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MATERIALS MIND

Issue 29

January 2021

www.iomm.org.my

Institute of Materials, Malaysia

HIGHLIGHTS

- IMM YEARBOOK
- IMM Training and Certification Schemes
- Corrosion in Concrete Structures in the Tropics
- The Effect of Storage Device of FTIR Spectra on the Degree of Similarity Using *Compare* Algorithm for Paint Fingerprinting
- FTIR Qualitative Analyses for Quality Assurance and Quality Control of Protective Paints

TABLE OF CONTENTS

JANUARY 2021 Issue 29

EDITORIAL BOARD MEMBERS

INSTITUTE OF MATERIALS, MALAYSIA

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Electronic copy of Materials Mind can be accessed via www.iomm.org.my under Materials Mind Webpage.

INSTITUTE OF MATERIALS, MALAYSIA
(PPM-004-10-11061987)

TO ALL IMM MEMBERS,

NOTICE OF 31st ANNUAL GENERAL MEETING

Notice is hereby given that the 31st Annual General Meeting of the IMM will be held as follows:

Format	:	Physical AGM, where venue to be confirmed *OR* Virtual Live Event *OR* Hybrid AGM
Date	:	19th March 2021 (Friday)
Time	:	3.00 pm – 6.00 pm (note: time to be confirmed again before 28th February 2021)

AGENDA

1. Adoption of the agenda
2. President's address
3. To approve the minutes of the 30th Annual General Meeting (*)
4. To receive and adopt the 2020 report of the council presented by the Honorary Secretary of IMM (*)
5. To receive and adopt the 2020 statement of accounts presented by the Honorary Treasurer of IMM (*)
6. Proposed amendment to IMM Constitution (*)
7. Tabling the appointment of auditor(s) for 2021 by the Honorary Treasurer of IMM
8. Any other matters

(*) can be accessed electronically on IMM website (www.iomm.org.my) after 8th Feb 2021.

By order of the Council,
Prof. Ts. ChM. Dr. Melissa Chan Chin Han
Honorary Secretary, IMM

Date: 2nd January 2021

REPLY SLIP

I hereby confirm that I will **be able / not be able*** to attend the AGM above.
SIGNATURE:_____
NAME:_____
ORGANIZATION NAME:_____
MEMBERSHIP NO.:_____
DATE:_____

Please indicate confirmation *via* email to secretariat@iomm.org.my before **12:00** pm, 12th March 2021.
**Delete whichever not applicable.*

ANNUAL GENERAL MEETING PROXY VOTING FORM

I _____(please print name in full) and IMM Membership no. _____wish to record my apologies for absence and hereby appoint_____(please print name in full) and IMM Membership no. _____(or, failing him/her, the Chairman of the Meeting) to act as my proxy at the 30th Annual General Meeting of the IMM.

Signature: _____ Date:_____

This Proxy Voting Form should be returned to the IMM office via email (secretariat@iomm.org.my) before 12:00 pm, 12th March 2021.

Suite 515, Level 5, Block A, Kelana Centre Point (Lobby B), No.3, Jalan SS 7/19, Kelana Jaya,
47301 Petaling Jaya, Selangor, Malaysia.
Tel: +603 7661 1591
Email: secretariat@iomm.org.my Website: www.iomm.org.my WhatsApp: +6018 9113 480 Facebook: Institute of Materials Malaysia

NOTICE FOR RENEWAL OF ANNUAL MEMBERSHIP AND SUBSCRIPTION FEES 2021

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	40.00

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 **secretariatoffice.imm@gmail.com** or WhatsApp to **018- 9113480** or send by courier/post to:

The Secretariat
Institute of Materials, Malaysia
Suite 515, 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/

IMM COUNC

2020-2022

Advisor	Prof. Ts. Dr. Mohamad Kamal Harun - Universiti Teknologi MARA
President	Dato' Dr. Ir. Ts. Haji Mohd Abdul Karim Abdullah - Serba Dinamik Group Berhad
Deputy President	Ts. Dr. Chew Khoon Hee - Tunku Abdul Rahman University College
Honorary Secretary	Prof. Ts. ChM. Dr. Melissa Chan Chin Han - Universiti Teknologi MARA
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Immediate Past President	Ts. Mohd. Azmi Mohd. Noor - Kebabangan Petroleum Operating Company Sdn Bhd
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2018-2020

Advisor	Datuk Ir. Dr. Abdul Rahim Hj. Hashim - Universiti Malaya
President	Ts. Mohd Azmi Mohd Noor - Kebabangan Petroleum Operating Company Sdn Bhd
Deputy President	Dato' Dr. Ir. Haji Mohd. Abdul Karim Abdullah - Serba Dinamik Group Bhd
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2016-2018

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IL MEMBERS

2008-2010

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2006-2008

Advisor	Dato' Dr. Mohd Ariffin Aton
President	Zainuddin Ishak
Deputy President	Dato' Dr. Ong Eng Long
Honorary Secretary	Ir. Max Ong Chong Hup
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Immediate Past President	Dr. A. Rahim Mohd. Nor
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	Prof. Dr. Esah Hamzah
	Assoc. Prof. Dr. Mohamad Kamal Harun
	Assoc. Prof. Dr. Saifollah Abdullah
	Dr. Abdul Aziz Mohamed
	Dr. Edwin Jong Nyon Tchan
	Dr. Leong Kok Hong

2004-2006

Advisor	Dato' Dr. Mohd Ariffin Aton
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Deputy President	Dato' Dr. Ong Eng Long
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	Assoc. Prof. Dr. Mohamad Kamal Harun
	Dr. Abdul Aziz Mohamed
	Dr. Edwin Jong Nyon Tchan
	Dr. Leong Kok Hong
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	Chong Chien Fatt
	Harry Woon Tar Woi
	Johar Juhari
	Kamarudin Malek
	Nor Hisham Abdul Hamid

2002-2004

Advisor	Dato' Dr. Mohd Ariffin Aton
President	Dr. A. Rahim Mohd. Nor
Deputy President	Zainuddin Ishak
Honorary Secretary	Ir. Max Ong Chong Hup
Honorary Treasurer	Ir. Mohd. Suradi Yasin
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	Prof. Dr. Radzali Othman
	Assoc. Prof. Dr. Ahmad Fauzi Md. Noor
	Assoc. Prof. Dr. Esah Hamzah
	Assoc. Prof. Dr. Mohamad Kamal Harun
	Dr. Edwin Jong Nyon Tchan
	Dr. Teh Ser Kok
	Ir. Mohd Raziff Embi
	Chong Chien Fatt
	Haji Ghalib Tham
	Harry Woon Tar Woi
	Johar Juhari
	Kang Kim Ang
	Maimunah Ismail

IMM COUNCIL MEMBERS

2000-2002

Advisor	Dato' Dr. Hj. Mohd Mansor Salleh
President	Dr. A. Rahim Mohd. Nor
Deputy President	Zainuddin Ishak
Honorary Secretary	Ir. Max Ong Chong Hup
Honorary Treasurer	Ir. Mohd. Suradi Yasin
Immediate Past President	Dr. Samad Solbai
Council Members	Dato' Dr. Ong Eng Long
	Prof. Dr. Che Husna Azhari
	Assoc. Prof. Dr. Esah Hamzah
	Assoc. Prof. Dr. Mohamad Kamal Harun
	Dr. Lim Ching Liang
	Dr. Samad Solbai
	Dr. Teh Ser Kok
	Ir. Mohd Raziff Embi
	Ir. Tee Yin Tiong
	Chong Chien Fatt
	Hamizan Mohd Derus
	Harry Woon Tar Woi
	Kang Kim Ang
	Maimunah Ismail

1998-2000

Advisor	Dato' Dr. Hj. Mohd Mansor Salleh
President	Dr. Samad Solbai
Deputy President	Dr. A. Rahim Mohd. Nor
Honorary Secretary	Ir. Max Ong Chong Hup
Honorary Treasurer	Ir. Mohd. Suradi Yasin
Council Members	Dato' Dr. Ong Eng Long
	Prof. Dr. Che Husna Azhari
	Prof. Dr. Radhakrishna
	Assoc. Prof. Dr. Esah Hamzah
	Dr. Lim Ching Liang
	Dr. Teh Ser Kok
	Ir. Mohd Raziff Embi
	Bob Phang
	David Lim Chee Cheong
	Kang Kim Ang
	Maimunah Ismail
	Mohd Adaham Adullah
	Wan Zaharah Wan Mohamad
	Zainuddin Ishak

1987-PROTEM COMMITTTEE

Chairman	Dato' Dr. Hj. Mohd Mansor Salleh
Deputy Chairman	Dr. Teh Ser Kok
Honorary Secretary	Ir. Max Ong Chong Hup
Honorary Treasurer	Helmi Hashim
Council Members	Dr. Lim Ching Liang
	Dr. Samad Solbai
	Ir. Mohd. Suradi Yasin
	Abdullah Hassan
	Andrew Wong Hee Sing
	Bert Heikoop
	Brian Shone
	David Lim Chee Cheong
	Jamaliah Idris
	Peter Kok Lok San
	Wan Zaharah Wan Mohamad

1996-1998

Advisor	Dato' Dr. Hj. Mohd Mansor Salleh
President	Dr. Samad Solbai
Deputy President	Dr. A. Rahim Mohd. Nor
Honorary Secretary	Ir. Max Ong Chong Hup
Honorary Treasurer	Ir. Mohd. Suradi Yasin
Council Members	Prof. Dr. Che Husna Azhari
	Assoc. Prof. Dr. Esah Hamzah
	Dr. Muhamad Deraman
	Dr. Teh Ser Kok
	Ir. Mohd Raziff Embi
	Ir. Rahim Noh
	Johar Juhari
	Kang Kim Ang
	Maimunah Ismail
	Ramli Omar
	Wan Zaharah Wan Mohamad

GOOD DECK-A70 LIGHTWEIGHT EPOXY SYSTEM

DESCRIPTION

Good Deck A70 is a three-component, technically advanced self-leveling, epoxy-filler composite. It is 70% lighter than conventional Self Leveling Epoxy and is best to mitigate water ponding issues on metal deck @ Offshore structures.

