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HIGHLIGHTS

What Are The Key Criteria to Have A Safe and Reliable Installation of Composite Repair System?

Is There A Better Way to Detect Wet or Saturated Insulation?

Sustainable Additive Manufacturing: Exploring Challenges and Opportunities of Recycled Plastic Materials in 3D Printing

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Ts. Dr. Chew Khoon Hee
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INSTITUTE OF MATERIALS, MALAYSIA

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IMM CERTIFICATION:.....

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(Supporting documents to be submitted wherever applicable)

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				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
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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.

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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.

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(Signature) (Date)

COVER STORY

What are The Key Criteria to Have A Safe and Reliable Installation of Composite Repair System?

Non-metallic composite repair technology has proven to be an effective and efficient means of repairing corroded or otherwise damaged pipelines and piping systems across a variety of industries due to its lightweight, high strength, and corrosion-resistant properties. The two main codes and standards for composite repair system are:

1. ASME PCC-2-2022, Article 401 – Nonmetallic Composite Repair Systems: High-Risk Applications.
2. ISO 24817- 2017 - Petroleum, petrochemical and natural gas industries — Composite repairs for pipework — Qualification and design, installation, testing and inspection.

However, is there a thorough understanding and implementation of the right "Controlled Processes" to achieve the ultimate goals of safe and reliable installation of Composite Repair Systems? This article discusses the crucial roles of the "Controlled Processes", highlighting the Key Criteria during the implementation of Selection, Design, Training, Installation/ Inspection and Documentation phases.

Many studies have demonstrated that when composite repair systems are correctly selected, designed, installed, inspected and documented, they can restore a piping and pipeline's structural integrity and pressure containment capability for a wide range of anomalies and applications—even to an extent that the performance level of the damaged pipe is equal to that of the original pipe. Of course, there are cases where poorly selected and designed, improperly installed, inspected and documented composite system will provide little to no benefit. This means that safe and reliable performance of a composite repair system is critically dependent on five 'Controlled Processes': (1) Selection of Materials that have been tested to meet qualification requirements according to the standards, (2) Repair Design, (3) Installer Training, (4) Repair Installation and (5) Repair Documentation.

(1) Selection of Materials that have been tested to meet qualification requirement

In general, the following are types of composite repair systems in the market.

(a) Pre-cured - Provided in pre-cured sheets that are bonded layer-upon-layer in the field utilizing adhesive between each layer.

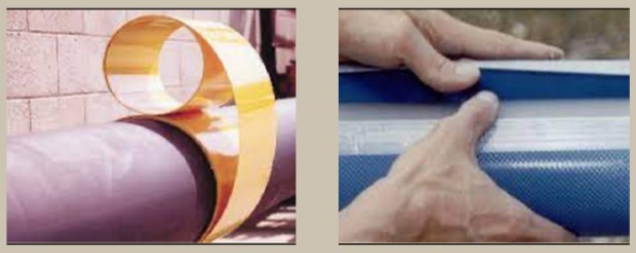

Figure 1: Pre-cured composite repair systems

(b) Pre-saturated, field-cured - Typically provided in rolls with resin impregnated into the fiber at the factory that are applied and cured in place in the field.

Figure 2: Pre-saturated, field-cured composite repair system

(c) Field-saturated, field-cured - Typically provided in rolls of dry fiber and resin separate, then mixed and combined in the field, then cured in place.

Figure 3: Field-saturated, field-cured composite repair system

Each system, regardless of type, has specific properties and parameters that affect all aspects of the system from start to finish. For example, pre-cured systems generally offer fast turnaround installations for simple straight pipe geometry only, but they are not capable of repairing leaking defects. Moisture Cured Urethane (MCU) systems are a good example of a pre-saturated, field-cured composite system offering simple and fast application, but they are not suitable for higher risk defects (dents for example) and high pressure leaking defect repairs due to lower bond strength adhesion resulting from the polymer type in combination with the curing process (MCU uses water to initiate curing and produces gases of carbon dioxide during curing). The excess water and gases of carbon dioxide are the main culprits for the potential porosity and voids within the laminate of MCU composite repair.

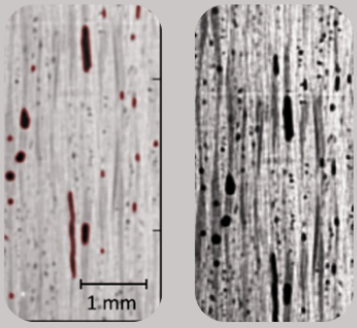

Figure 4: Microscopic view of cross section of the defective composite repair system with voids and porosity

In general, factors that affect the overall performance of the composite repair system, such as elastic modulus, tensile strength and adhesion strength, can be traced to the fiber type, matrix material (i.e., resin), and fiber orientation. For example, HJ3's CarbonSeal system, which is a high layer thickness (1.3 mm per layer), bi-directional carbon fiber with ambient cured novalac epoxy resin, offers faster application and a more cost-effective repair for any demanding defect requiring restoration of strength in both hoop and axial directions due to its high strength per layer and carbon fiber-based fabric structure. In contrast, a carbon fiber system with similar strength properties but with uni-directional iber architecture and a low layer thickness (typically 0.4 mm to 0.8 mm) will likely require more layers resulting in longer installation time to achieve the same result in terms of hoop reinforcement and offer little axial reinforcement. For a uni-directional architecture, the axial reinforcement will largely be driven by the matrix (resin) which can be an order of magnitude lower in strength than the hoop strength. Additionally, some novalac epoxy systems require post curing (controlled application of high temperature beyond ambient or installation conditions) to complete the curing process and achieve the strength determined in qualification testing and hence the level of reinforcement that the calculation is based upon. This leads to additional cost and extensive curing time.

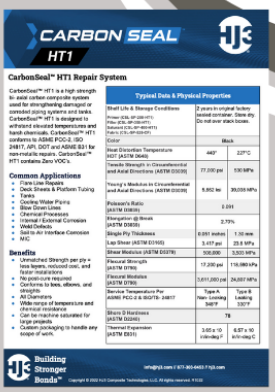

Figure 5: Technical Data Sheet of HJ3's CarbonSeal Repair System

All the technical data and testing results should be documented in the manufacturer's Technical Binder, Testing Report or Accredited Third Party Testing report which has outlined all full-scale testing for both Type A and Type B repair in accordance with Table 401-3.2-1 in ASME PCC-2 and Table 4 in ISO 24817.

