. This suggests that the cost is around RM 1.75 million per kilometre of building new pipelines. Based on our projected cost for repurposing 20-30 years old natural gas pipelines in Malaysia, the best-case scenario has an estimated cost of RM 1.10 million per kilometre of old natural gas pipelines. As such, the repurposing offers significant savings of ~37%. For worse case scenario where half the welded joints for 1 km of pipeline have failed and require replacement, the cost will be a staggering ~60% higher than building the new pipelines, which is at RM 2.80 million per kilometre. It is therefore necessary to conduct a thorough pipeline integrity assessment to determine actual retrofitting requirements and costs. Factors such as operational risks, regulatory requirements, and potential carbon credit benefits for $CO_2$ transportation need to be considered when evaluating the repurposing of natural gas pipelines against the new construction of pipelines for $CO_2$ transportation.


*Figure 1: Refurbished Equipment in Long-Term Storage*

According to a study by the European Union Agency for the Cooperation of Energy Regulators (2021) – Transporting Pure Hydrogen by Repurposing Existing Gas Infrastructure, it was estimated that the cost of repurposing ranges from 10-35% [4, 5]. Our estimation of 37% cost According to a study by the European Union Agency for the Cooperation of Energy Regulators (2021) – Transporting Pure Hydrogen by Repurposing Existing Gas Infrastructure, it was estimated that the cost of repurposing ranges from 10-35% [4, 5]. Our estimation of 37% cost saving is closed to the estimated cost by Det Norske Veritas (DNV). It should nevertheless be noted that this range may differ significantly if the conditions of the pipelines require the owners/operators to repair the damaged parts extensively and significantly.

### 4. Conclusion

Repurposing existing NG pipelines for $CO_2$ transport presents a promising avenue for accelerating CCS deployment and reducing carbon emissions. However, it requires careful consideration of technical, economic, and environmental factors. While carbon steel is suitable for both NG and $CO_2$, specific considerations are necessary to address the potential impacts of $CO_2$ on material properties, including corrosion and embrittlement. Rigorous assessments of pipeline integrity, including wall thickness, corrosion, and fatigue, are crucial to ensure safe operation. The unique flow characteristics of $CO_2$, particularly in the supercritical phase, must be carefully considered to optimize pipeline design and operation.

Repurposing appears economically beneficial when a thorough pipeline integrity assessment reveals minimal required repairs. The estimated CAPEX for repurposing a 1-km pipeline in Malaysia ranges from RM 1.1 million (best case) to RM 2.8 million (worst case). Compared to building new pipelines (estimated at RM 1.75 million per km), repurposing offers potential savings of 37% in the best-case scenario. The economic viability of repurposing depends heavily on the pipeline's condition. Factors like the percentage of welded joints requiring replacement and the need for extensive repairs significantly impact the costs. In the worst-case scenario with extensive repairs, repurposing might be more expensive than building new pipelines.

*Table 2: Estimated cost for repurposing of NG pipelines to carry $CO_2$ in Malaysia.*

| | Estimated cost |
|---|---|
| Advanced ultrasonic testing (PAUT or ToFD) | RM 1,000 – 3,000* per day<br>A full-length inspection for 1 km pipeline was estimated to consume around 9** days by assuming the team inspects 15 welds per day for every 12 meters (weld-focus inspection).<br>*Applicable for experienced engineer (reference: personal communication with industry players)<br>**This number may vary depending on the accessibility of the pipeline (it takes longer time if the pipeline runs through challenging terrain), crew and equipment efficiency, and other factors that may arise.<br>The inspection cost was estimated to be RM 3,000 per day x 9 days = RM 27,000<br>It will take additional time for mobilization/de-mobilization and setup (2 days), and report preparation (7-10 days). Hence, it arrives to the following costs<br>Mob/demob<br>Travel distance of RM 2.00 per km for fuels, tolls, and vehicle wears. Assumption for 350 km. Hence, the cost is RM 2 per km x 350 km x 2 (for round trip) = RM 1,400<br>Labour costs for engineer = RM 150 per hour. 8 hours working. Hence, the cost is as follows,<br>RM 150 x 8 hours = RM 1,200<br><br>Set-up cost (2 days with 1 engineer and 1 technician)<br>Experience engineer's daily rate = RM 3,000 per day x 2 days = RM 6,000<br>Support technician = RM 500 – 800 per day. Assumed the experienced technician was deployed. Then RM 800 x 2 days = RM 1,600<br>Report preparation (assumed 10 days for experienced engineer)<br>Report preparation rate = RM 3,000 per day x 10 days = RM 30,000<br><br>The TOTAL estimated cost for 1 km pipeline inspection using PAUT = RM 27,000 + RM 1,400 + RM 1,200 + RM 6,000 + RM 30,000 = RM 65,600 (excluding hotel, administration fee, and other applicable taxes which can have additional 10-20% additional cost). |
| Pigging (ILI) | Cleaning<br>Preparation for cleaning = 1 day<br>Cleaning runs assuming heavy cleaning is required to remove significant debris and other restrictions = 3-5 days<br>Using the rate of experienced engineer above, the total number of days = 6 days x RM 150 per hour x 8 hours per day = RM 7,200<br>Pigging<br>Final preparation and planning for pigging = 1-2 days<br>Tool run time: 1 day<br>Post-run activities = 1-2 days<br>Using the rate of experienced engineer above, the total number of days = 7 days x RM 150 per hour x 8 hours per day = RM 8,400<br>Mob/demob<br>Travel distance of RM 2.00 per km for fuels, tolls, and vehicle wears. Assumption for 350 km. Hence, the cost is RM 2 per km x 350 km x 2 (for round trip) = RM 1,400<br>Labour costs for engineer = RM 150 per hour. 8 hours working. Hence, the cost is as follows,<br>RM 150 x 8 hours = RM 1,200<br><br>Report preparation (assumed 14 days for experienced engineer)<br>Report preparation rate = RM 3,000 per day x 14 days = RM 42,000<br><br>The TOTAL estimated cost for 1 km pipeline inspection using ILI = RM 7,200 + RM 8,400 + RM 1,400 + RM 1,200 + RM 42,000 = RM 60,200 (excluding hotel, administration fee, and other applicable taxes which can have additional 10-20% additional cost). |
| Material Integrity analysis | RM 25,000 – RM 45,000 depending on the complexity of analysis. |
| Welded joint materials | Valves<br>Replace existing valves with CO2-compatible ones capable of handling dense-phase CO2 pressures (80-150 bar).<br>Manual valve: RM 35,000 – 55,000 per valve<br>Automated valve: RM 65,000 – RM 120,000 per valve<br>Assumption was made that 100-km pipeline requires 10 valves. This suggests the cost per km is around RM 5,500 per km for manual valve at higher range of price and RM 12,000 per km for automatic valve at higher range of price.<br>Compressors<br>RM 500,000 – 1,500,000 depending on capacity and design<br>Pipeline linings and repairs<br>RM 100-300 per meter x 1 km pipeline = RM 300,000 based on the maximum range of charges<br>Leak detection systems<br>RM 100,000 – 200,000 per setup |
| - | The total estimated CAPEX cost for repurposing natural gas pipeline in Malaysia under certain scenario is as follows,<br>~RM 1,100,000 per km (best case scenario with the most competitive rates (lowest cost for retrofitting components, lowest replacement costs for welded joint materials and best rates for material integrity analysis), and 10% of the welded joint requires replacement, and pipeline linings repairs for the entire 1 km pipeline)<br>~RM 2,800,000 per km (worst case scenario with the most expensive rates and 50% of the welded joint requires replacement, and pipeline linings repairs for the entire 1 km pipeline) |

5. References

[1] DNV-RP-F104. Design and operation of carbon dioxide pipelines. 2021.
[2] Institute WR. Guidelines for Carbon Dioxide Capture, Transport, and Storage. 2008.
[3] The Star. Gas Malaysia to allocate up to RM1.4bil for CAPEX to build 800km of pipelines. 2023.
[4] Monsma V, Illson T, Hussain A. Repurposing Pipelines for Hydrogen Transportation. 2023.
[5] Monsma V. Repurposing onshore pipelines is essential to scaling hydrogen. How can it be done in practice?

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STUDENT EDITORIAL

# From Raw Materials to Composites: Different Fabrication Techniques for Unsaturated Polyester/ Coconut Coir Fibre Composites

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## Introduction

Generally, polymer composites consist of fibres embedded in the polymer to enhance mechanical properties of the composites. The fibres in these polymer composites can be varied in form, composition, orientation, length-to-diameter (L/D) ratio and size. Each of these variations affects the mechanical properties of the polymer composites (Callister and Rethwisch, 2020).