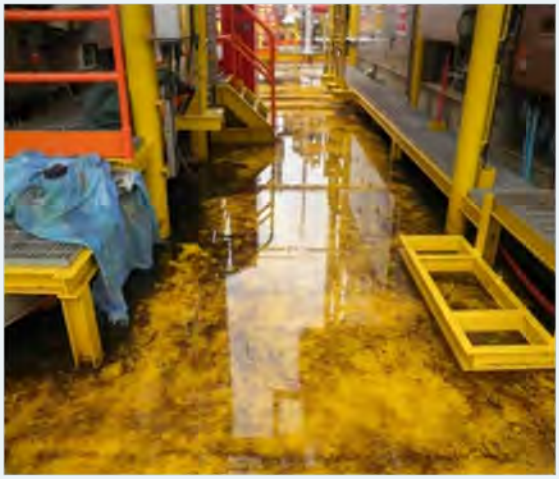
RECOMMENDED USES

Good Deck A70 is a type of epoxy floor coating that creates a durable, low maintenance flooring surface. Besides, it can be use in uneven/water ponding issue, pitted deck surfaces It can create a smooth, seamless surface, as the epoxy resins is pour onto the floor.

Good Deck A70 can be applied from thicknesses of 5-50mm in uneven metal deck surface.

BENEFITS

- ❖Lightweight Underlayment
- ❖100% Volume Solid
- ❖ Solvent free, low odor
- ❖Easy to apply, can be over coated after 3-4 hours. of applications
- ❖Excellent impact resistance
- ❖Compatible with any Primer system.
- ❖Can to Top Coat with PU



For more Information & Enquiry, you may contact or email :
Email: info@abadiservices.com
Tel: +6017 8858728

LIST OF HONOURS

IMM ADVISOR

2020 - 2022

Prof. Ts. Dr. Mohamad Kamal Harun

2013 - 2018

Datuk Ir. (Dr.) Abdul Rahim Hj. Hashim

2007 - 2012

Datuk Ir. Yeow Kian Chai

2002 - 2006

Dato' Dr. Mohd Ariffin Aton

1996 - 2001

Prof. Dato' Dr. Hj. Mohd Mansor Salleh

HONORARY FELLOWS OF IMM

2020	PROF. TS. DR. MOHAMAD KAMAL HARUN
2020	IR. MOHD SURADI MOHD YASIN
2020	IR. MAX ONG CHONG HUP
2018	DATUK IR. (DR.) ABDUL RAHIM HASHIM
2017	DATO' DR. IR. HAJI MOHD ABDUL KARIM ABDULLAH
2016	DATO' DR. ONG ENG LONG
2013	DATUK ANUAR TAIB
2012	EN. ZAINUDDIN ISHAK
2010	YAB. PEHIN SRI HAJI ABDUL TAIB MAHMUD
2008	DR. A. RAHIM MD. NOR
2007	DATUK IR. YEOW KIAN CHAI
2004	DR. IR. SAMAD SOLBAI
2002	ROY VOGELPOEL
2000	PROF. DATO' DR. HJ MOHD MANSOR SALLEH
1992	BRIAN SHONE

IMM PAST PRESIDENTS

2016 - 2020

Ts. Mohd. Azmi Mohd. Noor

2012 - 2016

Prof. Ts. Dr. Mohamad Kamal

2008 - 2012

Dato' Dr. Ong Eng Long

2004 - 2008

Mr. Zainuddin Ishak

2000 - 2004

Dr. A. Rahim Md. Nor

1996 - 2000

Dr. Ir. Samad Solbai

1988 - 1996

Prof. Dato' Dr. Hj. Mohd Mansor Salleh

COVER STORY

IMM TRAINING AND CERTIFICATION SERVICES

Prepared by:
N. Hithaya Jeevan
Secretariat of Institute of Materials, Malaysia

Background

The Institute of Materials Malaysia has been associated with training and certification of technical workers for more than 30 years. A major part of these schemes involves the certification of engineers and technicians in the oil and gas industry. IMM is currently making inroads into the construction, power and transport industry.

The job of personnel in these industries requires individuals to be competent and IMM has built a reputation over the years as a reliable training and certification body. To-date IMM has certified more than 9000 skilled workers through its competency development and certification programs for skilled workers. Most of them are required to carry out tasks that demand special skills while a significant number are also involved in making important technical judgements or decisions. Such judgements/decisions carry a significant impact on the work being carried out and any errors or shortcomings could result in serious consequences such as structural failures, corrosion, vibrations, loss of products, economic loss and injuries or even loss of lives.

Benefits of IMM Certification

IMM-approved training courses and the related certification programs are designed to equip workers with the skills and knowledge for entry into the industrial sector. The IMM certification provides proof and assurance to prospective employers that the certified persons have reached a given level of proficiency in a particular field. The focus is not only on developing competencies and skills from raw talent but also on upskilling their existing competencies to complement their work experience as it provides a jumping-off point for career advancements in the industry. Such skills enhancement through formal certification programs will expose the workforce to related and new technologies for improved efficiency. This in turn leads the existing workforce towards enhancing national productivity and making our industries more competitive.

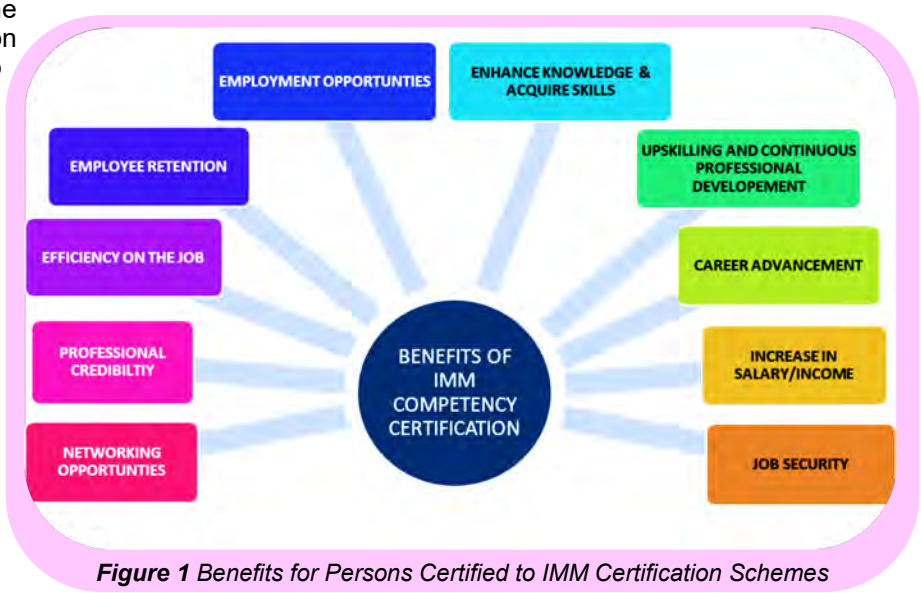


Figure 1 *Benefits for Persons Certified to IMM Certification Schemes*

IMM certification also increases the value of the competency tested worker to their respective organizations. IMM certification opens more doors as many positions work out better with a certified hire in place as industry work specifications increasingly demand certified personnel for contract jobs. Employers are more inclined, towards the certified candidate over the uncertified one. In addition, IMM's certification programs gives certified person access to additional resources and better networking opportunities with peers and industry leaders, providing various opportunities for business and career advancements. Figure 1 summarizes the benefits of IMM training and certification programs.

Development of Certification Schemes

As one of the nation's recognized certification body for skilled workers in the materials science and technology fields, IMM has the capability to assess and certify that a person is competent to standards established and required by the industry in various sub-fields. Competence-based certification means that IMM is expected to examine a candidate's knowledge, skills, personal attributes, and qualifications specific to the program and/or scope of certification.

IMM's certification schemes have been developed over the years along with the competence criteria. The Technical Committees comprising subject matter experts continue to play a crucial role in developing new certification schemes or upgrading existing schemes and ensuring standards of competence meet the industry requirements. The development or review of the certification schemes are coordinated by Program Custodians nominated by the respective Technical Committees. The Program Custodian acts as the liaison between the Technical Committee and the IMM Secretariat which works closely with the Examination and Certification Panel.

The Examination and Certification Panel is the approving authority for all matters relating to examination and certification and includes examination sets, examiners, examination results, certification schemes and details, quality manuals and SOP, and other documents.