Figure 6: Technical Binder of CarbonSeal Repair Systems

(2) Repair Design

ASME PCC-2 Article 401 Appendix 401-I, contains a two-page "Component Repair Data Sheet" that is an ideal reference for ensuring that all parameters required for the repair design have been completed. ASME PCC-2 addresses this by including a list of important questions to be resolved in the "assessment" process. It is paramount to collect the above data before designing and installing a composite repair in order to form the basis for determining the repair requirements. An anomaly targeted for repair must be characterized in terms of extent and severity to determine its impact on the integrity of the piping. For example, essential data to assess a corrosion defect include the pipe diameter, nominal and remaining wall thickness, and material grade, as well as the length and width of the corrosion. Standards and guidance documents such as API 579/ASME FFS-1, ASME B31G, or BS7910 are typically used to perform the required calculations for corrosion assessment. As part of this assessment, the decision is made as to whether the anomaly is in need of repair.

Once the severity of the defect has been assessed, the composite repair requirements can be determined using Design Methodology in ASME PCC-2 Article 401 Section 401-3.4 or ISO 24817 Section 7.5. The inputs to the composite repair design must consider all facets of operation which are captured in the Design Data Sheet of ASME PCC-2, for example, expected loads, including external bending moments and axial loads, expected maximum operating temperature of the piping, or the ambient temperature of the soil/water/atmosphere in the vicinity of the repair.

The end user must review and approve the Repair Design by confirming the inputs to the assessment and ensuring the design methodology addresses those inputs and is valid to match the risk and expectation of each specific repair.

(3) Installer Training

Personnel involved in the installation of a Composite Repair System shall be trained and qualified according to Installer Qualifications in ASME PCC-2 Article 401 Mandatory Appendix 401-VII or ISO 24817 Annex I. The installers are taught the full installation instructions, and the training qualifications must include the definition and terminology of the composite repair system, health and safety, surface preparation, material preparation, material application, control of repair conditions, QA/QC methods and QA/QC documentation. Typically, each new installer must attend 2 days of theoretical classroom training and practical training of installing a composite repair on one (1) straight pipe, one (1) elbow and one (1) tee. After successful inspection of the composite repair, the straight pipe with a through wall hole will be subjected to a hydrostatic pressure test. The new installer will be awarded with installer qualification certificate once he/she has passed the examination and tests for both theoretical and physical application.

Figure 7: Installer qualification hand on installation training

(4) Repair Installation

During repair installation, the qualified installer is required to follow full installation instructions from the manufacturer and conduct all required quality assurance methods in accordance with Hold Points in ASME PCC-2 Table 401-4.6-1 or ISO 24817 Table 14. Listed below are several key criteria that should be adhered to when composite repair systems are installed on piping:

- Surface been prepared to the manufacturer's requirements.
- Proper materials on hand that match the repair design and installed according to the installation procedure.
- Service temperature limitations during the installation.
- Cure fully completed before the line is placed back in service.
- Measurements taken during and after curing time has elapsed to ensure that all materials (fillers, primers and resins) were properly mixed and have cured properly (e.g., hardness tests, etc.).

If the incorrect composite repair system or the installation is not properly completed, then the premature failure of the composite may happen in service which may eventually lead to safety issues, risk to personnel and/or fire.

Figure 8: Composite repair failures

Figure 9: Collapse of offshore platform due to fire and explosion

(5) Repair Documentation

The final step of the primary key "Controlled Processes" will be the Repair Documentation. The information and data from all the above controlled process will be recorded and documented into one final report for traceability and tracking to ensure that what has been designed is delivered to the end user.

Final Thoughts

In summary, a good rule for any end user is to make sure that all the above controlled processes are strictly followed to ensure a high level of confidence in any composite repair system being used on assets. A composite repair system must demonstrate that it meets the requirements of ASME PCC-2 and/or ISO 24817 industry standards before being used to repair a piping anomaly. Composite repair system manufacturers should be able to produce official documentation demonstrating their compliance with these standards and the required material and performance properties. The repair system sent should also be controlled under a documented quality control program (e.g. ISO 9001) to ensure the materials sent to the field are of equal quality and strength to the materials used in the qualification testing. For anomalies more complex than standard external corrosion, it is essential that testing be conducted on the composite repair system to demonstrate that adequate performance levels can be achieved, for example reinforcement of a pipeline dent or crack. HJ3 has worked with various accredited third parties to ensure HJ3's CarbonSeal is capable of reinforcing pipe material having corrosion, crack or dent features subject to the pressure loading conditions considered in these testing program. The program involved testing defects repair on 12.75-inch x 0.375-inch Grade X42 pipe samples with 75% corrosion wall loss features, as well as repair on 12.75-inch x 0.188-inch Grade X42 pipe samples with dents. Defects were filled with load transfer filler material prior to installing the carbon-epoxy repair system. Several noteworthy observations are made in reviewing the results of this testing program.

- The composite thickness designed and used by HJ3 in repairing the pressure cycle fatigue and inter-layer strain burst tests was validated as an optimized repair configuration for several reasons. First, the hoop strain in the reinforced region was low enough to permit a 100,000-cycles runout condition to be achieved. Secondly, the average hoop strain range in the composite material was measured to be less than the ASME PCC-2 design strain limit.

- The dent sample achieved the 250,000-cycle runout condition. During pressure cycling, the hoop strain measurements in the reinforced dents at 20,000 cycles are significantly less than the unreinforced dents for the dent magnitude considered in this study.

Figure 10: Composite Repair System Validation Program

In another testing program which involved a combination of unreinforced and reinforced 12.75-in x 0.25-in, Grade X52, LF ERW pipe samples with 3-in x 50% deep (approximate) crack geometries in their seam welds. ADV worked with HJ3 to determine an effective repair thickness of HJ3's CarbonSeal, carbon-epoxy repair system. One of the samples of repaired pipeline which has been cycled with a "moderately aggressive" condition, the failure was at the 20,376 cycles (this is the one of lowest of three repaired samples of pipelines in this test program) corresponds to 122 years of service assuming a fatigue safety factor of 5 (i.e., 20,376 cycles / 5 (fatigue safety factor) / 33.4 cycles per year @ ΔP = 67% SMYS). For a "light" pressure cycle condition (12.7 cycles per year @ ΔP = 67% SMYS) typical for gas transmission pipelines, the 20,376 cycles represent 320 years of service.

Figure 11: Composite Reinforcement of Cracks Study

Overall, HJ3's CarbonSeal composite technology is an effective repair method for reinforcing severe corrosion, crack and dent features. The validation efforts and results provided in these reports can be used to support the repair of corrosion, crack and dent features in high pressure transmission pipelines.