Additionally, there are several fabrication methods for composite materials, such as injection moulding, autoclave moulding, filament winding, pultrusion, resin transfer moulding (RTM), hand lay-up, spray lay-up, compression moulding and vacuum infusion (Nagavally, 2017; Rajak, 2019). The current study focused on composite materials made from natural fibre and thermosetting matrix, primarily using three different fabrications, which are compression moulding, hand lay-up and vacuum infusion processes. Both compression moulding and vacuum infusion moulding are closed moulding processes, while the hand lay-up is an open moulding process (Nagavally, 2017). Different fabrication methods for polymer composites result in different mechanical properties and the choice of fabrication method also depends on the specific application and its requirements (Rajak, 2019).

Hong et al. (2024) studied denim fabric-reinforced unsaturated polyester composites produced using various processing methods. Their research highlighted that different fabrication methods for thermosetting composite materials result in varying mechanical properties. The variation is due to defects such as void formation, delamination and reinforcement agglomeration, which occur differently depending on the fabrication methods and affect the properties of the composites.

In the present study, coconut coir fibre-reinforced unsaturated polyester composites were prepared using different fabrication techniques and the tensile properties of these composites were investigated.

## Materials

Coconut coir fibre in mat form (CCM) and unsaturated polyester (UP) were used as the raw materials of the thermosetting composite. CCM acted as reinforcement while UP acted as the polymer matrix. Both CCM and the UP were purchased from Taurenz Resources, Kedah, Malaysia. The CCM was in randomly orientated fibre in mat form. Before preparing the UP/CCM composite samples, 1 wt % of hardener, which is methyl ethyl ketone peroxide (MEKP) was mixed with the UP before proceeding to produce the thermosetting composite samples using different techniques. Additionally, the gel time of the UP resin was 20 minutes with the addition of 1 wt % of MEKP at room temperature. Hence, all fabrications of composites were done within 20 minutes to avoid the composite sample cured during the fabrication process.

Preparation of UP Composites with Different Techniques
1 wt % of the MEKP was mixed with the UP resin and stirred for 2 minutes. A total of 100 g of this mixture was used for the different fabrication methods, as explained below:

### Compression moulding

The releasing agent was applied on the mould and the CCM was placed on the mould. The UP resin was then poured onto the CCM and impregnated using a brusher to press the UP resin into the CCM. The compression pressure of 2.1 MPa was applied to compress the UP composite for 10 minutes and force out any trapped air bubbles. No heat is required for this process. The UP/CCM composite was left for curing at room temperature for 24 hours. The setup of the compression moulding technique was shown in Figure 1.

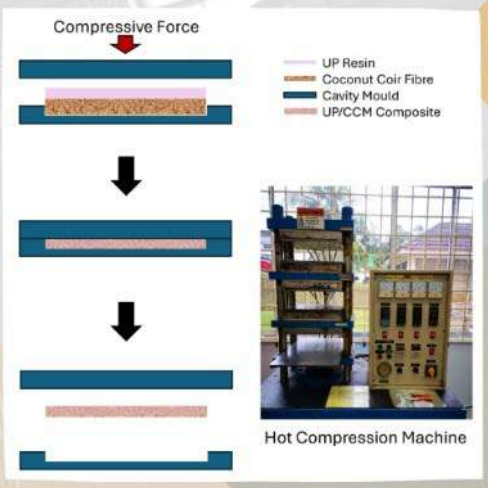


*Figure 1: The setup of compression moulding*

### Hand Lay-up

The UP resin was applied to the CCM layer by layer using a brush, impregnating the CCM. A roller was used to remove air bubbles from the UP composite. The UP/CCM composite was then left to cure for 24 hours. Figure 2 shows the fabrication method of hand lay-up.

### Vacuum Infusion

The vacuum infusion setup was presented as shown in Figure 3. Releasing agent was first applied to the acrylic mould to ensure easy removal of the UP composite from the mould. The CCM was put on the acrylic mould and covered with peel ply, infusion mesh layer and vacuum bag. The vacuum bag was sealed to the acrylic mould using sealant tape to ensure proper sealing. The vacuum pump was then connected, and the UP resin was sucked into the mould through the vacuum process, which removed air and impregnated the CCM with the UP resin. After curing and hardening within the vacuum bag for 24 hours, the UP/CCM composite was demoulded by removing the vacuum bag.

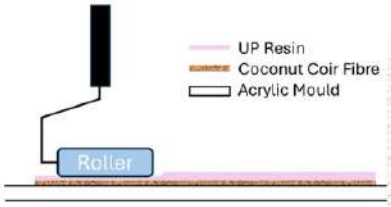


*Figure 2: Fabrication method of hand lay-up*

### Post-curing Process

After curing for 24 hours at room temperature, all samples from compression moulding, hand lay-up and vacuum infusion were removed from moulds and placed in an oven at 60 °C for 1 hour for post-curing. This step was to ensure that all samples were fully cured.

### Tensile Test

The tensile properties (ultimate tensile strength, modulus of elasticity and elongation at break) were measured using 10 Tons Universal Tensile Tester (Shimadzu's AGS-X Series). Each specimen was cut to the standard Type IV dimensions according to ASTM D638. A total of 5 specimens from each fabrication method were tested to get an average value. The tests were conducted at a crosshead speed of 10 mm/min and performed at room temperature.

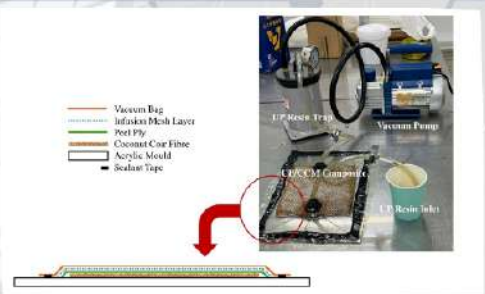


*Figure 3: Setup of vacuum infusion moulding*

### Results and Discussion

Figure 4 shows that the tensile strength of the UP/CCM composites increased as compared to neat UP, regardless of the fabrication method used. This is due to the incorporation of the CCM, which reinforces the tensile strength of the composites, allowing them to withstand more stress than neat UP before failure. The stress transferred from UP matrix to the CCM fibres within the composites. El-Wazery et al. (2017) also stated that when the fibres reinforcements are incorporated into a weak polymer matrix, the reinforcements share the major load. Therefore, the strength and stiffness of the composite materials depend on the strength and stiffness of the reinforcement.

When comparing different fabrication techniques, the results show that the UP/CCM composite produced by compression moulding shows the highest tensile strength, followed by the vacuum infusion UP/CCM composite, with the hand lay-up UP/CCM composite having the lowest tensile strength. The higher tensile strength of the compression-moulded composite has fewer trapped air bubbles, as the compressive force is applied during the process, which effectively removes most of the air bubbles from the composites. These bubbles act as weak points in the specimen, causing stress concentrations that initiate cracks and lead to failure during tensile testing.

In vacuum infusion, the vacuum pump helps to extract air bubbles, many of which become trapped on the infusion mesh layer, resulting in fewer bubbles within the composite as compared to hand lay-up composite. However, in the hand lay-up method, it is difficult to remove bubbles from the composite using the roller, leading to more air being trapped in the composite. These trapped bubbles weaken the composite, resulting in the lowest tensile strength among the three fabrication methods.

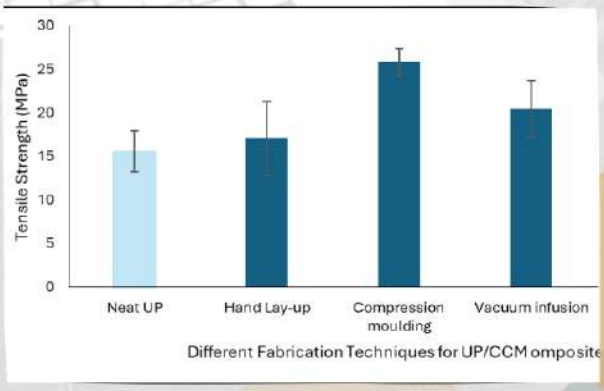


*Figure 4: Tensile strength of neat UP and UP/CCM composites produced using different fabrication methods*

Based on Figure 5, the modulus of elasticity of all UP/CCM composites is higher than neat UP. This increase is attributed to the incorporation of the higher stiffness fibres, which improves the overall stiffness of the UP/CCM composites. The modulus of elasticity results for the specimens produced using the three different fabrication techniques follow the same trend as the tensile strength results.