IMM's certification schemes for each category of competency cover the following elements in line with ISO requirements:

- Scope – job and certification title
- Job and task description – description of the tasks required to perform the audit
- Required competence – knowledge and skills
- Prerequisites – qualifications, work experience and training
- Assessment methods – written, oral, practical and observations
- Examination structure and duration
- Criteria for certification -assessments/examination pass scores
- Criteria for recertification – confirmation of continuing satisfactory work, work experience, examination/ interview, continuous professional development

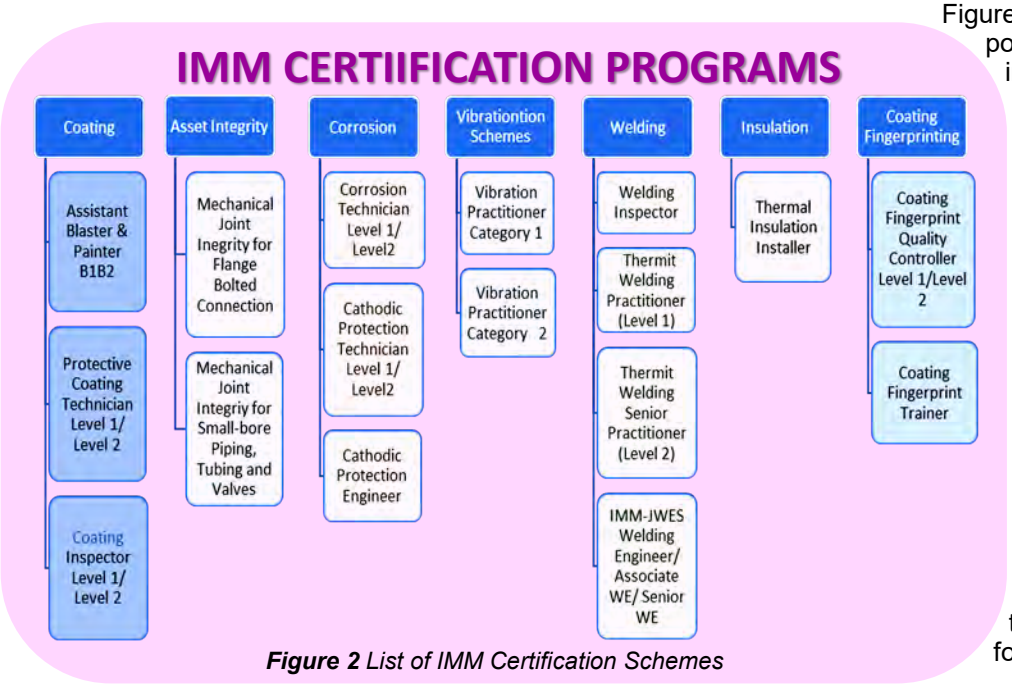


Figure 2 *List of IMM Certification Schemes*

Figure 2 shows a list of the more popular IMM certification schemes including newly introduced schemes such as Mechanical Joint integrity, Thermit Welding and Coating Fingerprinting. To ensure continued competency of the certified personnel, IMM has stipulated re-certification requirements which requires renewal of certification at the end of 3 years or 5 years depending on the individual scheme. The process of re-certification involves assessment of the manager- or supervisor-endorsed work experience during the certification cycle, compliance to continuous professional development requirements and may include the need for a refresher course followed by an examination.

Maintaining the Standards, Impartiality and Credibility of IMM Certification Schemes

To add further credence to its certification operations, IMM has put in place a system in accordance with the requirements of ISO/IEC 17024, *Conformity assessment – General requirements for bodies operating certification of persons.* It is now in the final stages of achieving accreditation to MS ISO/IEC 17024 after having been audited by technical assessors from the national accreditation body, the Department of Standards Malaysia.

The structure in place at IMM ensures impartiality which is a major requirement under ISO/IEC 17024 as training and certification activities are segregated. Pre-requisite training is outsourced to authorized training bodies (ATBs) who manage the training while IMM takes responsibility for the conduct of the certification examinations, independent of the training. However, generally, for the convenience of the candidates, the examinations are scheduled back-to-back with the training while ensuring that the examiner assigned is not the trainer.

The synergy between the industry and academia puts IMM in a strong position as a leading certification body and enables IMM to not only develop the training and certification programs but also to assess and certify if a candidate complies with the skill sets required to work in the industry according to established requirements/specifications. Thus, IMM certification programs developed jointly by the industry and academia has been proven to improve confidence on the job to both employer and employee and the user of services of the certified persons.

Conclusion

Being backed by technical resources, IMM's competency training and certification programs are well recognized by multi-national companies, small and medium enterprises and by authorities and clients in Malaysia as well as beyond its borders. With reviews and further improvements initiated in 2020, the year 2021 shall continue to see the dawning of a new era for IMMs' certification programs.

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 Technician Level 1 • Certified Corrosion Technician Level 2 • Certified Cathodic Protection Technician Level 1 • Certified Cathodic Protection Technician Level 2 • 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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IMM AUTHORIZED TRAINING BODY (ATB)/ AUT
TRAINING PARTNER (ATP) FOR I

AUTHORISED TRAINING BODIES (ATBs)

(Offer IMM Certification Training Programs and Courses)

ATBs	Training Programs & Courses
Seacademy Sdn. Bhd. (Sarawak) **Topfields Borneo Sdn. Bhd.** (Sarawak) **Sabah Skills & Technology Centre** (Sabah) **Epsilon Skills Academy Sdn. Bhd.** (Peninsular Malaysia) **Schmidt Abrasive Blasting Sdn. Bhd.** (Peninsular Malaysia) **SRC Global Resources Sdn. Bhd.** (Peninsular Malaysia) **NFK Technologies Sdn. Bhd.** (Peninsular Malaysia) **Advance Multiskills Training Centre Sdn. Bhd.** [Excludes courses marked with *] (Sarawak)	**Coating** • Certified 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) **Epsilon Skills Academy Sdn Bhd** (Peninsular Malaysia) **SRC Global Resources Sdn. Bhd.** (Peninsular Malaysia) **NFK Technologies Sdn. Bhd.** (Peninsular Malaysia)	**Mechanical Joint Integrity** • Certified Mechanical Joint Integrity for Small-bore Piping, Tubing and Valves • Certified Mechanical Joint Integrity for Flange Bolted Connections
Prasarana Malaysia Berhad (Malaysia)	**Thermit Welding** • Certified Thermit Welding Practitioner (Level 1) • Certified Thermit Welding Senior Practitioner (Level 2)

Note: The respective coverage area is indicated in brackets.

AUTHORISED TESTING CENTRE (ATC)

(Offers IMM Examination and Assessments)

ATC: JOTAC Academy Sdn. Bhd.
(Peninsular Malaysia)

Certification Examination/Assessments

- Certified Protective Coating Technician (Blaster and/or Painter) Level 1 & Level 2
- Certified Coating Inspector Level 1 & Level 2
- Certified Corrosion Technician Level 1
- Certified Cathodic Protection Technician Level 1

HORIZED TESTING CENTRE (ATC)/ AUTHORIZED IMM COURSES & CERTIFICATION

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
- Refresher Course for Certified Protective Coating Technician (Blaster and/or Painter) Level 1 and Level 2
- Certified Assistant Blaster & Painter Level 1 & Level 2
- Certified Blasting and Painting Supervisor
- Certified Coating Inspector Level 1 & Level 2
- Refresher Course for Certified Coating Inspector Level 1 and Level 2
- Certified Coating 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

Coating Fingerprinting

- Coating Fingerprint Foundation Course
- Certified Coating Fingerprint Quality Controller Level 1
- Certified Coating Fingerprint Quality Controller Level 2
- Refresher Course of Certified Coating Fingerprint Quality Controller Level 1/Level 2

Train the Trainer

- Certified Trainer

Corrosion

- Certified Corrosion Technician Level 1
- Certified Corrosion Technician Level 2
- Certified Cathodic Protection Technician Level 1
- Certified Cathodic Protection Technician Level 2
- Certified Cathodic Protection Engineer
- Corrosion Control by Cathodic Protection

Thermal Insulation

- Introduction to Thermal Insulation
- Certified Thermal Insulation Installer

Vibration

- Certified Vibration Practitioner Category 1
- Certified Vibration Practitioner Category 2
- Certified Vibration Specialist Category 3
- Certified Vibration Specialist Category 4

Welding

- Certified Welding Inspector
- Repair Welding of Pressure Equipment in Refineries & Chemical Plants
- Welding & Joining Technology for Non-Welding Personnel
- Steel Technology for Non-Technical Personnel

IMM-JWES Courses

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

Mechanical Joint Integrity

- Certified Mechanical Joint Integrity for Small-bore Piping, Tubing and Valves
- Certified Mechanical Joint Integrity for Flange Bolted Connections
- Valve Operations, Maintenance & Inspection Including Flange Breaking

Loss of Primary Containment

- Mechanical Joint Integrity
- Pressure Safety Valve
- Small Bore Tubing

Rotating Equipment

- Competent Mobile Industrial Compressor Operator
- Competent Mobile Industrial Equipment Inspector
- Inspection & Maintenance of Pumps
- Practical Approach to Inspection and Maintenance of Stream Turbine
- Practical Approach to Precision Alignment Methods
- Practical Approach to Precision Balancing Methods
- Reciprocating Compressors: Operations, Maintenance, Inspection & Troubleshooting
- Troubleshooting Techniques for Rotating Equipment

Other Materials Courses

- Materials Selection & Corrosion
- Metallurgical Failure Investigation
- Basic Course on Operation of Mobile Air Compressor

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IMM
INSTITUTE OF MATERIALS MALAYSIA



IMM AUTHORISED TRAINING BODY

FOR SARAWAK REGION

PROGRAM: COATINGS

- Certified Assistant Blaster & Painter B1/B2
- Certified Protective Coating Technician (Blaster and/or Painter) L1L2
- Certified Blasting and Painting Supervisor
- Certified Coating Inspector Level 1
- Certified Coating Inspector Level 2
- Certified Coating Quality Control Technician

NON-CERTIFICATION COURSES

- Corrosion Control by Protective Paints
- Corrosion Control by Protective Coating
- Basic Knowledge on Corrosion Protection for Technicians and Engineers