Written by:
Mr. Shann Ching Liew

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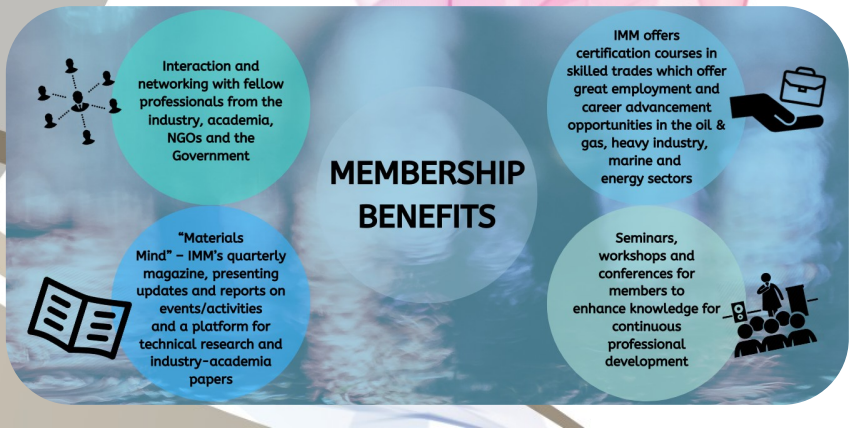

TECHNICAL ARTICLE

Is There A Better Way to Detect Wet or Saturated Insulation?

Prepared by:
Mr. Danny Tan, IMM Insulation Committee Chairperson

"Wet or Saturated Insulation" in a tightly enclosed insulation after the system has been serviced or installed for an extended period in operations, and the relation of this "Wet, and/ or Saturated" insulation towards its contribution to Corrosion Under Insulation (CUI). There are the pertinent questions asked: is there a better way to detect wet or saturated insulation without opening the cladding? A photo of an insulated pipe with CUI corrosion exposed is shown in Figure 1.

Figure 1: Corrosion of Insulated Pipe (Corrosion Under Insulation)

The phrase "remove all wet insulation" which often appears in insulation specifications or guidelines in insulation technical specifications documents, but the critical action is to detect this wet insulation or to remove "wet insulation" in the enclosed insulation system is the key to mitigating CUI, especially in Malaysia's high humidity environment perspective. With wet insulation, there will be loss of insulation thermal efficiency, increased energy consumption, and increased insulation weight plus many other issues.

Wet insulation/water ingress is driven by many factors, including dripping water or liquid, condensation, cyclical operating temperatures and all these will lead to CUI on carbon steel and alloy steel surfaces. This is unfortunately a common problem affecting many industries due to ineffective corrosion management programs.

CUI preventive measures should include routine "Moisture Under Insulation" - MUI inspections and maintenance with some form of Non-Destructive Testing (NDT) to identify Wet Insulation, but all these inspections and maintenance programs are on "periodic" basis and could be ineffective in monitoring water ingress or wet insulation as CUI is a hidden issue.
CUI often remains undetected until insulation is removed, either physically or whenever there is a leak or other event, some of which can be extremely hazardous. Routine insulation inspection involves physically removing the insulation and will incur costs for scaffolding, physical inspection, physical repairs and physical replacements after opening the cladding to investigate damaged wet insulation.

Insulation does not cause corrosion until the ingress of water and prolonged contact of the corrosive or conductive water/liquid with the metal surface and the contaminants (salts) leaching out from the insulation blankets.

The water can come from rainwater penetrating cladding leakage, deluge system water, wash water or condensation from the cyclical temperature or low-temperature operation.

In 3 simple terms, CUI occurs when water ingress:

1. Temperature range -4 °C to 175°C provides the ideal CUI temperature,
2. Prolonged exposure to moisture or water (wet insulation) and,
3. contaminants (salts) leaching from insulation blankets or from the environment.

Therein lies the core issue – water/moisture /water ingress and that's why the importance of removing wet insulation or identifying wet insulation becomes critically important.

Smart Water Ingress Detection Device: WI Discovery Leakage Detector is shown in Figure 2.

Figure 2: WI Discovery Leakage Detector

Figure 3: WI Discovery Leakage Detector – A better way to detect water ingress without opening Cladding.

It is important to look for damaged insulation or wet insulation on hot thermal insulation systems where damaged insulation or wet insulation will lead to loss of insulation efficiency, thus heat will transfer to the external metallic cladding surface.

Typically, the surface temperature for any hot thermal insulation cladding should not exceed the ambient temperature and is normally around 32°C - 38 °C in our environment. The “best holistic” approach method to identify wet insulation or damaged insulation is by visual inspection without opening the external cladding using the Smart Thermal Indicating Coating (STIC) tool as an active visual inspection method to determine wet insulation or damaged insulation without opening the external jacketing or external cladding.

Figure 5: Smart Thermal Indicating Coating with an irreversible color change above 60°C as active visual inspection to detect wet Insulation/damaged insulation.

There is no easy answer to the question of how to handle “wet insulation” when it comes to mechanical insulation systems as moisture under insulation is a hidden issue. There are, however, a few basic best practices that may apply to all insulation systems: -

- Keep all insulation materials dry during storage, handling, and installation, until they are totally protected (watertight) with the specified protective covering/external cladding.
- Not all insulations are the same, and each should be addressed given its own characteristics, water resistance, hydrophobic properties, and when in doubt, consult the insulation materials supplier.
- Take into consideration the installation conditions, surrounding environment, and operating temperatures as we are in humid environments and are not the same as those from lower humidity countries.
- Ask these questions – Has the surface been insulated properly with external cladding or coated with the right CUI Coating systems as per NACE 0198-2017 specified Inert Multi-Polymeric Matrix (IMM) Hi-Temp CUI coating systems for cyclical environment insulation system?
- Has the system been designed to allow for the escape or ventingof any moisture that may ingress the enclosed insulation systems?
- Has WI Discovery LeakageDetector been considered to detect conductive water/liquid and detectwet insulation at the bottom of the cladding?
- Have the pipingand equipment systemsbeen designed with consideration of the insulation system, and the insulation system designed to guard againstany areas where ponding or accumulation of water can occur?
- Installationshould never take place in rainy weatheror when weather is anticipated to rain due to high humidity environment.
- On installed insulation systems, all areas where the protective covering or cladding has been compromised, and other areas that potentially allow for the entrance of moisture or other contaminants, must be examinedin a timely manner to determine the extent of any damage to the total insulation systems, and the required repairs/replacement should be executed in a timely and proper manner by experienced insulator personnel.
- For lower temperate insulation requirements, with a temperature lower than 90°C, insulative coatingsmay be considered instead of thetraditional insulation systems for personnel protection as per ASTM 1055/ASTM 1057.
- Pro-active visual inspection tools like STIC to provide early signs of wet insulation or damaged insulation.
- Wet insulation can be visible with irreversible color change from the bottom of the external cladding.
- WI Discovery LeakageDetector, able to detect “conductive water or corrosive water” with LEDlighting emitting from the bottom of the cladding.