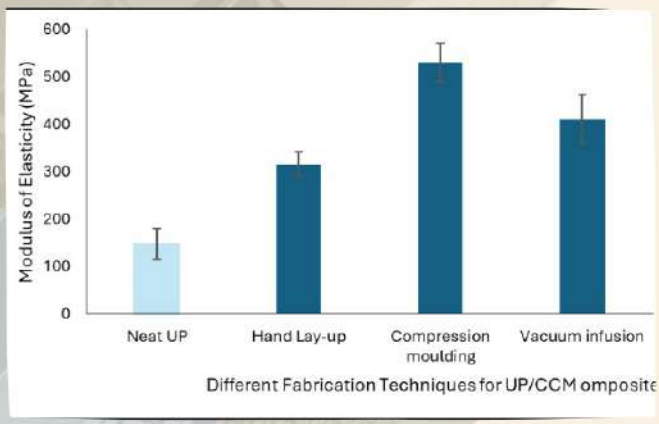


*Figure 5: Modulus of elasticity of neat UP and UP/CCM composites produced using different fabrication methods*

Figure 6 shows the elongation at break for both neat UP and UP/CCM composites. The neat UP shows higher elongation at break than all UP composites. This is likely because the incorporation of the fibres reduces the chain mobility of the UP, increasing the rigidity of the composites. Among of three fabrication methods, the compression moulded composites showed the highest elongation at break, followed by vacuum infusion composites, with the hand lay-up composites showing the lowest. This is due to the fact that the presence of numerous air bubbles in the hand lay-up composites leads to rapid crack formation when subjected to tensile forces.

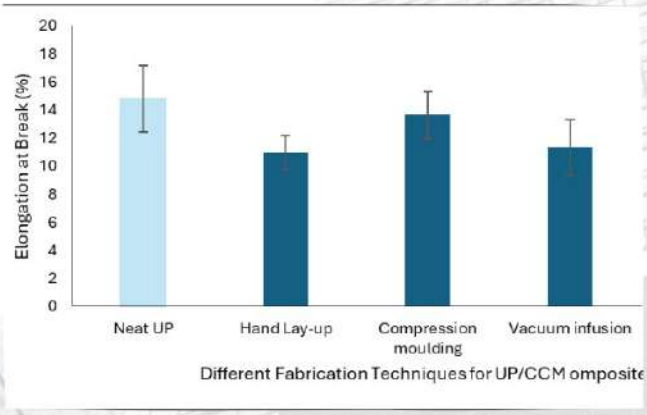


*Figure 6: Elongation at break of neat UP and UP/CCM composites produced using different fabrication methods*

## Conclusion

In summary, the incorporation of CCM into UP enhances the ultimate tensile strength and modulus of elasticity but reduces the elongation at break of UP/CCM composites across all three fabrication techniques. Among the fabrication techniques, compression-moulded specimens showed the highest ultimate tensile strength, modulus of elasticity and elongation at break. This could be due to using the compression moulding process, which more effectively removes the air bubbles from the UP composites as compared to the vacuum infusion and hand lay-up. The presence of the air bubbles can create stress concentrations and initiate the failure during testing.

## References

Callister Jr, W.D. and Rethwisch, D.G., 2020. Materials science and engineering: an introduction. John Wiley & Sons.

El-Wazery, M.S., El-Elamy, M.I. and Zoalfakar, S.H., 2017. Mechanical properties of glass fiber reinforced polyester composites. Int. J. Appl. Sci. Eng, 14(3), pp.121-131.

Lee Hong, C., Ming Yeng, C., Seong Chun, K. and Thai Kiat, O., 2024. Denim fabric-reinforced unsaturated polyester: effect of different fabrication methods on mechanical properties and water absorption properties. Polym. Bulletin, 81(3), pp.2545-2563.

Nagavally, R.R., 2017. Composite materials-history, types, fabrication techniques, advantages, and applications. Int. J. Mech. Prod. Eng, 5(9), pp.82-87.

Rajak, D.K., Pagar, D.D., Menezes, P.L. and Linul, E., 2019. Fiber-reinforced polymer composites: Manufacturing, properties, and applications. Polym, 11(10), pp.1667-1704.

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| IMM Certification Schemes and Courses | Technical Training Courses (Non-certification) |
|---|---|
| • Certified Coating Fingerprint Quality Controller Level 1<br>• Certified Coating Fingerprint Quality Controller Level 2<br>• Certified Coating Fingerprint Trainer | • Coating Fingerprint Foundation Course<br>• Refresher Course of Certified Coating Fingerprint Quality Controller Level 1/Level 2 |

### PROGRAM: CORROSION

| IMM Certification Schemes and Courses | Technical Training Courses (Non-certification) |
|---|---|
| • Certified Corrosion Monitoring Practitioner Level 1<br>• Certified Corrosion Monitoring Practitioner Level 2<br>• Certified Corrosion Monitoring Practitioner Level 3<br>• Certified Cathodic Protection Practitioner Level 1<br>• Certified Cathodic Protection Practitioner Level 2<br>• Certified Cathodic Protection Practitioner Level 3<br>• Certified Cathodic Protection Engineer | • Corrosion Control by Cathodic Protection |

### PROGRAM: VIBRATION

| IMM Certification Schemes and Courses | Technical Training Courses (Non-certification) |
|---|---|
| • Certified Vibration Practitioner Category 1<br>• Certified Vibration Practitioner Category 2<br>• Certified Vibration Specialist Category 3<br>• Certified Vibration Specialist Category 4 | - |


## PROGRAM: MECHANICAL JOINT INTEGRITY (MJI)

| IMM Certification Schemes and Courses | Technical Training Courses (Non-certification) |
|---|---|
| • Certified Technician in Mechanical Joint Integrity (MJI) for Flange Bolted Connection<br>• Certified Technician in Mechanical Joint Integrity (MJI) for Small Bore – Piping, Tubing, Valves | • Mechanical Joint Integrity<br>• Pressure Safety Valve<br>• Small Bore Tubing |

## PROGRAM: THERMAL INSULATION

| IMM Certification Schemes and Courses | Technical Training Courses (Non-certification) |
|---|---|
| • Certified Thermal Insulation Installer | • Introduction to Thermal Insulation |

## PROGRAM: WELDING

| IMM Certification Schemes and Courses | Technical Training Courses (Non-certification) |
|---|---|
| • Certified Welding Inspector<br>• IMM-JWES Certified Associate Welding Engineer<br>• IMM-JWES Certified Welding Engineer<br>• IMM-JWES Certified Senior Welding Engineer | • Repair Welding of Pressure Equipment in Refineries & Chemical Plants<br>• Welding & Joining Technology for Non-Welding Personnel<br>• Steel Technology for Non-Technical Personnel |

## MISCELLANEOUS MATERIALS SCIENCE AND TECHNOLOGY (NON-CERTIFICATION) COURSES

| Technical Training Courses | Technical Training Courses |
|---|---|
| • Materials Selection & Corrosion<br>• Metallurgical Failure Investigation<br>• Basic Course on Operation of Mobile Air Compressor<br>• Competent Mobile Industrial Compressor Operator<br>• Competent Mobile Industrial Equipment Inspector<br>• Practical Approach to Inspection and Maintenance of Steam Turbine | • Practical Approach to Precision Alignment Methods<br>• Practical Approach to Precision Balancing Methods<br>• Reciprocating Compressors: Operations, Maintenance, Inspection and Troubleshooting<br>• Troubleshooting Techniques for Rotating Equipment<br>• Valve Operations, Maintenance and Inspection Including Flange Breaking |

Note: A certifcate of attendance will be issued to all participants of non-certifcation professional development training courses while candidates who pass the assessment/examination of IMM-certification schemes will be certified with the issue of IMM competency certificate and IMM certification ID card in addition to the certificate of attendance.

**More information on training and certification is available on IMM's website at www.iomm.org.my.**

**For further enquiries:**

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**Suite 1006, Level 10, Block A, Kelana Centre Point, No. 3 Jalan SS 7/19,**
**47301 Petaling Jaya, Selangor.**

# Materials Lecture Competition 2024 & Young Person's World Lecture Competition 2024

*Prepared by: Dr. Abdul Hakim Md Yusop, Chairperson, IMM-MLC Committee*
*Edited by: Dr. Nor Akmal Fadil, Co-Chairperson, IMM-MLC Committee*

**Date: 3rd, 24th Sept, 28th November 2024**
**Venue: Zoom Online Platform**

## Materials Lecture Competition 2024 (MLC 2024)

Universiti Malaya (UM) has been selected as the host for the Materials Lecture Competition 2024 (MLC 2024). The MLC 2024 semi-final and final round were held online on 3rd Sept 2024 and 24th Sept 2024, respectively, by UM in collaboration with the Institute of Materials, Malaysia (IMM) and the Institute of Materials, Minerals and Mining UK (IOM3-UK). Both events were held on the Zoom online platform and aired live on the Facebook page of the Faculty of Mechanical Engineering, UM. Since the year 2020, national and international competitions have been held online due to the continued Covid-19 pandemic situation.

The aim of the event was to provide a platform for young talents to exhibit effective and impressive presentation skills in delivering topics in the field of material science and engineering. The MLC 2024 semi-final event was officiated by Dr. Abdul Hakim Md Yusop, the Chairperson of the IMM-MLC Committee. The semi-final and final judging panels comprised experts from academia and industry, mirroring international standards to ensure competition quality (Table 1).