SSTC Valuing Skills IMM

IMM Programs in **KOTA KINABALU**

COATINGS

- Certified Assistant Blaster & Painter B1/B2
- Certified Protective Coating Technician (Blaster and/or Painter)L1L2
- Certified Coatings Inspector Level 1
- Certified Coatings Inspector Level 2

MECHANICAL JOINT INTEGRITY

- Certified Mechanical Joint Integrity for Small-bore, Piping, Tubing & Valves.
- Certified Mechanical Joint Integrity for Flange Bolted Conections

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88460 Kota Kinabalu Sabah

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1) obs: observer
2) Alt: alternate

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	Nurjaimi Ali	PETRONAS Group Technical Solution
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	Selvandran Vello	Hempel (M) Sdn Bhd
	Teh Tiong Poh (alt)	Jotun (M) Sdn Bhd
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2020-2022 SESSION

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	Assoc. Prof. Ts. Dr. Tay Chia Chay	Universiti Teknologi MARA

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	Yii Ming Sing	Freelance

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2020-2022 SESSION

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2020-2022 SESSION

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Compiled by: IMM Secretariat,
The information was updated as of 31st December 2020

IKM PROFESSIONAL CENTRE
TRAINING CALENDAR 2021

Dates (Tentative)	Courses	Trainers
Feb, 23 - 24 (Tue & Wed)	MS ISO/IEC 17025:2017 Management Systems Internal Auditing	ChM Pua Hiang
Mar, 02 - 03 (Tue & Wed)	Measurement Uncertainty in Chemical Analysis	ChM Chang Hon Fong
Mar, 09 - 10 (Tue & Wed)	Calibration of Equipment in Testing Laboratories	Mr Chen Soo Fatt
Mar, 16 - 17 (Tue & Wed)	Method Validation & Quantification of Measurement Uncertainty in Microbiological Testing	Dr Vivian New Chia Yeung
Mar, 22 - 23 (Mon & Tue)	Basic Laboratory Skills & Techniques	Prof ChM Dr Sharon Teh Geok Bee
Mar, 30 (Tue)	Decision Rules and Conformity Assessment Meeting the MS ISO/IEC 17025:2017 Requirements	ChM Chang Hon Fong
Apr, 06 - 07 (Tue & Wed)	General QA/QC Procedures for Testing Laboratories	ChM Pua Hiang
Jun, 01 - 02 (Tue & Wed)	Understanding the Elements of MS ISO/IEC 17025:2017	ChM Chang Hon Fong
Jun, 15 - 16 (Tue & Wed)	Chemical Safety and Security	Datin ChM Dr Zuriati Zakaria
Jun, 22 - 23 (Tue & Wed)	Procedures of Method Validation & Verification	ChM Chang Hon Fong
Jun, 28 - 29 (Mon & Tue)	Statistical Methods for Chemists	Prof ChM Dr Sharon Teh Geok Bee
Jul, 06 - 07 (Tue & Wed)	Measurement Uncertainty in Chemical Analysis	ChM Chang Hon Fong
Jul, 13 - 14 (Tue & Wed)	MS ISO/IEC 17025:2017 Management Systems Internal Auditing	ChM Pua Hiang
Jul, 27 - 28 (Tue & Wed)	Management of Chemicals & Chemical/Lab Wastes	ChM Dr Malarvili Ramalingam
Aug, 17 - 18 (Tue & Wed)	Decision Rules and Conformity Assessment Meeting the MS ISO/IEC 17025:2017 Requirements	ChM Chang Hon Fong
Aug, 24 - 25 (Tue & Wed)	General QA/QC Procedures for Testing Laboratories	ChM Pua Hiang
Sept, 07 - 08 (Tue & Wed)	Understanding the Elements of MS ISO/IEC 17025:2017	ChM Chang Hon Fong
Sept, 28 - 29 (Tue & Wed)	Procedures of Method Validation & Verification	ChM Chang Hon Fong

Registration details are available at IKM Website.
Email us for more information: **ayu@ikm.org.my**
Tel: **03–77283272**

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ICOMST HACKATHON

TITLE & PROBLEM STATEMENT

1 AI AND PHYSICS BASED CONDITION MONITORING SYSTEM FOR ROTATING EQUIPMENT

Machine condition monitoring and fault diagnosis as a part of system maintenance has gained a lot of interest due to the potential benefits to be learned from reduced maintenance budgets, enhanced productivity and improved machine availability. However, AI (big data analysis) based condition monitoring system can create false alarm. Therefore, the solution is to cross check the alarm using physics equation.

Propose a method of Artificial intelligence (AI) based condition monitoring system with the capability of cross checking with Physics equation.

2 ONLINE MATERIAL DAMAGE DETECTION USING NON-DESTRUCTIVE/INTRUSIVE TESTING

The NDT inspections to assess the damage to structure or parts of the system is crucial for the saving of the maintenance cost, improving the safety and reliability of the entire system. Monitoring of structures to identify types of damages such as cracks in the early stages that occur under loading is essential in practical applications as it can reduce the risk of failure in structures.

Develop an online material damage detection to identify and visualize damage based on several non-destructive testing (NDT) methods.

ICOMST HACKATHON

TITLE & PROBLEM STATEMENT

3 DRONE TECHNOLOGY FOR CORROSION INSPECTION ON INACCESSIBLE AREA

Nowadays there are both simple drones which can record video or take still images, and advanced drones, to which all types of data collecting equipment can be attached. An increasing number of companies today are using drone technology for visual inspection, as it is a cost-conscious and effective way to inspect at heights and inaccessible areas

Build an AI based algorithm to identify corrosion on piping and structure.

4 AUTOMATED CUI DETECTION ON PIPELINE

Corrosion Under Insulation (CUI) has been identified as one of the most significant inspection challenges as it affects asset integrity. This corrosion type stems from the synergistic impact of the presence of water in the space between the insulation and the metallic pipe surface. In terms of detection accuracy and precision, the industry faces significant issues in the inspection of insulated assets, not only of pipes, but also tanks and vessels.

Develop automated inspection technologies for detecting CUI covering both visual inspection and other non-destructive testing (NDT) techniques.

REGISTRATION
FORM

2 DAY SINGLE PASS (ENTITLES ENTRY FOR ONE HOLDER)		
VIRTUAL ONLY	PHYSICAL ONLY	HYBRID (PHYSICAL+VIRTUAL)
RM 200	RM 900	RM 1000

ACCESS TO ALL TECHNICAL SESSIONS, PRESENTATIONS AND EXHIBITION AREA — INCLUDES FOOD, BEVERAGES AND NETWORKING SESSION — ALL COLLATERAL MATERIALS FROM THE CONFERENCE

*FREE ADMISSION FOR STUDENTS (PROVIDE STUDENT ID)

FILL IN YOUR DETAILS BELOW:

NO	NAME	COMPANY	EMAIL	COUNTRY
1				
2				
3				
4				
5				

I AM INTERESTED IN:

- ○ PHYSICAL ONLY
- ○ VIRTUAL ONLY
- ○ HYBRID
- ○ STUDENT (PLEASE PROVIDE STUDENT ID CARD)

PAYMENT MUST BE MADE BY CHEQUE, TELEGRAPHIC TRANSFER & BANK DRAFT TO:

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ACCOUNT NO:	8009055156
BANK NAME:	CIMB BANK BERHAD
BANK BRANCH:	SURIA KLCC, KUALA LUMPUR
COUNTRY:	MALAYSIA
SWIFT CODE:	CIBBMYKL

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KINDLY SUBMIT PROOF OF PAYMENT TO THE IMM SECRETARIAT
VIA EMAIL (SECRETARIAT@IOMM.ORG.MY)

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TEL : +6018-9113480

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47301, PETALING JAYA

IMM ACT
20

IMM TVET Regional Series of Technical Forums
2nd March 2020
Grand Palace Hotel, Miri

Education & Further Studies Fair
7th – 8th & 14th – 15th March 2020
Mid Valley Exhibition Centre

The First-of-its-kind Virtual Traini
Coating Fingerprint Certific
22nd - 24th July 20
Zoom Online Platf

Virtual Industrial Talk – INJECTION MOLDING – What You Need To Know?
29th July 2020
Google Meet Online Platform

TIVITIES
20

MALAYSIA Board of Technologist (MBOT) with the Technical Expert Panel (TEP) Workshop
9th July 2020
Begonia Room, Palm Garden Hotel IOI Resort City, Putrajaya

Materials Lecture Competition 2020
First Winner and Malaysia Finalist in YPWLC 2020
27th August 2020
ZOOM platform centred in Infocomm Development Centre (iDEC), UPM

ing Courses for "IMM
cation Scheme"
20
orm

IMM First Council Meeting
(Term: 2020 - 2022)
10th March 2020
Meeting Room Level 4, Menara Serba Dinamik, Shah Alam

IMM ACT
20

Sabah Oil & GasConference and Exhibition (SOGCE 2019)
10th – 11th July 2019
Magellan Sutera Harbour Resort, Kota Kinabalu

29th Annual General Meeting
22nd March 2019
Kelab Golf Negara Subang

IMM Corrosio
17th Octo
Sheraton I

Participation of IMM in the Sarawak Oil & Gas Seminar and Exhibition (SOGSE) 2019
13th - 14th April 2019
Imperial Mall Hotel, Miri, Sarawak

Exhibition at KLESF
1st - 3rd November 2019
Mines International Exhibition & Convention Centre

Making Inroads into Industry: Memorandu between IMM and Pra
19th Apr
Alila Bangsar,

Forum on "Towards Polymeric Coating Fingerprinting" V: Big Wave
4th April 2019
Dewan Presiden, Kelab Golf Negara Subang