Figure 6: WI Discovery Leakage Detector with “photos” of installed locations.

In conclusion, early detection of water ingress by “removing wet insulation” via holistic CUI monitoring devices such as WI Discovery Leakage Detector and STIC as an active visual inspection for CUI mitigation scoping is one of the best practices adopted by the oil & gas and petrol-chemicals industries.

TECHNICAL TRAINING
AND CERTIFICATION PROGRAM

CERTIFIED THERMAL INSULATION PRACTITIONER LEVEL 1

Focus on providing an overview of industrial insulation and assisting supervisors, engineers, and managers in understanding how insulation works. Insulation works refers to the activities of applying insulation materials to piping or other process equipment to control and maintain temperature and prevent heat loss, such as the application of mineral wool, perlite, or calcium silicate, as well as the application of cladding for protection against contact damage or weather.

Course Objectives

1. To train and upgrade individuals in thermal insulation materials applications as well as the trade of sheet metal shop fabrication plus field installations.
2. To understand the thermal insulation design, installation, QA/QC, HSE, repair and maintenance.

Course Content

- Insulation specifications
- Insulation materials
- Hot & cold insulation
- Corrosion under insulation (CUI)
- Measurement
- QA&QC and inspection
- Insulation installation
- (8) Cladding (metal & non-metal)
- Health, safety & environment

Who Should Apply

This course is suitable for those who wish to understand the thermal insulation for industries, prevention of corrosion under insulation (CUI), QA/QC & inspection, theoretical background & developments.

Pre-requisites

- No previous working experience required.

Certificate

- IMM Certified Thermal Insulation Practitioner Level 1

Course Duration

5 days (3 days Theory + 1.5 day Practical Workshop + 0.5 day exam)

Eligible for

MBOT LEMBAGA TEKNOLOGIS MALAYSIA
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Materials Technology Education Sdn Bhd

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TECHNICAL TRAINING
AND CERTIFICATION PROGRAM

CERTIFIED THERMAL INSULATION PRACTITIONER LEVEL 2

The certified course is meant for training and upgrading individuals in thermal insulation materials applications as well as the trade of sheet metal shop fabrication plus field installations.

Course Objectives

It aims to provide participants with the knowledge and skills to carry out insulation works efficiently and effectively with the clear understanding of the following:

(1) Types of thermal insulation and sheet metal materials specified by the vendors and clients in insulation specifications.

(2) Equipment and piping systems components commonly seen in the oil and gas industries.

(3) Tools and aids usage during the preparation and field installation of thermal insulation materials.

(4) Sheet metal equipment and tools used during the layouts, cutting, fabrication and field installation works.

(5) Standard insulation calculation

Who Should Apply

This program is intended for technicians, supervisors, engineers, or anyone who passed IMM Certified Thermal Insulation Practitioner Level 1 and is interested to upgrade his/her knowledge in the usage and technique of thermal insulation and sheet metal application.

Pre-requisites

IMM Certified Thermal Insulation Practitioner Level 1 or minimum One (1) year working related experiences.

Certificate

IMM Certified Thermal Insulation Practitioner Level 2

Course Duration

6 days (3 days Theory + 2.5 days @ Workshop Practical + 0.5-day Exam)

Course Content

1. Introduction to insulating and sheet metal trade
2. Equipment and piping system components in the petrochemical, oil & gas, and energy industries
3. Types of thermal insulation materials for hot, cold, and dual temperature services
4. Types of sheet metal materials
5. Equipment and tools used in the insulating and sheet metal trade
6. Basic safety for insulating and sheet metal trade
7. Plan and isometric piping drawings
8. Pattern layout/fabrication/field installation
   - Pipe and elbow
   - Equal and unequal branch and header
   - Concentric and eccentric reducer
   - Valve
   - Flange
   - Strainer
   - Elbow Trunnion

Eligible for

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STUDENT EDITORIAL

Sustainable Additive Manufacturing: Exploring Challenges and Opportunities of Recycled Plastic Materials in 3D Printing

Prepared and edited by Ts. Dr. Ho Shuh Huey[1], Ts. Dr. Chan Ming Yeng[1], Ir. Ts. Dr. Koay Seong Chun[2]

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Introduction

Polymers play an important role in modern society as they offer a variety of mechanical and chemical properties that make them useful for a wide array of applications such as automotive, agriculture, construction, and packaging. Polymeric materials are inexpensive, lightweight, and durable materials processed into a variety of products that are widely used in industrial and consumer applications, leading to an increase in their production [1]. However, the issue of the non-degradability of plastic materials has caused plastic waste pollution which affects ecological environment as the management of polymers is crucial. One of the proposed ways to reduce plastic waste pollution is to remanufacture, repair, reprocess, or recycle polymer materials into 3D printed feedstock.

In recent years, polymers such as polylactic acid (PLA), acrylonitrile butadiene styrene (ABS), polyamide (PA/Nylon), and polycarbonate (PC) have been widely used in producing plastic prototypes for additive manufacturing (AM). Additive manufacturing (AM), also known as 3D printing, has been extensively implemented in various manufacturing sectors such as aerospace, automotive, dental, heavy equipment, medical industries, and consumer goods since the fourth industrial revolution [2]. Over the past few years, an increment of 32% has been reported for the use of 3D printing in the production of machine components [3], leading to numerous social impacts. 3D printing is a process of making three dimensional solid objects from a digital file by producing 3D products layer by layer using feedstock such as wire, filament, or powder without the need of machining. 3D printing offers cheap, fast, automated production without limitations to geometry complexity, high material efficiency, and less waste. A few steps are involved in additive manufacturing: i) Scan an existing object or create a 3D model using computer-aided design, ii) Slice the 3D model with slicing software, and iii) Feed the file to your printer and the model is ready to print [4]. Material jetting, VAT photopolymerization, material extrusion, binder jetting powder bed fusion, sheet lamination, and directed energy deposition are the classifications of additive manufacturing.