The MLC 2024 semi-final competition was aimed at selecting five finalists among participants from fourteen Malaysian universities, as shown in Table 2. The first five participants in Table 2 were the MLC 2024 top five finalists who won the semi-final round. The top five finalists had competed in the MLC 2024 final round, hosted online by UM. The MLC 2024 Final event was officiated by the Head of Centre of Advanced Materials (CAM), Universiti Malaya, Assoc. Prof. Dr. Hendrik Simon Cornelis Metselaar. The half-day competition ended with closing remarks given by Ir. Hisyam Yahya, representing Ts. Dr. Chew Khoon Hee, President of IMM.

Jerome Liew from Universiti Malaya was the winner of MLC 2024, while Ainaa Amirah Marzuki from Universiti Teknologi Malaysia and Aslam Hadi from Universiti Teknikal Malaysia came in second and third place, respectively. The winners received cash prizes of RM 3,000, RM 2,000 and RM 1,000, respectively, while the last two finalists received consolation prizes of RM500 each. The cash prize was sponsored by IMM. Jerome Liew represented Malaysia in the Young Persons' World Lecture Competition (YPWLC 2024) in November, which was organised by IOM3-UK via an online competition.

*Table 1: The panel of judges for the MLC 2024 semi-final and final*

| MLC 2023 Semi-final | MLC 2023 Final |
|---|---|
| 1. Assoc. Prof. Ir. Ts. Dr. Wan Sharuzi Wan Harun (Moderator), Universiti Malaysia Pahang | 1. Assoc. Prof. Dr. Norkhairunnisa Mazlan, Universiti Putra Malaysia (Moderator) |
| 2. Dr. Firdaus Suhor, PETRONAS Research Sdn Bhd, | 2. Mr. Kang Kim Ang, CORRTROL Group of Companies |
| 3. Ir Hanafi Ali, Sarawak Energy Berhad, | 3. Ir. Ts. Noor Hisham Yahaya, Safe Asbestos Solutions Sdn. Bhd. |
| 4. Assoc. Prof. Dr. Sarizam, Universiti Malaysia Kelantan. | 4. Prof. Dr. Mariyam Jameelah Ghazali, Universiti Kebangsaan Malaysia |

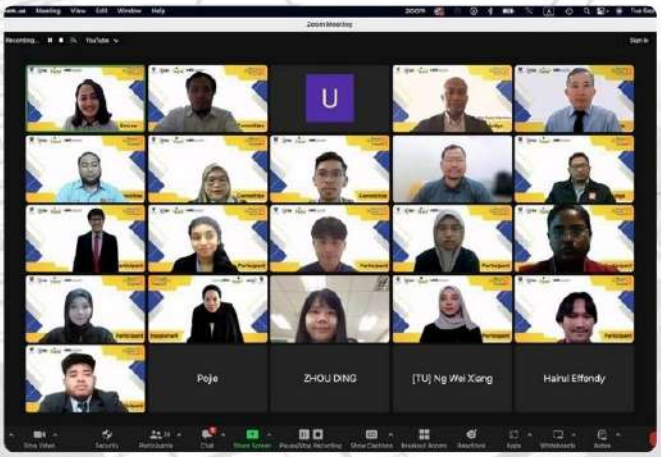



*Figure 1: Webex screenshot of the thirteen MLC 2024 semi-final participants with IMM representative, MLC Chairperson, MLC committee members, and the judges*


*Figure 2: MLC 2024 top five finalists*

**Young Persons' World Lecture Competition 2024 (YPWLC 2024)**

The IOM3 Young Persons' World Lecture Competition (YPWLC) has been held annually in different locations around the globe, including Brazil, South Africa, Malaysia, and Australia, since 2005 in London. The YPWLC 2024 took place virtually on 28th November 2024 at 20:00 – 11:30 MYT (12:00 – 15:30 GMT). This is the fourth time the competition has been held virtually due to the Covid-19 pandemic. The competition was organized by the IOM3 Student & Early Career Committee and participated by the finalists from around the world (Malaysia, South Africa, United Kingdom, and Hong Kong) who had won their respective finals and represented their countries at this year's final.

Malaysia's representative, Jerome Liew, a postgraduate student from Universiti Malaya, won the third prize in the prestigious competition with his topic 'MXENE: Pursuing Fast-Charging Battery' to bring home a prize of £1,400. Besides, he was awarded a free one-year IOM3 membership to be part of a dynamic and vibrant professional community.

The judging panel of YPWLC 2024 included the President of IOM3 as the Chair of the judging panel, Dr. Kate Thornton CEng. CSci. FIMMM, IOM3 President; Dr. Ilija Rasovic MIMMM, Event Co-ordinator and the Vice-Chair, Student & Early Career Committee; Dr. Michael Kenyon MIMMM, Vice-Chair, Student & Early Career Committee; and Mr. Martyn Jones CEng. FIMMM, Chair, Members' Board.

The first prize went to Sebasa Theresa Ramahlare, representing South Africa, with her talk on 'Biodegradable Mulch Biofilms Potential Environmentally Friendly Alternative for Agricultural Mulching". Oliver Preuß from FEMS - Federation of European Materials Societies won the second place for his lecture 'Dislocation-Based Toughening and Damage-Tolerance in Oxide Ceramics'.

The main objective of the YPWLC competition is to encourage young materials scientists and engineers to develop their communication and presentation skills. Delivering informative complex technical knowledge enthusiastically and understandably to a non-specialist audience has become an essential communication skill in today's dynamic world.

Since 2013, Malaysian finalists selected via the IMM Materials Lecture Competition have consistently secured the top-three prizes at the YPWLC, including 2024's third prize. Over 12 years, Malaysia, through IMM, has maintained a continuous presence at the event, with unwavering support from both public and private universities nationwide.

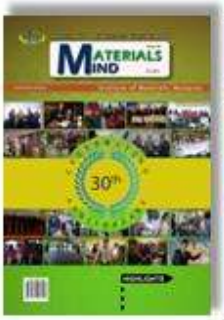

*Figure 3: Malaysia finalist, Jerome Liew from Universiti Malaya (UM) won third place at YPWLC 2024 (source: https://www.instagram.com/umresearch/p/DDD2zTWyXI5/)*

*Table 2: MLC 2024 semi-final participants and the top five finalists*

| Name | Title |
|---|---|
| 1. Jerome Liew, Universiti Malaya, (UM) | 1. MXene: The Future of Fast-Charging Battery |
| 2. Ainaa Amirah Binti Marzuki @ Mahadi, Universiti Teknologi Malaysia (UTM) | 2. Materials Then and Now: Exploring the Potential of Magnetorheological (MR) Foam |
| 3. Aslam Hadi Bin Hamzah, Universiti Teknikal Malaysia Melaka (UTEM) | 3. Investigation of Recycled PET based on Mechanical Properties through Fused Deposition Modelling (FDM) Process |
| 4. Normaiza Binti Nordin, Universiti Malaysia Sabah (UMS) | 4. Nafion Membrane in Microbial Fuel Cell: Properties and Proton Transfer Mechanism |
| 5. Natasya Salsabilla, Universiti Tun Hussein Onn Malaysia (UTHM) | 5. Effect of Amine and Thiol as Functional Groups on Gold Nanobipyramids Properties for Glucose Sensing |
| 6. Ong Kar Kien, Tunku Abdul Rahman University Of Management And Technology | 6. Ionic Liquid as promising material to optimize the EDLC performance |
| 7. Sitti Shalyza Qasidah Binti Salleh, Universiti Teknologi Petronas (UTP) | 7. Advancing Durability: Self-Healing Coatings |
| 8. Ahmad Firdaus Bin Amran, Universiti Kebangsaan Malaysia (UKM) | 8. The Effect of Heat Treatment on the Microstructure and Strength of Graphene Nanoplatelet Reinforced Aluminium Composite |
| 9. Ng Wei Xiang, Taylor's University | 9. The Application of Pearlite and Coir as Filter Media for Lake Water Treatment |
| 10. Sarveishini Yogendran, Universiti Putra Malaysia | 10. Revolutionizing Aircraft Efficiencies: The Impact of Carbon Nanotubes (CNTs) on Fuel Reduction |
| 11. Clara Edah Norman, Curtin University Malaysia | 11. Utilising Fish Bone Meal in Fish Feed Formulation |
| 12. Yogasri A/P Chandren, Universiti Selangor (UNISEL) | 12. Optimizing Solid State Fermentation of Fusarium oxysporum for Effective Polyethylene Terephthalate (PET) Biodegradation |
| 13. Kummudasri A/P Uthayarajan, Universiti Tenaga Nasional | 13. From Trash to Treasure: Transforming Black Plastics to High-Tech Carbon Nanotube |

# MATERIALS MIND

## Quarterly Magazine of Institute of Materials, Malaysia





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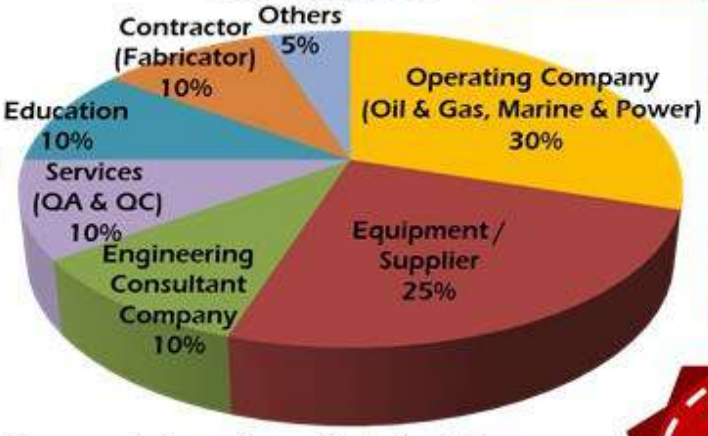



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Event & Activity Reports, Conference Information, Technical Papers, Information on IMM, IMM Course Details, Advertorial, IMM Supporting Events and many more…..