Memorandum of Unders
tute of Materials, Malay
Hussein Onn Mala
UTHM-IMM Materia
29th Aug
Mudzaffar H

IMM-UiTM Student Chapter Academic Visit to Kualiti Alam - Cenviro
6th March 2019
Kualiti Alam - Cenviro, Negeri Sembilan

TIVITIES
019

Forum on "Using Technology to Address Global Plastic and Environmental Issue"
22nd March 2019
Kelab Golf Negara Subang

Appreciation Dinner with Datuk Ir. Dr. Abdul Rahim Hashim
25th January 2019
Concorde Hotel, Shah Alam

n Conference
ober 2019
mperial KL

IMM Corrosion Committee Half-Day Seminar and Site Visit to Prasarana Centre of Excellence and Rapid Rail Depot
27th June 2019
Prasarana Centre of Excellence, Kompleks Rapid Rail Subang, Petaling Jaya, Selangor

Young Person's World Lecture Competition 2019
10th October 2019
297 Euston Road, London, United Kingdom

the Land Transport
um of Understanding
asarana Malaysia Bhd
ril 2019
Kuala Lumpur

Materials Lecture Competition 2019
30th April 2019
Centre of Graduate Studies, UTeM main campus, Melaka

standing between Insti-
ysia and Universiti Tun
aysia to Establish
ls Student Chapter
ust 2019
otel, Melaka

IMM International Applied Vibration Conference 2019:
"Vibration Technology in the Era of Industrial Revolution 4.0"
13th - 14th November 2019
Sheraton Imperial, Kuala Lumpur

IMM ACT
20

Half-Day Seminar "Corrosion Controls and Prevention" and Site Visit to Navy Base, Lumut
14th May 2018
Cawangan Penguasa Kejuruteraan Armada Pangkalan Tentera Laut Diraja Malaysia, Lumut

Materials Lecture Competition 2018
3rd May 2018
Universiti Teknologi Malaysia, Kuala Lumpur Campus

Malaysia Board o Professional Assessm
19th – 21st O
Royale Chulan, Bukit B

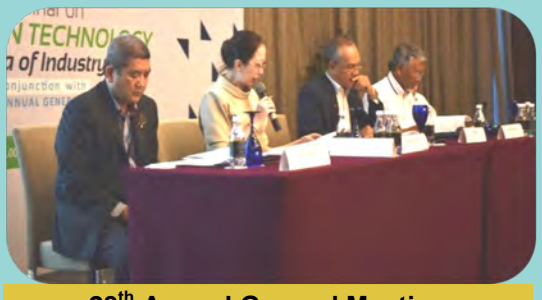
4th Malaysian Oil and Gas Services Exhibition and Conference (MOGSEC 2018)
25th - 27th September 2018
Kuala Lumpur Convention Centre

Corrosion Forum: Corrosion and Coatings Development in Industry
5th July 2018
Universiti Teknologi MARA Shah Alam

Inaugural Sympo Infrastructure a
24th Janu
Universiti Tunku Abdul Rah

Seminar on Vibration Technology in the Era of Industry 4.0
16th March 2018
Impiana KLCC Hotel, Kuala Lumpur

First IMM Internatio Confere
21st – 22nd
Parkroyal, Bukit B



28th Annual General Meeting
16th March 2018
Impiana KLCC Hotel, Kuala Lumpur

TIVITIES
18

Young Person's World Lecture Competition 2018
11th October 2018
Fairview Course Arena, Port Elizabeth, South Africa

Memorandum of Understanding Signing Ceremony between Universiti Teknologi MARA and Institute of Materials, Malaysia
13th September 2018
Universiti Teknologi MARA Shah Alam

of Technologists:
ment Panel Workshop
ctober 2018
Bintang, Kuala Lumpur

Strategic Collaboration between Polytechnic of Sultan Azlan Shah, Ministry of Higher Education and Institute of Materials, Malaysia
16th August 2018
Dewan Mualim, Behrang

PetroEdge & NrgEdge Signed Memorandum of Understanding with Institute of Materials, Malaysia
20th April 2018
Holiday Inn Glenmarie, Kuala Lumpur

sium on Railway
nd Engineering
ary 2018
man Sungai Long Campus

Malaysia Board of Technologist Strategic Technology Field Optimization Workshop
4th- 6th May 2018
WP Hotel, Kuala Lumpur

onal Applied Vibration
nce (IAVIC)
November 2018
intang, Kuala Lumpur

IMM ACT
20

IMM Away Day
14th January 2017
Amverton Resort, Pulau Carey

IMM & Society for Protective Coatings Cooperation Agreement Signing Ceremony
17th March 2017
PETRONAS Twin Tower, Kuala Lumpur

30th Annive
6th No
Intercontinenta

1-Day Conference on Insulation
16th March 2017
Universiti Teknologi Malaysia Space, Kuala Lumpur

1-Day Confere
27
Corus

IMM Vibration Conference
16th November 2017
Corus Hotel, Kuala Lumpur

1-Day Coating Conference
18th May 2017
Corus Hotel, Kuala Lumpur

Materials Le
Asia Pacific Univ

TIVITIES 17

Memorandum of Understanding Signing Ceremony Between IMM and South West JiaTong University
16th November 2017
Corus Hotel, Kuala Lumpur

27th Annual General Meeting
16th March 2017
Universiti Teknologi Malaysia Space, Kuala Lumpur

rsary IMM Dinner
vember 2017
l Hotel, Kuala Lumpur

1-Day Conference on Prevention of Loss of Primary Containment
31st October 2017
Bintulu

nce on Pipelines Corrosion Management
th September 2017
s Hotel, Kuala Lumpur

1-Day Symposium on Materials Processing, Inspection & Testing
24th August 2017
Puteri Pacific Hotel, Johor Bahru

ecture Competition 2017
16th May 2017
ersity Auditorium, Bukit Jalil, KL

IMM Friendly Futsal Game 2017
25th February 2017
Kompleks Rakan Muda Puchong (IM4U Central)

INSTITUTE OF MATERIALS, MALAYSIA

Updated on 30th December 2020

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 recognised leading institution in Materials Science and Technology.

IMM Mission

(1) To be the technical authority on material science and technology
(2) To develop an enhance competency and skills for all categories and practitioner
(3) To become an internationally recognized certifying body
(4) To be the forum for industry and academia collaboration
(5) To positively contribute to society and quality of life

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, The Society for Protective Coatings, US (SSPC), 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.

Kindly fill the form and email to secretariat@iomm.org.my or send it to :

IMM SECRETARIAT
Suite 515, Level 5, Block A, Kelana Centre Point (Lobby B),
No. 3 Jalan SS 7/19, Kelana Jaya,
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 40.00
Student	RM 10.00	-	-	RM 10.00
Ordinary/ Company for affiliates	RM 40.00/ RM 50.00	-	-	NIL

INSTITUTE OF MATERIALS, MALAYSIA

Updated on 30th December 2020

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.

First IMM International Applied Vibration Conference (IAVIC) 2020

1-Day Symposium on Materials Processing, Inspection & Testing 2020

UiTM Materials Lecture Competition 2020

Exhibition at KLESF @ MIECC 2020

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. National Association of Corrosion Engineers USA
18. Persatuan Arkitek Malaysia
19. Plastics & Rubber Institute of Malaysia
20. Singapore Welding Society
21. Society of Petroleum Engineers
22. Steel Structures Painting Council USA
23. The Welding Institute UK

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.

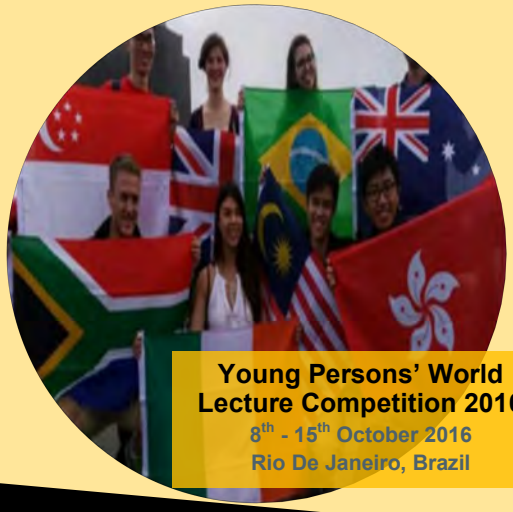
Email : secretariat@iomm.org.my Website : www.iomm.org.my

IMM ACTIVITIES 2015

Vibration Awareness Seminar
17th November 2016
Promenade Hotel, Kota Kinabalu

FIRST "IMM C
Fingerprint Quality
23rd - 24th F
Four Points S

Materials Lecture Competition 2016
26th May 2016
Universiti Malaya



Young Persons' World Lecture Competition 2016
8th - 15th October 2016
Rio De Janeiro, Brazil

Co
Fabri
P

IMM A

IEM-IMM-UMS Forum on Oil & Gas Industry
19th November 2015
The Palace Hotel

5th Regional Materials Technology Conference
8th May 2015
Miri

Materials Lec
Competition
14th May 201
Bangi-Putrajaya

Forum on "Towards Fingerprinting of Polymeric Coatings" IV
29th October 2015
Kelab Golf Negara Subang

The-first-of-its-kind IM
Cou
10
Ho

ertified Coating
Controller" Course
ebruary 2016
Sheraton Hotel

1-Day Conference Under Insulation
13th October 2016
Corus Hotel, Kuala Lumpur

Admission of The William Pit Fellow
13th October 2016
Pembroke College of Cambridge

oatings & Corrosion,
ication & Welding 2016
17th - 19th May 2016
utra World Trade Centre

10th International Materials Technology Conference & Exhibition 2016
16th - 19th May 2016
Putraworld Trade Centre