The sustainability of recycling plastic waste and the feasibility of using recycled polymeric material feedstock in 3D printing have been focused recently [3,5,6]. Using pure recycled polymeric materials in 3D printing is an efficient way to reduce plastic waste. However, their usage in various applications has been restricted due to pure recycled polymeric materials providing low strength and stiffness, and the properties may be lower after several recycling times. In order to solve this problem, bio-composite (polymers matrix with natural fiber) has been explored [7,8,9]. Although polymer recycling can be achieved in additive manufacturing, the fabrication of the recycled plastic materials feedstock is still very challenging. In this article, the challenges and opportunities of recycled plastic material in 3D printing are reviewed.

Challenges of Recycled Plastic Materials in 3D printing

Recently, some researchers have been focusing on the fabrication of plastic or composite filaments from recycled materials for fused filament fabrication (FFF). However, the usage of recycled materials in 3D printing faces some challenges, leading to the presence of defects in the final 3D printed parts. There are two main challenges when using recycled materials in 3D printing. The first challenge arises from the possibility of contaminants and impurities from previous usage that remained in the recycled materials [10]. These contaminants can restrict proper bonding between layers during the 3D printing process, resulting in poor interlayer adhesion (Figure 1). Consequently, the overall strength and mechanical properties of the 3D-printed part are reduced. Furthermore, contaminants or impurities can interfere with the 3D printing process, causing clogging or inconsistent material flow through the printing nozzle. Consequently, this can lead to various print defects, incomplete layers, or failed prints. Notably, the presence of impurities in recycled materials can create surface defects on the 3D printed part, such as roughness, bumps, or irregularities, which negatively affect the surface quality and functionality of the final product.

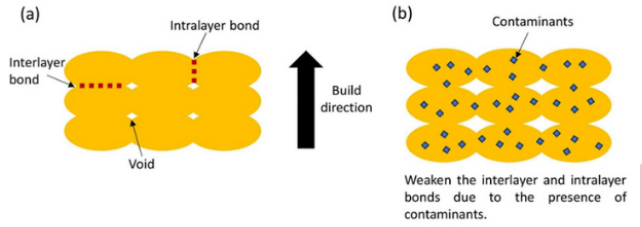

Figure 1: Proposed illustration of two scenarios related to 3D printed parts (a) good interlayer and intralayer bonds, and (b) poor interlayer and intralayer bonds caused by the presence of contaminants in the recycled materials.

The second challenge is the warping defect that occurs when using recycled materials in 3D printing. Warping is a common defect that can occur during the 3D printing of recycled materials. It happens due to the deformation or curling of the printed part (Figure 2), especially at the edges or corners of the part, which is caused by uneven cooling and the uneven distribution of thermal stress in the material during the printing process [11]. According to the report by Tan et al. (2023), poor interlayer bonding is a common problem in 3D printed recycled materials, as it can reduce the mechanical strength and dimensional stability of the 3D printed parts. The poor adhesion between layers makes the part easier to warp [11]. Furthermore, the recycled materials often have different thermal properties in comparison with the virgin materials, leading to uneven cooling and shrinkage during 3D printing, resulting in warping. Moreover, incorrect, or inappropriate printing settings, such as a high print bed temperature, excessive print speed, can cause warping issues in recycled materials [12].

Figure 2: Illustration of 3D printed parts with the warp and curl defects.

Opportunities of Recycled Plastic Materials in 3D printing

Recycling plastic materials is a great choice for 3D printing. Nowadays, many researchers focus on utilizing recyclable plastics into 3D printable materials, which is an excellent approach to reduce the amount of plastic waste in landfills and waterways. Recycling plastic materials offers some benefits over virgin plastic, such as reducing the environmental impact caused by plastic waste disposal. It is also more sustainable as the process of recycling plastic generates less greenhouse gases and uses less energy compared to producing virgin plastic.

The Tokyo Olympic 2020 is a great example of how sustainability can be achieved by recycling plastic materials and using them in 3D printing for applications. The global consumer company P&G collaborated with Tokyo Olympic Organizers to collect an estimated 45 tonnes of plastic waste from communities and recover it from the ocean. They then recycled this waste into recycled plastic resin and used it to fabricate podiums through 3D printing [13].

Recent researches have found that Styrofoam can be recycled and formulated into various types of 3D printable filaments, including plastic blends and composite materials [14-15]. These studies provide a good example of how Styrofoam waste can be transformed into 3D printing materials for sustainability. Additionally, polypropylene, a plastic material commonly used in food containers, can be recycled, and turned into recycled plastic resin. When combined with fibers extracted from chopstick waste, it can be used to print applications, such as face shield frames [11]. As technology advances, the possibilities of converting recyclable materials into 3D-printed objects are endless.

There is almost every type of plastic material that can be recycled and turned into 3D printable materials. Moreover, plastic waste is readily abundant. If recycled plastic materials can be 3D printed into products, this presents an opportunity for promoting recycling, making it a significant step towards sustainability.

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IMM TRAINING AND CERTIFICATION PROGRAM OVERVIEW

The Institute of Materials, Malaysia (IMM) offers engineering & technical professionals and practitioners a range of Certification Schemes and technical training courses to meet the requirements of the oil & gas, refining, petrochemical, transport, construction and other industries. Our programs have been developed together with the industry, academia and relevant stakeholders to ensure that the technical training and certification provided meet the relevant industry standards and requirements.

PROGRAM: COATING

IMM Certification Schemes and Courses	Technical Training Courses (Non-certification)
• Certified Protective Coating Technician (Blaster and/or Painter) Level 1 and Level 2 • Certified IMM-B1/B2 Assistant Blaster & Painter • Certified Coating Inspector Level 1 • Certified Coating Inspector Level 2 • Certified Blasting and Painting Supervisor • Certified Thermal Spray Coating Applicator • Certified Coating Quality Control Technician	• Refresher Course of Certified Protective Coating Technician (Blaster and/or Painter) Level 1 and Level 2 • Refresher Course of Certified Coating Inspector • Basic Knowledge on Corrosion Protection for Technicians and Engineers • Corrosion Control by Protective Coating • Basic Corrosion & Coating Course

PROGRAM: COATING FINGERPRINTING

IMM Certification Schemes and Courses	Technical Training Courses (Non-certification)
• Certified Coating Fingerprint Quality Controller Level 1 • Certified Coating Fingerprint Quality Controller Level 2 • Certified Coating Fingerprint Trainer	• Coating Fingerprint Foundation Course • 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 • 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 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 • Certified Vibration Practitioner Category 2 • Certified Vibration Specialist Category 3 • 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 • Certified Technician in Mechanical Joint Integrity (MJI) for Small Bore – Piping, Tubing, Valves	• Mechanical Joint Integrity • Pressure Safety Valve • 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 • IMM-JWES Certified Associate Welding Engineer • IMM-JWES Certified Welding Engineer • IMM-JWES Certified Senior Welding Engineer	• Repair Welding of Pressure Equipment in Refineries & Chemical Plants • Welding & Joining Technology for Non-Welding Personnel • Steel Technology for Non-Technical Personnel

MISCELLANEOUS MATERIALS SCIENCE AND TECHNOLOGY (NON-CERTIFICATION) COURSES

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

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Bridging Theory and Practice: IMM's Factory Tour at NOVA FRP Sdn. Bhd.