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# Launch of IMM Materials Failure Investigation Practitioner (MFIP) Certification Scheme

*Reported by: Aberamy Dayalam, Manager of IMM Secretariat*

**Date: 29th October 2024**
**Venue: Nottingham University Future Students Centre, Menara Axis, Petaling Jaya**

The IMM Materials Failure Investigation Practitioner (MFIP) Certification Scheme Launch Event was successfully held on the 29th October 2024 at Nottingham University Future Students Centre, Menara Axis, Petaling Jaya. The event, hosted by the Institute of Materials Malaysia (IMM), aimed at introducing the MFIP Certification Scheme to industry professionals. The launch served as a platform to highlight the significance of certified materials failure investigation practitioners in ensuring industry standards and best practices.

*Figure 1: The Launching of the IMM MFIP Certification Scheme*

*Figure 2: Welcoming remarks by Ts. Dr. Chew Khoon Hee*

The event commenced with the registration of invitees. Attendees, including professionals from various industries, gathered to witness the official introduction of the MFIP Certification Scheme.

The event began with welcoming remarks delivered by the IMM President, Ts. Dr. Chew Khoon Hee. In his speech, Dr. Chew emphasized the importance of material failure investigation in industrial applications and the role that the MFIP Certification Scheme would play in strengthening industry expertise.

Following the welcoming remarks, Ir. Ong Hock Guan, Chairman of the IMM Corrosion Committee, provided an in-depth introduction to the MFIP Certification Scheme. He elaborated on the objectives, structure, and benefits of the certification, highlighting its relevance to professionals in the field of materials failure investigation.

*Figure 3: Introduction session by Ir. Ong Hock Guan*

A Q&A session was held, allowing attendees to seek clarification on the MFIP Certification Scheme. This interactive segment provided valuable insights into the certification's requirements and benefits.

Then, the IMM MFIP Certificates were presented to Level 4 recipients. The recipients of this prestigious certification were:

- Assoc. Prof. Eur-Ing. Nigel Patrick Brewitt
- Assoc. Prof. Dr. Andrew Spowage
- Prof. Dr. Ir. Cheong Kuan Yew
- Ir. Dr. Edwin Jong Nyon Tchan
- Dr. Tan Keng Soong

These individuals were recognized for their exceptional contributions to the field of materials failure investigation and their achievement in obtaining Level 4 certification.

*Figure 4: Q&A session handled by Ir. Max Ong Chong Hup & Ir. Ong Hock Guan*

*Figure 5: IMM MFIP Level 4 certificate presented to Assoc. Prof. Dr. Andrew Spowage*

*Figure 6: IMM MFIP Level 4 certificate presented to Assoc. Prof. Eur-Ing. Nigel Patrick Brewitt*

The formal session was followed by a lunch and networking session. This provided attendees with the opportunity to engage with industry peers, discuss potential collaborations, and share insights on materials failure investigation practices.

The event marked the successful launch of the MFIP Certification Scheme. The IMM expressed gratitude to all attendees for their participation and support, reinforcing its commitment to advancing materials science and professional certification in Malaysia.

*Figure 7: Networking session*

The launch of the MFIP Certification Scheme represents a significant milestone for the IMM and the materials engineering industry. By establishing a structured certification process, IMM aims to enhance industry competency, improve failure investigation methodologies, and ensure a higher standard of professional practice. The event successfully created awareness and set the stage for future advancements in materials failure investigation certification.


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11 - 15th July 2025
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# One-Day IMM Corrosion Conference 2024 and Plant Visit to Sumisaujana TCM Chemicals Sdn. Bhd.

*Reported by: Syarifah Nur Asyura Binti Syed Mohamad Sazly,*
*Materials Technology Education Sdn. Bhd.*

**Date: 17th October 2024**
**Venue: Sheraton Imperial Kuala Lumpur Hotel**

The Institute of Materials, Malaysia (IMM) Corrosion Committee successfully hosted the 1-Day Conference titled Navigating Corrosion Challenges in the 2020s: Sustainable Practices for a Resilient Future on Thursday, October 17, 2024, at the Sheraton Imperial Kuala Lumpur Hotel. The event attracted a remarkable crowd, with 145 participants and 46 exhibitors.

*Figure 1: Group photo of speakers and IMM Members*

This year's theme, *Sustainable Practices for a Resilient Future*, focused on leveraging advanced technologies to tackle corrosion challenges. The conference emphasized cost reduction through proactive measures such as predicting and preventing equipment failures, enhancing plant and equipment availability, and optimizing inspection and monitoring techniques.

*Figure 2: Participants getting ready for the conference to begin*

*Figure 3: Opening Speech by IMM Deputy President*

The day commenced at 8:00 a.m. with 13 insightful presentations delivered by experts from diverse sectors, including operators, contractors, and vendors. Between sessions, participants explored exhibition booths featuring cutting-edge technologies and innovative solutions for corrosion control. These breaks also provided opportunities

*Figure 4: Presentation by EPOMS and Ankaa Consulting*

*Figure 5: Questions from participants*

*Figure 6: Participants visited the exhibition booth*

*Figure 7: Presentation by Petronas Carigali and Sabah Shell Berhad*



Figure 8: Panel Discussion

for meaningful discussions and networking, fostering the exchange of ideas between attendees and exhibitors.

The event concluded with an engaging panel discussion moderated by the Chairman of the IMM Corrosion Committee, Ir. Ong Hock Guan, alongside all 13 speakers.

On the following day, participants were invited to a half-day technical visit to Sumisaujana TCM Chemicals Sdn. Bhd., located at No. 57, Jalan Tiaj 2/1, 42300 Puncak Alam, Selangor. The visit included an insightful tour of the facility, showcasing the company's latest laboratory services and technologies. It was an eye-opening experience for the attendees, sparking numerous intriguing questions during the walkabout. IMM extends its heartfelt appreciation to Sumisaujana TCM Chemicals Sdn. Bhd. for hosting this enriching visit.


Figure 9: Plant Visit to Sumisaujana

# Oil & Gas Asia (OGA) 2024

*Reported by: Zeti Aisyha M.A.Razali, Intern IMM Secretariat*
*Reviewed by: Aberamy Dayalam, Manager of IMM Secretariat*


**Date: 25th – 27th September 2024**
**Venue: Kuala Lumpur Convention Centre (KLCC)**

Oil & Gas Asia (OGA) 2024 is Malaysia's leading event for the oil, gas, energy, and petrochemical industries and marked its 20th edition in 2024. The event was held over three days, which took place from 25th – 27th September 2024 at Kuala Lumpur Convention Centre (KLCC).

Through its partnerships with key organisations such as the Malaysian Petrochemicals Association (MPA) and the Malaysian Oil, Gas & Energy Services Council (MOGSC), OGA offers an essential platform for business collaboration and knowledge sharing throughout the energy value chain.

OGA promotes innovation, investment, and sustainable practices in the industry through exhibitions, conferences, and networking events. Serving as a hub for industry leaders, OGA fosters growth and advancement in Malaysia's oil, gas, energy, and petrochemicals sectors, as well as in related industries globally.



*Figure 1,2: The IMM Secretariat explained the details of the IMM Training & Certification Programs to the visitors at OGA 2024.*

Over 2,000 companies were present at the event, with 25,000 professional and trade visitors from more than 100 countries. The Institute of Materials, Malaysia (IMM) participated as an exhibitor and as one of the supporting associations. The IMM booth was located in Hall 6, booth number 6028. Materials Technology Education Sdn. Bhd. (MTE) and Topfields Borneo Sdn. Bhd. (Topfields) were invited to join IMM as exhibitors. However, Topfields Borneo Sdn. Bhd. participated as a visitor.