Academy of Sciences Malaysia Conferment 2016
13th December 2016
Kuala Lumpur Convention Center

ACTIVITIES 2016

cture
2015
5
Hotel

Young Person's World Lecture Competition 2015
22nd October 2015
Grogheda, Ireland

Kuala Lumpur Engineering & Science Fair 2015
30th Oct 2015 - 1st Nov 2015
The Mines International Exhibition and Convention Centre

MM Coating Fingerprint Foundation
urse in the world
th September 2015
liday Inn Glenmarie

24th Asean Welding Federation Council Meeting
21st - 24th October 2015
Majapahit Hotel, Surabaya, Indonesia

IMM ACT
2014 -

9th International Materials Technology Conference & Exhibition 2014
13th - 16th May 2014
Putra World Trade Center

Seminar on Materials & Asset Integrity
21st March 2014
Kelab Golf Negara Subang

Forum on Towards
Polymeric
22nd Mar
Kelab Golf Ne

Forum on Towards Fingerprinting of Polymeric Coatings II
11th October 2013
Tanjung Puteri Golf Resort

Materials Lecture
30th Ma
Seri Pacific Hote

Forum on "Towards Fingerprinting of Polymeric Coatings" III
20th June 2014
Glenmarie Golf and Country Club

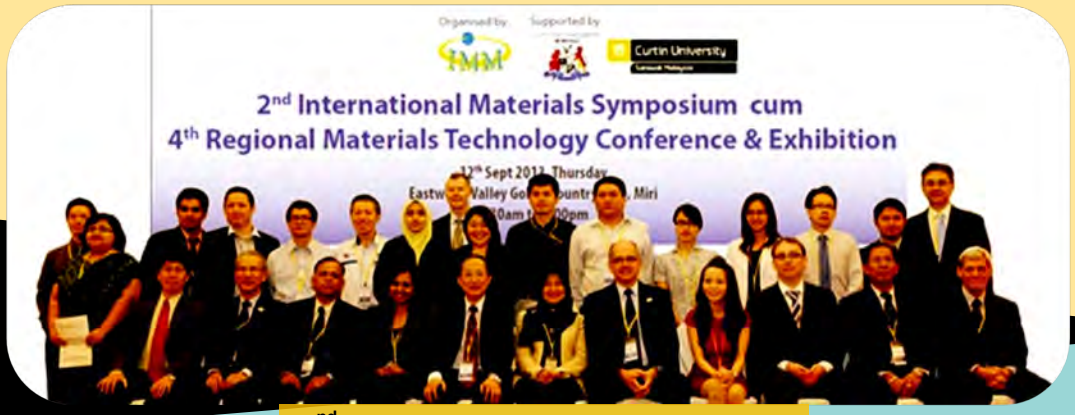
W
28th Nove

TIVITIES - 2013

Young Person's World Lecture Competition 2014
23rd October 2014
California, USA

Forum on Specialty Polymers for High Temperature & High Pressure Application in the Oil & Gas Industry
14th June 2013
PETRONAS Twin Towers, Kuala Lumpur

Fingerprinting of Coatings I
ch 2013
gara Subang



2nd International Materials Symposium cum 4th Regional Materials Technology Conference & Exhibition
12th September 2013
Eastwood Valley Golf & Country Club, Sarawak

Competition 2013
y 2013
l, Kuala Lumpur

AWF AWS Collaboration
14th - 15th November 2013

I TF
mber 2014

IMM Expands Into Sabah and Sarawak (2009)

From Left: John Wong Pak Kung (Chairman IMM Labuan Chapter), Andrew Ronggie (Advisor IMM Kuching Chapter), Nurul Adzwan Sulaiman (Chairman IMM Kuching Chapter)

Pipeline Intergrity Seminar & Networking Cocktail

20th September 2012
Kuala Lumpur

Evening Talk on the "Good & Bad Practise in Fabrication and Use of Stainless Steel"

6th December 2012
Kuala Lumpur

IMM ACTIVITIES 2008 - 19

3rd International Materials Engineering & Technology Conference & Exhibition "Engineering Materials in the Millenium"

23rd - 24th May 2002
Holiday Inn, Miri

2nd International Materials Engineering & Technology Conference & Exhibition 1999

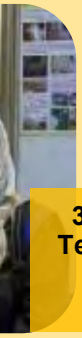
25th March 1999
Sheration Hotel Subang

4th International Materials Technology Conference & Exhibition 2004 & MoU Signing Ceremony between IMM-Intermerger Sdn Bhd on the Formation of Materials Technology Education Sdn Bhd

23rd - 25th March 2004
Hotel Istana, Kuala Lumpur

Seminar on"New Coating Technology"

26th March 2008
Holiday Inn Glenmarie Hotel, KL



3rd Regional Materials Technology Conference
26th April 2011
Miri

7th INTERNATIONAL MATERIALS TECHNOLOGY CONFERENCE & EXHIBITION 2010
14th - 16th June 2011
Hilton Hotel, Kuching

8th International Materials Technology Conference & Ex-hibition 2012
9th - 12th July 2012
Sunway Resort & Spa, Selangor

"Advanced Coatings Standard & Technology" Symposium Jointly Organised by IMM-SSPC MoU Signing Ceremony
15th November 2011
Glenmarie Golf & Country Club

TIES 2012 - 2009
80

st International Materials
echnology Conference &
Exhibition
1st - 3rd March 1990
Putra World Trade Centre

2nd International Materials Engineering & Technology Conference & Exhibition 1999
25th March 1999
Sheration Hotel Subang

6th International Materials Technology Conference & Exhibition 2008
14th - 16th June 2008
Hilton Hotel, Kuching

ational Materials Technology
ference & Exhibition 2006
17th - 20th July 2006
Crowne Plaza Mutiara Hotel, Kuala

DID YOU KNOW

Malaysian Materials Science & Technology Society (MMS) changed its name to the Institute of Materials, Malaysia (IMM) on 16 June 1997 by the new President, Ir. Dr. Samad Solbai, Ir. Max Ong Chong Hup (Honorary Secretary) and Ir. Mohd Suradi Yasin (Honorary Treasurer).

Founders of Malaysian Materials Science & Technology Society

Prof. Dato' Dr. Hj Mohd Mansor Salleh

Ir. Max Ong Chong Hup

NEW IMM PROFESSIONAL

MR. LIM CHIN RUENN

Organization: Metallurgical Consultancy and Services Sdn Bhd
Position: Technical Manager
Working experience(s):
- 9 years as Technical Manager at Metallurgical Consultancy and Services Sdn Bhd

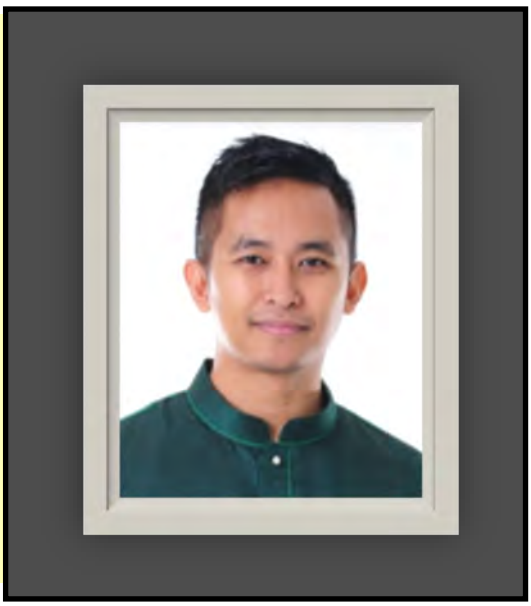
Qualification(s):
- Master in Metallurgy [University of Sheffield]

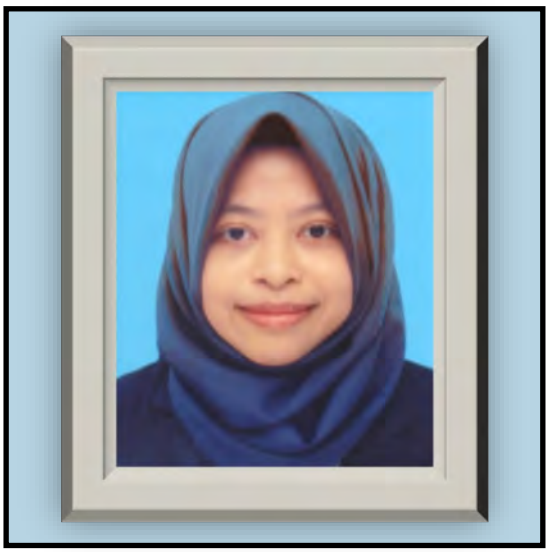
TS. DR. AHMAD ZAHIRANI AHMAD AZHAR

Organization: International Islamic University Malaysia
Position: Assistant Professor
Working experience(s):
- 8 years as Assistant Professor at International Islamic University Malaysia
- 8 months as Reliability Engineer at Intel Technology Sdn Bhd

Qualification(s):
- PhD (Ceramic Engineering) [Universiti Sains Malaysia]

Professional membership(s):
- Professional Technologist (Ts), MBOT
- Graduate Engineer, BEM
- Graduate Engineer, IEM





MS. FATIN FARHANAH HARIDAH

Organization: Hitachi Automotive Systems Ltd., Ibaraki, Japan
Position: Design Engineer
Working experience(s):
- 6 years as Design Engineer at Hitachi Automotive Systems Ltd.