Prepared by: Ts. Dr. Chan Ming Yeng
Reviewed by: Ts. Ong Thai Kiat, IMM non-metallic committee chairperson

Date: 22nd October 2024
Venue: NOVA FRP Sdn. Bhd.

A total of six non-metallic committee members, led by IMM non-metallic committee chairperson Ts. Ong Thai Kiat, participated in a factory visit to NOVA FRP Sdn. Bhd. on 22nd October 2024, from 10:00 AM to 12:00 PM. The company is located at Lot 42, 16, Jalan Kesuma 2/1, Bandar Tasik Kesuma, 43700 Beranang, Selangor. The NOVA FRP Sdn. Bhd. specializes in production of various grades of glass fiber reinforced polymer (FRP) products, including decorative items, furniture, statues, sculptures, public transportation seats, and custom-made compartments. This visit provided an opportunity for the IMM non-metallic committee members to explore the company's innovative processes and gain a deeper understanding of FRP manufacturing techniques.

The visit began with a warm welcome from Mr. Lai Yung Kang, the Project Manager of the company. In the office, Mr. Lai delivered an informative briefing about the company's history, operations and extensive range of products. All IMM non-metallic committee members had a group photo with Mr Lai (Figure 1) and then Mr. Lai led the committee members on a tour of the production lines, where the committee observed various manufacturing processes in action. This visit provided an opportunity to observe and experience the real processes involved in manufacturing FRP products, particularly the hand lay-up method and both small-scale and large-scale filament winding techniques.

Figure 1: A group photo with Mr. Lai in the office (from left: Dr. Ng Yong Sing; Assoc. Prof. Ts. Dr. Albert Tshai Kim Yeow; Ir. Ts. Dr. Koay Seong Chun; Mr. Lai Yung Kang; Ts. Ong Thai Kiat; Ts. Dr. Chan Ming Yeng; and Ts. Dr. Ho Shuh Huey).

The factory is divided into two main production stations: 1) first station focuses on the hand lay-up process (Figure 2), which is commonly used to produce various FRP products; and 2) second station employs the filament winding process, a highly specialized technique for manufacturing FRP round tanks (Figure 3) and pipes. During the tour, the IMM committee had the chance to observe both small-scale and large-scale filament winding operations, offering invaluable insights into these advanced fabrication methods.

Figure 2: Hand lay-up process.

Figure 3: Big round tank made from FRP.

This visit was particularly beneficial as it allowed the committee to experience the real-time production processes behind FRP products. Observing the integration of precision and craftsmanship in both manual and automated methods was an eye-opening experience for all attendees. Lastly, the visit concluded with a group photo with Mr. Lai, taken in front of the FRP round tank (Figure 4).

Figure 4: A group photo with Mr. Lai at production line of filament winding, in front of the FRP round tank.

A One-Day Stainless Steel and High-Nickel Alloy Workshop


Reported by: *Felicia Kabel, Curtin's IMM Student Chapter, Curtin University Malaysia, Miri, Sarawak.*
Ir. Dr. Christine Yeo, IMM-Miri Education Officer cum IMM-Curtin Student Advisor of Curtin University Malaysia, Sarawak, Faculty of Engineering, Universiti Malaysia Sabah.


Edited by: *Ir. A/P Dr Edwin Jong, IMM-Miri Committee Chairman, AMW Technology Sdn. Bhd.*
Professor Beena Giridharan, Curtin University Malaysia.

Date: 10th August 2024
Venue: SK3206, Curtin University Malaysia

Curtin University Malaysia successfully hosted a one-day Stainless Steel and High-Nickel Alloy Workshop on 10th August 2024 at SK3 206, uniting oil and gas professionals with enthusiastic students. Held from 8:30 am to 5:00 pm, the workshop highlighted applications and innovations in these vital materials.

Expert trainers included Sheron Lim and Ir. Andrew Ling (Sarawak Shell Berhad), Ts. Dr. Bernard Sim, Ir. Ts. Fatthie Khairullah Hishyam Bin Rabie, and Abdul Alaziz Bujang (represented by A/P Ir Dr. Edwin Jong) from Petronas Carigali Sdn. Bhd. Their insights enriched participants' understanding of stainless steel and high-nickel alloys in advancing industry sustainability.

In today's ever-advancing world, the relentless march of technology has exponentially increased the demand for raw materials. Among these, stainless steel stands out as an indispensable resource, omnipresent in our daily lives. Whether it's the gleaming cutlery in our kitchens or the robust appliances that simplify our routines, stainless steel has seamlessly integrated itself into the fabric of modern society. This material's prevalence is far from coincidental; its unique attributes, particularly its formidable resistance to corrosion, have rendered it essential in both domestic and industrial spheres.

The secret to stainless steel's enduring appeal lies in its composition. The inclusion of chromium, Cr typically at concentrations of 10.5% or greater, bestows upon stainless steel its renowned 'stainless' quality. This is achieved through the formation of a passive layer of chromium (III) oxide, Cr_2O_3 which acts as a formidable barrier against surface corrosion. Such properties make stainless steel an ideal choice for kitchenware, encompassing everything from forks and spoons to pots, knives, and household appliances like sinks and washing machines. It is even employed in water pipes and taps, where its rust resistance ensures the purity and safety of our water supply.

In the kitchen, stainless steel is celebrated for its rust resistance, durability, and ease of maintenance. It is the material of choice for cookware, offering an optimal balance between heat distribution and retention. This is why it is favoured by both professional chefs and home cooks alike.

Beyond the culinary realm, stainless steel's resistance to corrosion makes it an exemplary material for water systems, ensuring that pipes and taps remain free from rust and contamination, thus safeguarding our health.

While stainless steel dominates our everyday lives, high-nickel alloys come into their own in environments that demand more than ordinary materials can provide. These alloys are meticulously engineered to maintain their strength and integrity in conditions that would swiftly degrade lesser metals. With nickel content often exceeding 25%, these alloys exhibit remarkable resistance to both corrosion and extreme temperatures, making them indispensable in critical industrial applications.