Nearly 300 visitors, including students, lecturers, and parents, visited the IMM booth. IMM successfully promoted and introduced its certification programs, memberships, and upcoming conference to the visitors. Additionally, students, lecturers, and parents expressed interest by asking several questions related to IMM's certification programs. Four courses were highlighted in the IMM Certification Programs: the Coating Certification Scheme, the Corrosion Certification Scheme, the Mechanical Joint Integrity Certification Scheme, and lastly, the Welding Certification Scheme. Furthermore, IMM, MTE, and Topfields successfully organized several activities to attract visitors.


*Figure 3: IMM Booth Setup at OGA 2024.*

*Figure 4: A group photo at IMM Booth. From Left Behind : Mr. Abang Mohammad Khairie (Manager Materials Technology Education Sdn. Bhd), Mr. Syafiq Zaini (IMM Secretariat), Mr. Muhammad Iqram Izham (Materials Technology Education Sdn. Bhd.).*

In addition, the IMM booth was visited by the IMM Management Committee, IMM Council Members, and IMM members during the OGA 20th Anniversary. Throughout the event, they offered free Inside Scoop ice cream, Touch 'n Go (TnG) cards, HealthLand Family Wellness Centre vouchers, OGA pins, tote bags, and coffee. They also organized games such as golfing, chess and tic-tac-toe. Two conferences were held over three consecutive days: MOGSEC 2024 and the Petrochemicals Sustainability Conference (PSC) 2024.

*Figure 5: A group photo at IMM Booth with Ir. Ts. Haji Affandi Majid (Chairperson Coating Committee) and with our two training bodies (MTE & Topfields)*

*Figure 6: A group photo at IMM Booth with Mr. Rehan Ahmed (IMM Council Members) and Ms. Karen Cheng (Director of Materials Technology Education Sdn. Bhd.).*

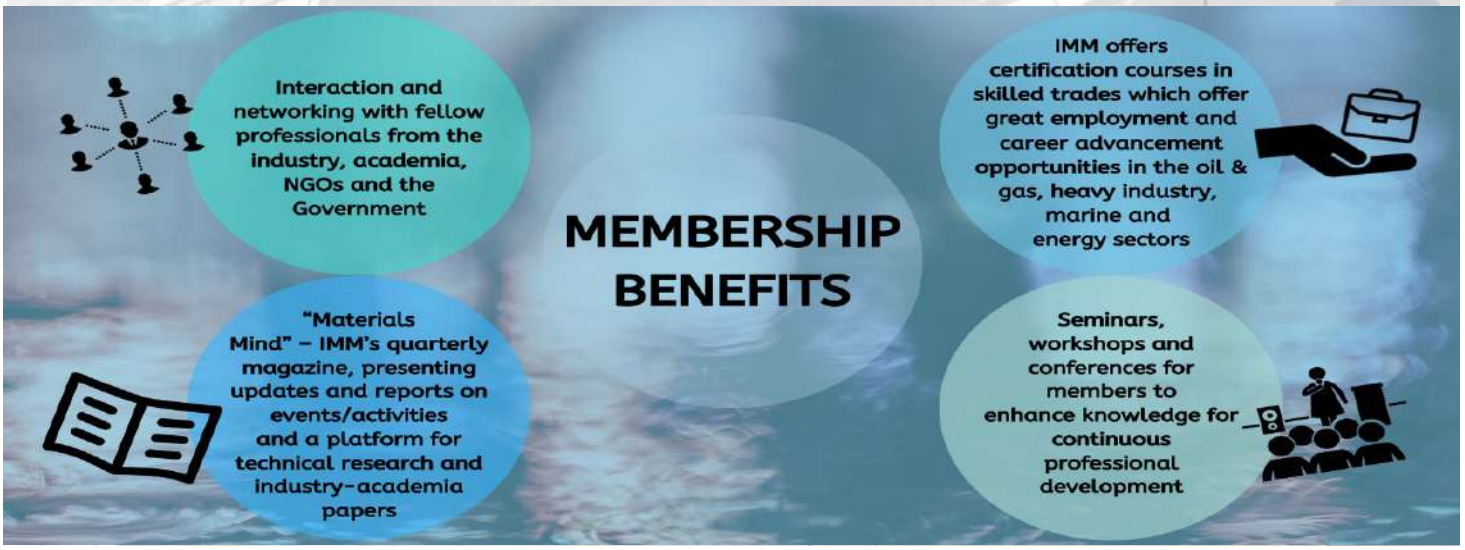
*Figure 7: A group photo at IMM Booth. Centre : Dr. Maxine Yee Swee Li (IMM Council Members)*
*Right : Ir Max Ong Chong Hup (IMM Council Members).*

The key highlights for OGA 2024 included SPEAK OGA, OGA x MOGSC Innovation Working Group, OGA x TalentCorp Malaysia, OGA x Malaysian Gas Association (MGA), OGA x MATRADE, and OGA x Society of Petroleum Engineers (SPE) KL and networking night.

*Figure 8,9: IMM Secretariat promoted the IMM Training & Certification Programs to the visitors at OGA 2024.*

Overall, OGA 2024 has created a great opportunity for IMM to promote and introduce its courses and certification programs to students, lecturers, and parents as part of their future planning to upskill. The focus is not only on competency certification but also networking and the exchange of knowledge across a wide variety of specialized areas of expertise.

*Figure 10,11: IMM Secretariat promoted the IMM Training & Certification Programs to the visitors at OGA 2024.*



# IMM AUTHORISED TRAINING BODIES (ATBs)/ ASSOCIATE TRAINING PARTNER (ATP) FOR IMM COURSES & CERTIFICATION

**AUTHORISED TRAINING BODIES (ATBs)**
(Offer IMM Certification Training Programs and Courses)

| ATBs | Training Programs & Courses |
|---|---|
| **Topfields Borneo Sdn. Bhd.**<br>(Sarawak) | **Coating**<br>• Certified B1B2 Assistant Blaster & Painter Level 1 & Level 2<br>• Certified Protective Coating Technician (Blaster and/ or Painter) Level 1 & Level 2<br>• Certified Blasting and Painting Supervisor<br>• Certified Coating Inspector Level 1 & Level 2<br>• Certified Quality Control Technician<br>• Certified Thermal Spray Coating Applicator<br>• Basic Knowledge on Corrosion Protection for Technicians and Engineers<br>• Corrosion Control by Protective Paints<br>• Corrosion Control by Protective Coating |
| **Sabah Skills & Technology Center**<br>(Sabah) | **Coating**<br>• Certified Protective Coating Technician (Blaster and/ or Painter) Level 1 & Level 2<br>• Certified Coating Inspector Level 1 & Level 2 |
| **Mui Lee Enterprise Sdn. Bhd.**<br>(Sarawak) | **Coating**<br>• Certified B1B2 Assistant Blaster & Painter Level 1 & Level 2<br>• Certified Protective Coating Technician (Blaster and/ or Painter) Level 1 & Level 2<br>• Certified Blasting and Painting Supervisor<br>• Certified Coating Inspector Level 1 & Level 2<br>• Refresher Course of Certified Coating Inspector for Recertification<br>• Refresher Course of Certified Protective Coating Technician (Blaster and/or Painter) Level 1 and Level 2 for Recertification |

## ASSOCIATE TRAINING PARTNER (ATP)

(Offers IMM Certification Training Programs and Courses)

# ATP: Materials Technology Education Sdn. Bhd.

(Malaysia and Overseas)

**IMM Training Programs & Courses**

### Coating

- Certified Protective Coating Technician (Blaster and/or Painter) Level 1 & Level 2
- Certified Protective Coating Technician (Blaster and/or Painter) Level 1 Refresher and Assessment
- Certified Protective Coating Technician (Blaster and Painter) Level 2 Refresher and Assessment
- Certified Blasting and Painting Supervisor
- Certified Coating Inspector Level 1 & Level 2
- Certified Coating Quality Control Technician
- Certified Thermal Spray Coating Applicator
- Refresher Course of Certified Coating Inspector for Recertification Painter) Level 1 and Level 2 for Recertification

### Thermal Insulation

- Introduction to Thermal Insulation
- Certified Thermal Insulation Installer

### Corrosion

- Certified Corrosion Monitoring Practitioner Level 1
- Certified Corrosion Monitoring Practitioner Level 2
- Certified Corrosion Monitoring Practitioner Level 3
- Certified Cathodic Protection Practitioner Level 1
- Certified Cathodic Protection Practitioner Level 2
- Certified Cathodic Protection Practitioner Level 3
- Certified Materials Failure Investigation Practitioner Level 1
- Certified Materials Failure Investigation Practitioner Level 2
- Certified Materials Failure Investigation Practitioner Level 3
- Certified Materials Failure Investigation Practitioner Level 4

### Vibration

- Certified Vibration Practitioner Category 1
- Certified Vibration Practitioner Category 2
- Certified Vibration Specialist Category 3
- Certified Vibration Specialist Category 4
- Certified Maintenance & Trobleshooting of Rotating Equipment Level 1
- Certified Maintenance & Trobleshooting of Rotating Equipment Level 2

### Mechanical Joint Integrity

- Certified Mechanical Joint Integrity for Small-bore Piping, Tubing and Valves
- Certified Mechanical Joint Integrity for Flange Bolted Connections
- Certified Mechanical Joint Integrity for Small-bore Piping, Tubing and Valves Refresher and Assessment
- Certified Mechanical Joint Integrity for Flange Bolted Connections Refresher and Assessment

### Welding

- Certified Welding Inspector
- Certified Associate Welding Engineer (AWE)
- Certified Welding Engineer (WE)
- Certified Senior Welding Engineer (SWE)

# INSTITUTE OF MATERIALS, MALAYSIA

*Updated on 30th December 2024*

Institute of Materials, Malaysia (IMM) is a non-profit professional society that promotes honourable practice, professional ethics and encourages education in materials science, technology and engineering. Engineers, academicians, technicians, skilled workers and professionals are amongst its members exceeding 6800.