Qualification(s):
- BEng. Materials Science and Engineering [Muroran Institute of Technology, Japan]

Professional membership(s):
- Society of Automotive Engineers of Japan

DR. ALYA NAILI ROZHAN

Organization: International Islamic University Malaysia
Position: Assistant Professor
Working experience(s):
- 5 years as Assistant Professor at International Islamic University Malaysia

Qualification(s):
- PhD (Engineering) [International Islamic University Malaysia]

Professional membership(s):
- Graduate Technologist, MBOT
- Graduate Engineer, BEM
- Member, Biochar Malaysia Association

TS. DR. LEE HWANG SHENG

Organization: Universiti Tunku Abdul Rahman (UTAR)
Position: Assistant Professor
Working experience(s):
- 7 years as Assistant Professor at UTAR
- 2 years as Sen. Failure Analysis Engineer at WinTech Nano-Technology Services Pte Ltd
- 2 years as Technology Development Electronic Package Failure Analysis Engineer at Intel Technology Sdn Bhd
- 2 years as Technology Development Electronic Package Failure Analysis Engineer at Intel Technology Sdn Bhd

Qualification(s):
PhD (Mechanical Engineering) [National University of Singapore]
Professional membership(s):
- Chartered Engineer (Ceng), The Institution of Engineering and Technology (IET)
- Professional Technologist (Ts), MBOT
- Graduate Engineer, BEM
- Graduate Engineer, IEM

DR. JAMUNA THEVI

Organization: SIRIM Berhad
Position: Senior Researcher
Working experience(s):
- 20 years as Researcher at SIRIM Berhad

Qualification(s):
- PhD (Biomedical Engineering) [Universiti Teknologi Malaysia]

Professional membership(s):
- Member, Asian Federation of Biotechnology

Involvement in committees:
- Secretary, IMM Standards Development Committee

TECHNICAL ARTICLE 1

CORROSION IN CONCRETE STRUCTURES IN THE TROPICS

Kuan You Wai[1,*]
[1]PKN Building Solution Sdn Bhd, Unit 17.2, Level 17, Wisma Sunway, 40100 Shah Alam, Selangor, Malaysia
[*]*kuanyouwai@gmail.com*

1. Introduction

Being in the Tropics, Malaysia enjoys abundant rain fall and sunshine. Such climate has supported vast green vegetation and lush greenery. Global urbanization and economic activities since the 70s have brought about greenhouse effects with increase in intensity and frequency of tropical cyclones in our region. Besides, increased emission of industrial and vehicular combustion increases the acidity of rainwater and other environmental pollutants also accelerate the dilapidation of our buildings. Such climate and industrial progress have brought about threats to the concrete structures silently in the Tropics. Nevertheless, the awareness of the adverse impact to the concrete structures is still in its infancy among the general public and engineering community. Recent scientific studies revealed that concrete structures which are commonly regarded for as being strong, robust and maintenance free suffer from accelerated dilapidation and disintegration due to the worsening greenhouse effect and environmental pollution. This is further exacerbated with increase in exposure to excessive dampness.

Figure 1 *Bare concrete surfaces of a bridge with excessive dampness*

"BS EN1504 Products and systems for the protection and repair of concrete structures" is the standard developed based on substantial scientific efforts in concrete diagnosis, repair and rehabilitation. It was enforced in European countries and implemented since 2011. It is also the standard recommended by the Ministry of Urban Wellbeing, Housing and Local Government for the diagnosis and maintenance of concrete structures in stratified buildings in Malaysia.

It contains holistic and scientific recommendations in diagnosis of concrete structures and eleven (11) principles in concrete repair and maintenance including the mitigation and remedies in loss of concrete strength and control of corrosion on the reinforcement steel bars (rebars). The focus of this article is mainly on the corrosion of rebars only.

Reinforcement steel bars and concrete mix work synergistically due to identical coefficient of thermal

Figure 2 *A flyer from Ministry of Urban Wellbeing, Housing and Local Government in Maintenance of Stratified Building*

2. Main Causes of Deterioration of Concrete Structures

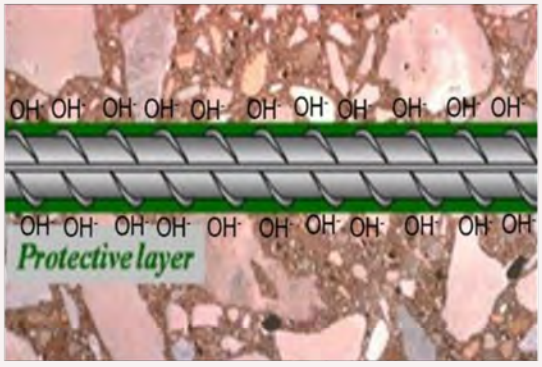


Figure 3 *Passive protective layer of OH^- due to high level of alkalinity of concrete mix*
Source:https://larissacglima.wordpress.com/2014/12/11/corrosion-of-steel-rebars-in-concrete/

expansion (Portland cement concrete at 8 to 12 microstrains/°C, rebar at 11.3 microstrains/°C) [1]. Nevertheless, little is known that the high level of alkalinity of concrete (pH 12 to 13) due to the large amount of calcium and small amount of sodium and potassium ions also provides a passive protective film to the rebars against corrosion. This layer, which is self-generated soon after the hydration of cement has started, consist of Fe_2O_3 adhering tightly to the rebars [2].

2.1 Carbonation of Concrete

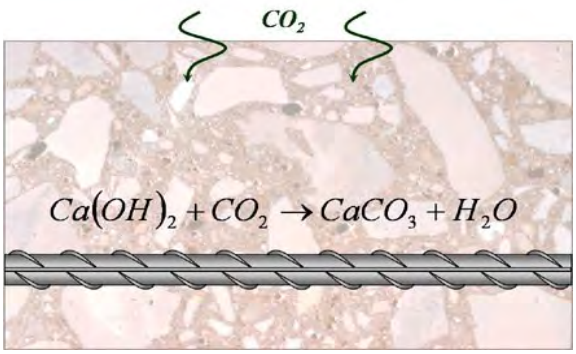


Figure 4 *Infiltration of CO_2 and carbonic acid into the concrete*
Source:https://www.cement.org/learn/concrete-technology/durability/corrosion-of-embedded-materials

Figure 5 *Calthemite on a concrete bridge*

Exposure of concrete structures to atmospheric carbon dioxide (CO_2) leads to carbonation of concrete. This is a natural occurrence whereby the surface increases in strength but suffers from neutralization (drop in pH). With sufficient concrete cover and protection against exposure of excessive dampness, such small amount of carbonation does not cause any degradation to concrete and corrosion to the reinforcement steel bars (rebars). However, excessive dampness caused by poor protection or waterproofing failure can cause infiltration of water with carbonic acid into our concrete structures and neutralization of the affected concrete with significant drop in pH. Besides, the soluble minerals in the concrete are dissolved and they leach out in the form of efflorescence or calthemite.

When the pH of concrete reaches 9 due to excessive ingress of acidic rainwater, the passive protective film of OH^- that protects the reinforcement steel bars against corrosion will break down and corrosion will be triggered. Corrosion of rebars involves a series of electrochemical reactions with the formation of corrosion cell comprising of an anode, a cathode, an electrolyte and ionic path in the presence of Oxygen (O_2) and water (H_2O).

$Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$	Ferrous Hydroxide
$4Fe(OH)_2 + O_2 + 2H_2O \rightarrow 4Fe(OH)_2$	Ferric Hydroxide
$2Fe(OH)_3 \rightarrow Fe_2O_3.H_2O + 2H_2O$	Hydrated Ferric Oxide (Rust)

The chemical reactions of corrosion to the rebars involve migration of electrons from the cathodic region to the anodic region. Corrosion kinetics is accelerated with the presence of heat and oxygen in the areas with cyclic wetting and drying. Areas submerged in or saturated with water lacks oxygen needed for the corrosion process. Besides, corrosion rate is influenced by the ratio of areas between the anodic zone and cathodic zone, too, whereby corrosion kinetics is maximized at the small anodic zone and huge cathodic zone. Lastly, the level of carbonation also depends on the level of porosity, permeability and cement content and the concrete thicker determinates how much the concrete embedded will be protected [3].

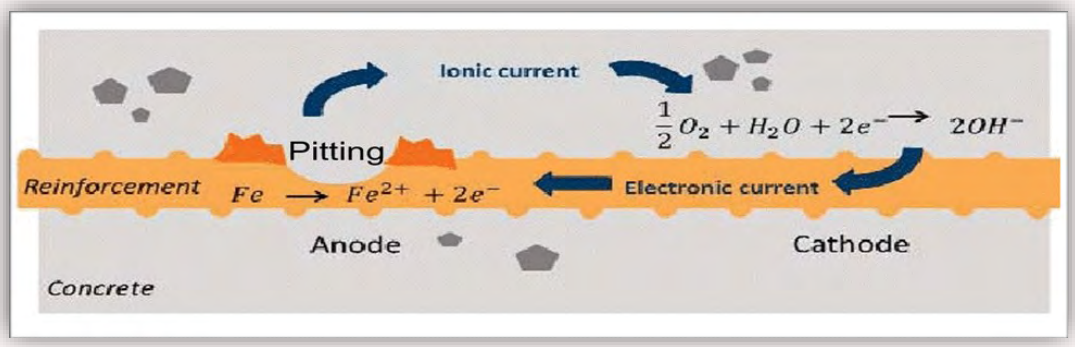


Figure 6 *Oxidation of rebars in carbonated concrete*
Source:https://sxd.danang.gov.vn/web/english/science-technology?articleId=110309

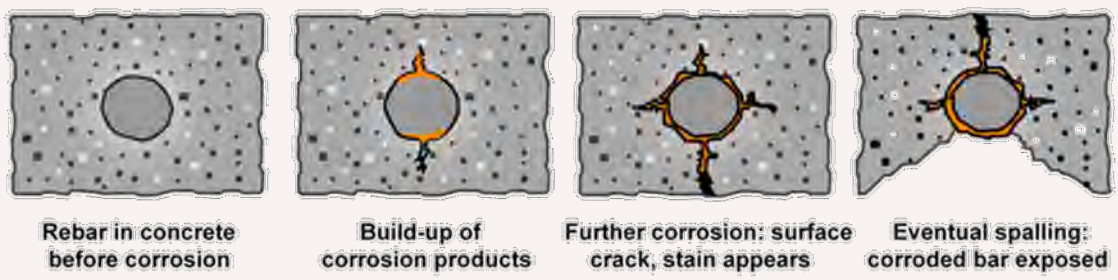


Figure 7 *Spalling and disintegration of concrete triggered by Carbonation*
Source: Ahmad I., et al, Experimental study on bond performance of epoxy coated bars and uncoated deformed bars in concrete, 2017

The by-products of oxidation/ corrosion on rebars expand continuously when it turns to Rust with volumetric increase of up to 6.5 time of the original size of the rebar. Such increase causes the stress to crack the concrete from within. Consequentially, cracked concrete suffer from loss in both compressive strength. Besides, sectional loss of the diameter of the rebars due to pitting effect also reduces the tensile strength of the rebars, resulting in an overall loss in structural strength and integrity.