In marine environments, for instance, high-nickel alloys are the materials of choice for components in desalination plants, water-makers, valves, and heat exchangers. The relentless assault of salt water, which can rapidly corrode standard metals, is no match for the robust resistance offered by these alloys. Their use is essential in maintaining the longevity and efficiency of marine equipment, where failure is not an option.

The aerospace industry also benefits greatly from high-nickel alloys. Jet engines, for example, operate under extreme conditions, with components exposed to high temperatures and substantial mechanical stress. High-nickel alloys maintain their strength and ductility under these demanding conditions, ensuring that engines perform reliably and safely. Similarly, in cryogenic applications, such as storing liquefied natural gas (LNG), these alloys must endure incredibly low temperatures without becoming brittle or losing their structural integrity.

The industrial world relies on a diverse array of stainless steels and high-nickel alloys, each meticulously tailored to specific applications. However, with the advanced properties of these materials comes the responsibility to understand and preserve their integrity throughout their lifecycle.

For example, the consequences of material failure can be catastrophic in the oil and gas industry. Both stainless steel and high-nickel alloys are widely employed in this sector and understanding the common failure modes such as stress corrosion cracking, fatigue, and intergranular corrosion is crucial to preventing accidents and ensuring the safety and reliability of critical infrastructure.

One of the key aspects of maintaining the integrity of these materials lies in the fabrication process, particularly welding. Welding, while indispensable in the fabrication of components, can alter the material's microstructure, potentially compromising its mechanical strength and corrosion resistance. Thus, employing proper welding techniques and post-weld treatments is vital to preserving the material's original properties and ensuring its performance in its intended application.

For engineers and industry professionals, staying abreast of the latest developments in material science is imperative. The forthcoming one-day materials workshop is designed to provide attendees with a comprehensive understanding of the properties of various stainless-steel grades and high-nickel alloys. However, it doesn't stop at theory; participants will engage with real-world case studies, exploring the uses of these materials in the oil and gas industry and examining common failure modes. Moreover, this workshop will offer insights into crucial fabrication methods, such as welding, emphasising their role in preserving the material's microstructure, mechanical strength, and corrosion resistance. This knowledge is invaluable for those involved in designing, fabricating, or maintaining equipment that relies on these advanced engineering materials.

As industries continue to push the boundaries of what is possible, the demand for materials capable of withstanding extreme conditions will undoubtedly grow. Stainless steel and high-nickel alloys will remain at the vanguard of this evolution, enabling new technologies and applications across a wide array of fields. Understanding how these materials work, where they excel, and how to preserve their properties will be key to engineering the future. Whether in the kitchen or on the cutting edge of aerospace innovation, these materials are far more than mere metals, as they are the building blocks of modern life. This workshop provided a unique opportunity to deepen the participants' understanding of the use of stainless steel and alloys in industry.

Figure 1: A group photo of the participants and organisers, including the trainers, Ir. Dr. Edwin, Ts. Dr. Bernard, Ir. Andrew Ling and Sheron Lim

NEW IMM PROFESSIONAL MEMBERS

MOHD HAIRULDIN BIN MUSTAFA

Age: 38 years old
Organization: Petronas Technical Services Sdn Bhd
Position: Senior Material, Corrosion and Inspection Engineer
Working experience(s):
• 9 months as Quality Control Engineer at Perodua Manufacturing Sdn Bhd
• 1 year 5 months as Asset Integrity Engineer at Worleyparsons Services Sdn Bhd
• 10 years 7 months as Senior Engineer (Materials, Corrosion, Inspection) at Petronas Technical Solutions
Qualification(s):
• Bachelor of Mechanical Engineering [Universiti Tenaga Nasional]
• Master of Science in Asset Management & Maintenance [Universiti Teknologi Petronas] – ongoing (started on Sept 2023)
Professional membership(s):
• Member (BEM)
• Member (AMPP/NACE)
Involvement in IMM committees: NIL

SOON KOK HENG

Age: 41 years old
Organization: University of Technology Sarawak
Position: Senior Lecturer
Working experience(s):
• 6 months as Research Assistant at Queen's University Belfast, United Kingdom
• 6 months as Acting Associate Head of School (Curriculum Enhancement and Accreditation)
• 3 years 3 months as Lecturer at Swinburne University of Technology Sarawak
• 9 years 3 months as Senior Lecturer at Swinburne University of Technology Sarawak
• 11 years 3 months as Head of Department (Mechanical Engineering Program)
Qualification(s):
• Diploma in Technology (Mechanical and Manufacturing) [Tunku Abdul Rahman College]
• Advanced Diploma in Technology (Mechanical and Manufacturing) [Tunku Abdul Rahman College]
• Master of Science in Manufacturing Systems Engineering [Queen's University Belfast, United Kingdom]
• Doctor of Philosophy in Mechanical Engineering (Polymer Nanocomposites) [Queen's University Belfast, United Kingdom]
Involvement in IMM committees: NIL

JUN WEI TAN

Age: 28 years old
Organization: Malaysian Refining Company Sdn Bhd
Position: Corrosion Engineer
Working experience(s):
• 3 years 5 months as Corrosion Engineer at Malaysian Refining Company Sdn Bhd
Qualification(s):
• Bachelor of Applied Science (BASc) in Mechanical Engineering [University of British Columbia, Canada]
Involvement in IMM committees: NIL

JOSHUA SAM YANGUS

Age: 33 years old
Organization: Petronas Chemicals Fertiliser Sabah Sdn. Bhd.
Position: Executive (Project Management)
Working experience(s):
• 1 year 8 months as Executive (Procurement/SCM) at Petronas
• 1 year 11 months as Executive (Maintenance Contract & Services) at
Petronas Chemicals Fertiliser Sabah Sdn. Bhd. (PCFSSB)
• 3 years 4 months as Executive (Project Management) at Petronas Chemicals Fertiliser Sabah Sdn. Bhd. (PCFSSB)
Qualification(s):
• Foundation Programme in Engineering [Universiti Teknologi PETRONAS]
• Bachelor of Engineering (Honours) Civil [Universiti Teknologi PETRONAS]
Professional Membership:
• Associate Member (Malaysian Geotechnical Society)
• Ordinary Member (MySET)
• Affiliate Member (American Society of Civil Engineers)
• Corporate Member of Institute of Engineers Malaysia
• Member (Project Management Institute)
Involvement in IMM committees: NIL