Registered with the Registrar of Societies on 6th November 1987, the Malaysian Materials Science & Technology Society (MMS) changed its name to the Institute of Materials, Malaysia (IMM) on 16th June 1997. The objectives of IMM include the training and development of individuals and companies in Malaysia to attain professional recognition in various fields of materials science, technology and engineering.

IMM is administered by a council of 30 members, with volunteers leading more than 15 materials committees and more than 4 regional chapters, and supported by a secretariat with full time staff.

### IMM Vision

To be internationally recognized competency certification institution in Materials Science, Technology and Engineering.

### IMM Mission

(1) To be the technical authority on Material Science, Technology and Engineering.
(2) To positively contribute to society and quality of life.
(3) To become an internationally recognized certification body.
(4) To develop and enhance competency and skills for all categories and practitioners.
(5) To be the platform for industry and academia collaboration.

The IMM membership is categorised into 6 different grades and open to anyone above the age of 17 years - individuals and companies keen in developing and contributing towards the growth of materials science, technology and engineering in Malaysia.

Over the years, IMM have conducted courses on coatings, coatings fingerprinting, corrosion, welding, vibration etc in support of the oil and gas industry in Malaysia. Over 750 Coatings Inspectors have been trained and certified as well as more than 3300 Blasters & Painters, Supervisors, Corrosion Technician and Vibration Practitioners. Its certification programmes are recognized by PETRONAS and all oil & gas operators. Since January 2011, more than 80 Associate Welding Engineers, more than 90 Welding Engineers, more than 30 Senior Welding Engineers and more than 45 Coating Fingerprint Quality Controllers were trained and certified.

IMM has also organised 10 International Materials Technology conferences (IMTCE) on a biennial basis, and numerous technical seminars, educational programmes, technical visits, and materials awareness programmes since 1988.

Public courses, such as Microbiologically Influenced Corrosion (MIC) and Welding Technology for Non-Welding Personnel, are being offered occasionally. Training on materials awareness has also been conducted in public listed companies.

The courses and programmes are being organised by Authorized Training Body/Bodies and Authorized Event Organizer/Organizers.

Collaborations with the Asian Welding Federation, Sabah Skills Technology Centre (SSTC), and local universities continue to be part of IMM's vision and long term mission to educate, train and serve the materials fraternity.


### GENERAL INFORMATION ON MEMBERSHIP

The IMM Membership is open to all individuals and companies in developing the contribution of Materials science, technology and engineering towards industrial growth in Malaysia. The technology of materials is advancing day-to-day throughout the world. Membership to the IMM will enable networking and exchange of knowledge from a very wide variety of specialised areas of expertise. Please feel free to download or print a copy of the application form together with the IMM regulations. If you have any doubt, please do not hesitate to contact our secretariat through the phone; +603-76611591 or email to secretariat@iomm.org.my

Annual subscriptions shall be payable in advance on 1st January of each year. Those admitted into the IMM between 1st July and 31st December in any year shall pay only half the annual subscription. Seniors (above 55 years old) get 50% discount off their annual subscriptions.

We have an online application for membership for selected grades. Membership application forms in document format can be accessed from www.iomm.org.my.

**IMM SECRETARIAT**
Suite 1006, Level 10, Block A, Kelana Centre Point,
No. 3 Jalan SS 7/19,
47301 Petaling Jaya, Selangor

### IMM MEMBERSHIP BENEFITS

(1) IMM activities offer members to interact and network with representative from the industry, academia and government related to the Materials profession.

(2) Members will gain knowledge on career opportunities for their children, friends etc as IMM offers certification courses in skilled trades *e.g.* Welding, Painting, Inspection, Corrosion *etc*.

(3) IMM-JWES Welding Engineer Certification program leading to a Welding Engineer Certification which offers great employment opportunities in the oil & gas, heavy industry, marine and energy sectors.

(4) IMM publications – quarterly magazine plus annual conferences offer presenters an opportunity for their technical research or industry-academia papers to be published in ISI- and Scopus-index journals.

(5) IMM organizes many free technical events for members to acquire new knowledge and networking opportunities. Participants to these events will also receive Certificate of Attendance for their Continuing Professional Development records.

### IMM MEMBERSHIP FEES SCHEDULE AS PER BELOW:

| Description | Amount | | | |
|---|---|---|---|---|
| | Entrance Fee | Processing Fee | Transfer Fee | Annual Subscription |
| Fellow (F.I.M.M) | - | RM 300.00 | RM 10.00 | RM 150.00 |
| Professional (M.I.M.M) | - | RM 150.00 | RM 10.00 | RM 100.00 |
| Associate (A.M.I.M.M) | - | RM 150.00 | RM 10.00 | RM 80.00 |
| Company | RM 50.00 | - | - | RM 200.00 |
| Ordinary | RM 20.00 | - | - | RM 50.00 |
| Student | RM 10.00 | - | - | RM 10.00 |
| Ordinary/ Company | RM 40.00/ RM 50.00 | - | - | NIL |

# INSTITUTE OF MATERIALS, MALAYSIA

*Updated on 30th December 2024*

## REGULATIONS GOVERNING ADMISSION AND TRANSFER OF MEMBER GRADES

The Council shall establish a Membership Committee which will be responsible for these Regulations and for review of applications for new membership and transfer to other grades (upgrades). The Membership Committee shall recommend for Council approval for admission and transfer of membership. All grades of memberships are awarded at the discretion of the Council and may be withheld or withdrawn in the event of conduct likely to prejudice the standing of the Institute. Every member shall receive a membership certificate.

Every application for membership, individual or company, shall be proposed and seconded according to these regulations and shall be forwarded to the IMM Secretariat who on behalf of the Honorary Secretary will process for consideration and approval of the Membership Committee before tabling for Council's endorsement. The Council may at its discretion reject any application without assigning any reason thereof. The Council may use its discretion to exempt the need for proposer and seconder for Student, Ordinary and Company membership.

Each company on admission as a member shall be entitled to nominate one representative to exercise all rights of membership. Only representatives of Company membership, as well as Fellows (F.I.M.M.). Professional Members (M.I.M.M.) and Ordinary members shall have the right to vote and to hold office in IMM.

Only Malaysian Citizens can become Ordinary Members, Associate Members (A.M.I.M.M.), Professional Members (M.I.M.M.) and Fellow Members (F.I.M.M.) with voting rights. Foreigners can have membership to similar grades but shall have no voting rights.

## MEMBERSHIP GRADE & REQUIREMENT

### *Honorary Fellow (Hon. F.I.M.M.)*

The Council shall have the power to elect Honorary Fellows who shall be persons of eminence in science or industry. The election shall be based on a majority vote within the Council. Honorary fellows shall enjoy such privileges as may from time to time be determined by the Council.

### *Fellow (F.I.M.M.)*

A person at least 35 years of age with approved academic qualifications, training and 8 years relevant responsible experience who has made significant contributions to the science and practice of profession of Materials Science and Engineering or has given distinguished service to industry or education.

### *Professional Member (M.I.M.M.)*

A person at least 25 years of age, with approved academic qualifications and training, having at least 3 years responsible experience in Materials Science and Engineering, or a person at least 40 years of age, with at least 15 years of experience with practical responsibility, as demonstrated by thesis/dissertation or report and interview.

### *Associate Member (A.M.I.M.M.)*

A person at least 25 years of age, who possesses an interest in Materials Science and Engineering but have not acquired the necessary experience or obtained the qualification, governing entry to Member grade. An Associate Member, on obtaining the necessary qualifications, may apply for transfer to Member grade.

### Company Member

Any company that is involved or has interest in Materials Science and Engineering will be qualified to join as a company member.

### *Ordinary Member*

Any Malaysian Citizen and above the age of 18 years engaged in activities related to research, development and applications in Materials Science and Engineering shall qualify for Ordinary Membership. Only Ordinary Members who meet the necessary minimum requirements may apply for transfer to membership grades of Fellow, Member and Associate Member and may use the abbreviated titles upon transfer.

### *Student Member*

A student member shall be a person not under 17 years of age who at the time of application satisfies the Council that he has received a good general education and is studying subjects related to Materials Science or Engineering. A student member shall transfer to the grade of Ordinary Member after graduation provided he or she is suitably qualified and as soon as he or she is earning a full-time salary. A Student shall not become member of the IMM without the prior approval of the Vice-Chancellor or Head of Department of the university or relevant authority concerned.


36th IMM Anniversary Celebration


YPWLC 2024 competition


One-Day IMM Corrosion Conference 2024 and Plant Visit to Sumisaujana TCM Chemicals Sdn Bhd

### FREE Ordinary Membership for Affiliates:

The Institute of Materials, Malaysia will recognize members of various professional institutions and societies for membership at "Ordinary Grade" without any annual subscriptions. Such members shall submit to IMM proof of their current membership of the respective institutions together with their application.

Members of the following institutions and societies are eligible to apply for affiliate membership:

1.American Welding Society
2.Asian Welding Federation
3.Board of Architects Malaysia
4.Board of Engineers, Malaysia
5.Engineering Institutes under the Engineering Council of UK
6.Geological Society of Malaysia
7.Institut Kimia Malaysia
8.Institute of Corrosion UK
9.Institute of Materials Singapore
10.Institute of Physics Malaysia
11.Institution of Engineers, Malaysia
12.Jabatan Minerals & Geoscience
13.Malaysian Medical Association
14.Malaysian Nurses Association
15.Malaysian Society for Non-Destructive Testing
16.Malaysian Welding & Joining Society
17.Persatuan Arkitek Malaysia
18.Plastics & Rubber Institute of Malaysia
19.Singapore Welding Society
20.Society of Petroleum Engineers

### FREE Company Membership for Affiliates:

The Institute of Materials, Malaysia will recognize various professional institutions and associations for membership at "Company Grade" without any annual subscriptions.

Companies registered with the following Trade Associations are recognized for Affiliate Company Memberships:

1.Federation of Malaysian Manufacturers (FMM)
2.Malaysian Offshore Contractors Association (MOCA)
3.Malaysian Oil & Gas Engineering Council (MOGEC)
4.Malaysian Oil & Gas Services Council (MOGSC)

The companies shall submit to IMM proof of their current membership at the respective trade associations together with their application.

NOTE: The above provisions for affiliate membership for individuals and companies was approved by the IMM Council in accordance with the powers vested in the Council as per Clause 6.1.3 of the IMM Constitution and was subsequently endorsed by members at its 21st Annual General Meeting held on 19th March 2011.

**INSTITUTE OF MATERIALS, MALAYSIA**

## ANNUAL REPORT OF THE COUNCIL

## (FOR THE YEAR ENDING 31ST DECEMBER 2024)

Dear IMM Members,

On behalf of the IMM Council, I am pleased to present the report of the activities of IMM covering the period from 1st January 2024 to 31st December 2024.

### (I) IMM MANAGEMENT COMMITTEE AND COUNCIL-MEETINGS

| Date | Management Committee Meeting (Term 2024-2026) |
|---|---|
| 3rd Feb 2024 | 8th Meeting (Term 2022-2024) |
| 20th Apr 2024 | 1st Meeting |
| 20th Aug 2024 | 2nd Meeting |
| 19th Oct 2024 | 3rd Meeting |

| Date | Council Meeting (Term 2024-2026) |
|---|---|
| 1st Mar 2024 | 8th Meeting (Term 2022-2024) |
| 3rd May 2024 | 1st Meeting |
| 9th Aug 2024 | 2nd Meeting |
| 8th Nov 2024 | 3rd Meeting |

### (II) IMM ACTIVITIES CARRIED OUT IN THE YEAR 2024

| Date | Activity |
|---|---|
| 20th Feb 2024 | 1th Meeting ADS Module 2 |
| 22nd Feb 2024 | IMM Coating Committee Meeting |
| 19th Mar 2024 | 31st Meeting of MFIP-WSC |
| 22nd Mar 2024 | 34th Annual General Meeting |
| 2nd Apr 2024 | 32nd MFIP Meeting |
| 29th Apr 2024 | Hari Raya Celebration Lunch |
| 28th May 2024 | 1st MLC Committee Meeting |
| 13th June 2024 | 1st Corrosion Committee Meeting |
| 22nd-23rd June 2024 | IMM Retreat Meeting |
| 24th June 2024 | MS ISO/IEC 17024 Audit Refresher Workshop for Internal Auditors |
| 27th - 28th June 2024 | Sabah Oil & Gas Conference & Exhibition (SOGCE) |
| 15th Jul 2024 | Opening Meeting Internal Audit MS ISO/IEC 17024 |
| 15th - 19th Jul 2024 | IMM Internal Audit MS ISO/IEC 17024 |
| 25th Jul 2024 | 1st ECP Committee Meeting (Term 2024-2026) |
| 29th Jul 2024 | Closing Meeting Internal Audit ISO |
| 3rd Aug 2024 | Discussion (a face-to-face meeting) - Execution of IMMR Sdn Bhd |
| 5th Aug 2024 | Online Meeting with MJIC (Ts. Mohd Azmi) |
| 6th Aug 2024 | 1st CPPL4 WG Meeting |
| 8th Aug 2024 | 1st Vibration Committee Meeting (Term 2024-2026) |
| 28th Aug 2024 | Short Meeting with Welding Committee (Mr. Zamri & Dr. Christine) |
| 3rd Sept 2024 | Semi-Final Materials Lecture Competition 2024 |
| 3rd Sept 2024 | 2nd CPPL4 WG Meeting |
| 9th Sept 2024 | 2nd Vibration Committee Meeting (Term 2024-2026) |
| 10th Sept 2024 | 3rd CPPL4 WG Meeting |
| 10th Sept 2024 | 1st Impartiality Committee Meeting (Term 2024-2026) |
| 17th Sept 2024 | 1st Meeting of RBIP Working Sub-Committee Kick Off |
| 23rd Sept 2024 | 2nd Meeting ADS Module 2 |
| 24th Sept 2024 | Final Materials Lecture Competition 2024 |
| 25th - 27th Sept 2024 | Oil & Gas Asia Conference & Exhibition 2024 |
| 9th Oct 2024 | 2nd Corrosion Committee Meeting |
| 17th - 18th Oct 2024 | IMM One-Day Corrosion Conference & Plant Visit |
| 23rd Oct 2024 | Meeting with UMPSA (Dr. Hafiz) |
| 24th Oct 2024 | IMM CPD Meeting |
| 29th Oct 2024 | IMM MFIP Certification Scheme Launch Event |
| 4th Nov 2024 | Vibration Committee Visit IMM Meeting |
| 13th Nov 2024 | Meeting with Entruss Ventures Sdn. Bhd. (Prof. Emeritus Dr. Che Husna Azhari) |
| 27th Nov 2024 | Meeting with Macroperi Engineering Sdn. Bhd. |
| 5th Dec 2024 | 3rd Corrosion Committee Meeting |
| 13th Dec 2024 | IMM Induction Program for Chairpersons Session 1 |
| 16th Dec 2024 | IMM - MTE Coordination Meeting |
| 18th Dec 2024 | Management Review (MR) Meeting |
| 20th Dec 2024 | IMM Induction Program for Chairpersons Session 2 |

### (III) HIGHLIGHTS OF ACTIVITIES IN 2024

*FULL REPORT ON SECTION (III) CAN BE ACCESSED ELECTRONICALLY ON IMM WEBSITE (www.iomm.org.my).*

### (IV) SUMMARY AND MOVING FORWARD

The IMM Management Committee and the IMM Council would like to extend their heartfelt gratitude to all Working Committee members, Regional Chapter members, IMM Secretariat staff, and other stakeholders for their continued efforts and support in helping IMM achieve its goals in 2024.

IMM will continue to develop new initiatives and enhance existing systems to remain relevant and competitive. We look forward to a

**On behalf of the Council**

Assoc. Prof. Ts. Dr. Tay Chia Chay Honorary Secretary (Acting), IMM

Date:

***Due to limited printed pages, the full article can be accessed electronically on IMM website or through scanning***

***Scan the QR Code***

MUI LEE

IMM

# ADVANCE YOUR CAREER WITH IMM CERTIFIED COURSES

## Available Courses :

### *Protective Coating Technician Level 1 / Level 1 & 2 / Refresher*

Master essential skills for blasters and painters to apply protective coatings - across any industry.

### *Coating Inspector Level 1 / Refresher*

Gain the foudation skills to inspect, assess and ensure coating quality

### Coating Inspector Level 2 / Refresher

Advance your inspection expertise with higher-level assessment and reporting capabilities

Other available courses:

***BPS - Certified Blasting and Painting Supervisor***

***ABP - B1B2 Assistant Blaster & Painter***

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Contact for more info :

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sharmilla@muilee.com.my

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