DR. BASAB BHATTACHARYA

Age: 50 years old
Organization: Element Materials Technology Singapore Pte Ltd.
Position: Head of Asset Integrity, Technical Lead –Asia and ME
Working experience(s):
• 9 years as Technical Manager at Exova Singapore Pte Ltd.
• 3 years as General Manager at Element Singapore Pte Ltd.
• 8 months as Regional Manager at Assets Integrity (SIS) - Asia
• 4 years as Head of Asset Integrity, Technical Lead – Asia and ME at Element Materials Technology Singapore Pte Ltd.
Qualification(s):
• Bachelor of Engineering (Metallurgy) [Jadavpur Universiti, India]
• Master of Engineering (Metallurgy) [Indian Institute of Science, India]
• PhD in Material Science and Engineering [McMaster University, Canada]
Professional Membership: NIL
Involvement in IMM committees: NIL

ASSOC. PROF. IR. DR. SUFIZAR BINTI AHMAD

Age: 45 years old
Organization: Universiti Tun Hussein Onn Malaysia (UTHM)
Position: Associate Professor
Working experience(s):
• 3 years 2 months as Head of Department at Fakulti Kejuruteraan Mekanikal dan Pembuatan, Jabatan Kejuruteraan Bahan dan Rekabentuk
• 8 months as Head of Department at Fakulti Kejuruteraan Mekanikal dan Pembuatan, Jabatan Pengajian Siswazah
• 1 year 5 months as Research Focus Member at Fakulti Kejuruteraan Mekanikal dan Pembuatan, Functional Composite Structure (FCS)
• 3 years 10 months as Researcher at Fakulti Kejuruteraan Mekanikal dan Pembuatan, Functional Composite Structure (FCS)
• 1 month as Chief Coordinator at Fakulti Kejuruteraan Mekanikal dan Pembuatan, Jabatan Pengajian Siswazah
Qualification(s):
• Bachelor of Science (Material Engineering) [Universiti Sains Malaysia]
• Master of Science (Materials Engineering [Universiti Sains Malaysia]
• PhD (Mechanical & Materials Engineering) [Universiti Kebangsaan Malaysia]
Professional Membership: NIL
Involvement in IMM committees: NIL

NORAZLIANIE BINTI SAZALI

Age: 35 years old
Organization: Universiti Malaysia Pahang
Position: Senior Lecturer
Working experience(s):
• 1 year as Quality Engineer at N.K. Rubber (M) Sdn Bhd
• 5 years as Assistant Engineer at Advanced Membrane Technology Research Centre, (AMTEC), Universiti Teknologi Malaysia
• 6 years as Tutor at Open University Malaysia
• 5 years as Senior Lecturer at Universiti Malaysia Pahang
• 1 year 6 months as Director of UMPSA Press at Universiti Malaysia Pahang
Qualification(s):
• Bachelor Degree in Mechanical Engineering [Universiti Malaysia Pahang]
• Master Degree in Mechanical Engineering [Universiti Tun Hussein Onn Malaysia]
• Doctor of Philosophy in Chemical (Gas Engineering) [Universiti Teknologi Malaysia]
Professional Membership:
• Professional Member [The Singapore National Institute of Chemistry]
• Member [Institution of Mechanical Engineers]
Involvement in IMM committees: NIL

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


IUPAC2025
KUALA LUMPUR, MALAYSIA
53rd IUPAC General Assembly (53GA)
11 - 15th July 2025
50th World Chemistry Congress (50WCC)
13 - 18th July 2025
IUPAC 2025
Kuala Lumpur, Malaysia
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INSTITUTE OF MATERIALS, MALAYSIA

Updated on 30th December 2023

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.

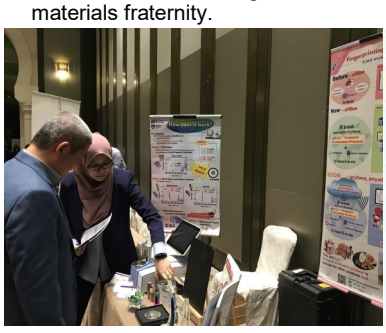
Over the years, IMM have conducted courses on coatings, coatings fingerprinting, corrosion, welding, vibration etc in support of the oil and gas industry in Malaysia. Over 750 Coatings Inspectors have been trained and certified as well as more than 3300 Blasters & Painters, Supervisors, Corrosion Technician 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	-	RM 300.00	RM 10.00	RM 150.00
Professional	-	RM 150.00	RM 10.00	RM 100.00
Associate	-	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 for affiliates	RM 40.00/ RM 50.00	-	-	NIL

Updated on 30th December 2023

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.

7th IMM Council Meeting (Term 2022-2024) & 36th IMM Anniversary Celebration

Kuala Lumpur Engineering Science Fair 2023

One-Day IMM Corrosion Conference 2023 and Plant Visit to Intertek Services (M) 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:

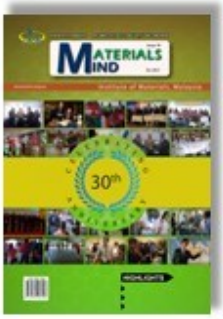
1.Federation of Malaysian Manufacturers (FMM)
2.Malaysian Offshore Contractors Association (MOCA)
3.Malaysian Oil & Gas Engineering Council (MOGEC)
4.Malaysian Oil & Gas Services Council (MOGSC)

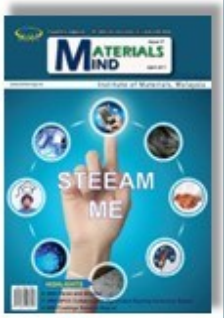
The companies shall submit to IMM proof of their current membership at the respective trade associations together with their application.

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.

MATERIALS MIND

Quarterly Magazine of Institute of Materials, Malaysia





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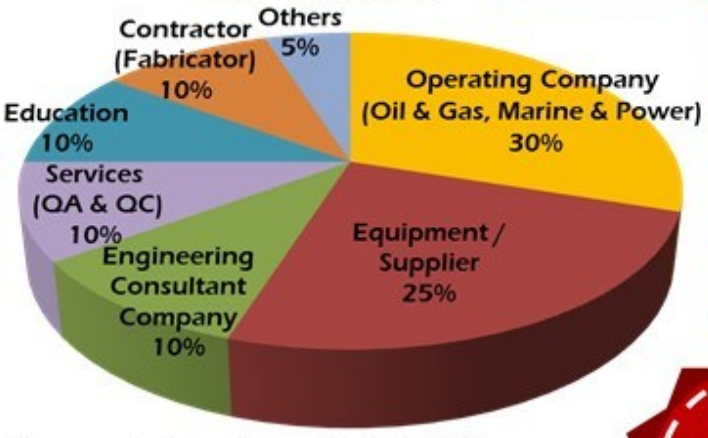
ISSN: 2289-9030

Our Readers



Magazine Content

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

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