Figure 8 *Spalled concrete under the soffits*

2.2 Chloride Attack of Concrete

Figure 9 *Aggressive corrosion on concrete piles at the tidal zone*
*Source:*https://www.vector-corrosion.com/about

In marine environment (sea-spray of 25 km from the coastal lines) and swimming pools, seawater and algae prevention chemicals contain chloride ions. Such chloride ions are detrimental to concrete and steel structures when the chloride ions react as catalysts in accelerating corrosion to the steel bars and spalling in concrete

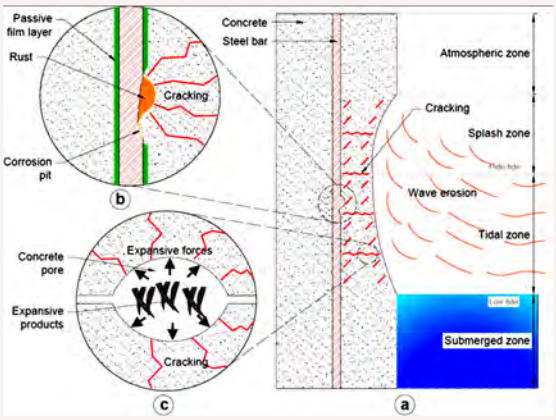


Figure 10 *Concrete Spalling in Marine Environment*
Source: Ting M.Z.Y., ed al. (2015), Deterioration of marine concrete exposed to wetting-drying action, Journal of Cleaner Production, Vol 278, 1 January 2021

Although the mechanism of chloride induced corrosion of steel is not yet fully understood, it is generally believed that the chloride ions become incorporated in the passive film, replacing some of the oxygen and increasing both its conductivity and its solubility. It has been suggested that chloride ions can complex with the ferrous ions produced by corrosion to form soluble complexes of iron (II) chloride.

The resulting iron chloride complex ion then combines with hydroxyl ions to form $Fe(OH)_2$ in solution and releases the chloride ions back to solution to complex more iron and thus essentially acts as a catalyst in corrosion reactions [3]. Corrosion has been recorded even at the concrete with pH 13.2 at 8,000ppm of chloride [4]. Thus, the presence of chloride ions trigger cycles of accelerated corrosion reactions if not extracted chemically or removed physically.

2.3 New Technical Challenges

Despite the common understanding in the widespread of water related damages to concrete structures, new technical challenges have arisen and threaten the safety due to corrosion to the concrete structures due to the rapid Urbanization and worsening Greenhouse Effects as follows:

2.3.1 Rising ground water due to heavier rainfall triggered by Greenhouse Effects

Water table is the upper surface of the zone of saturation where the pores and fractures of the ground are saturated with water. It fluctuates according to the seasonal change in rain volume. Besides, the water table is higher near to the rivers, pools, reclaimed lands and seaside.

The corrosive substances commonly found in the ground water that can adversely affect the concrete structures include dissolved oxygen, carbon dioxide and hydrogen sulfide. The presence of organic waste and the consequential bacterial activities in waste dumping sites causes more severe contamination to the ground water and causes more corrosion to the adjacent concrete structures. Nevertheless, if limestone and other alkaline minerals are in abundant in the soil, high level of alkalinity prevents corrosion.

Higher water table and corrosive ground water is detrimental to the foundation of the building and concrete structures. According to Section 84(4) and 84(5) of the Uniform Building By-Laws 198, ground water is not permitted in the lowest floor of buildings.

Figure *11* *Accelerated corrosion to rebars and cracking of concrete beams under a swimming pool of a 4 year old condominium in Kuala Lumpur*

2.3.2 Stray current by Electrical Railways with Direct Current

Studies by Dr. Thomas and Dr. Alan on stray current in USA indicates that despite a relatively mature technology for its control, corrosion caused by stray current from electrified rapid-transit systems with direct current costs the United States approximately $500 million annually. Part of that cost is the result of corrosion of the electrified rapid-transit system itself, and part is the result of corrosion on neighboring infrastructure components, such as buried pipelines, cables and foundation [5]. Massive construction of electrified transit systems in the Klang Valley and Penang has inherent risks of corrosion to the neighboring infrastructures and buildings. The risk of corrosion in these areas have yet to be evaluated.

Figure 12 Rising ground water

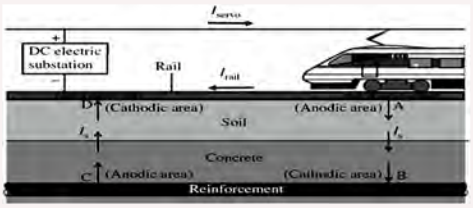


Figure 13 *Stray current from electrified railway system with DC power supply*

Source:https://www.degruyter.com/view/j/corrrev.2017.35.issue-6/corrrev-2017-0009/corrrev-2017-0009.xml

3.Testing of Carbonation, Chloride Profile and Corrosion Mapping

3.1 Testing on the Depth of Carbonation

Carbonation of concrete caused by carbon dioxide in the atmosphere has the effect of reducing the pH of concrete. Concrete is a highly alkali material. Monitoring alkalinity of concrete is important due to reduction of pH of concrete causes rebar corrosion. Thus, carbonation depth is assessed using a solution known as phenolphthalein indicator. When applied with such indicator, concrete with pH values more than 9 appears in pink color when contacted and colorless on concrete with lower pH. By spraying the solution to the concrete chips or core samples, the depth of carbonation can be easily identified.

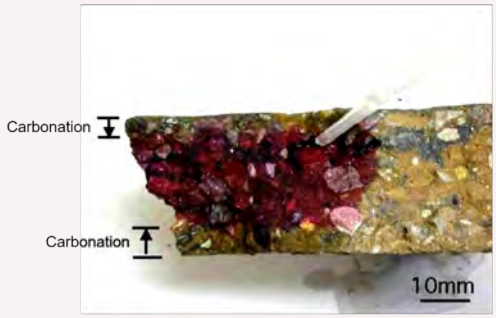


Figure 14 *Phenolphthalein test for Carbonation of Concrete*

Source:www.understandingcement.com/carbonation.html

3.2 Chloride profile

Analysis of Chloride profile of concrete requires the detection of the presence, depth and concentration of chloride in the contaminated concrete. EN 14629:2007 outlines the testing method for chloride content in hardened concrete whereby concrete powder is extracted and collected at different depth for analysis in a laboratory.

Figure 15 Extraction of Samples for Chloride Testing

Source:http://germann.org/productsbyapplication/chloride-profiling/profile-grinder

3.3 Corrosion mapping

The principle of the test is that the rebars at the test point and the reference electrode form a cell in which the rebar acts like an anode and the reference electrode acts like a cathode. The potential measured at each testing point will indicate the tendency of oxidation reaction at the anode. The electrical resistivity of the concrete affects the flow of ions and the rate at which corrosion can occur. A higher concrete resistivity decreases the flow indicating an empirical relationship between corrosion rate and resistivity can be determined from measurements on actual structures.

Resistivity test is more suitable for corrosion induced by Carbonation which normally covers large areas with small potential gradient.

On the other hand, potential mapping is a feasible method to detect different levels of corrosion risks of rebars induced by chlorides which is limited to local pits.

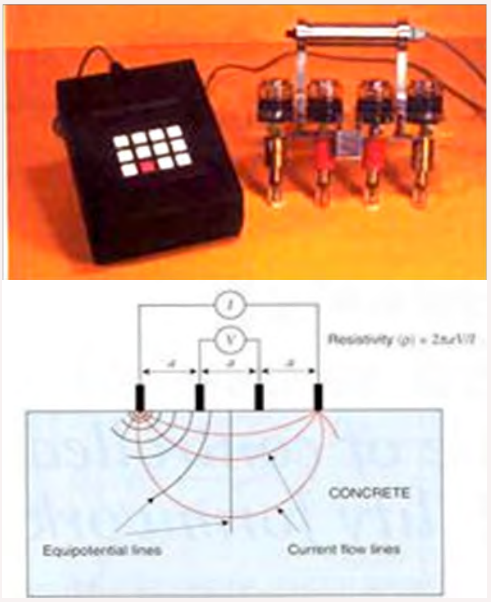


Figure 16 *Four Probes Resistivity Testing*

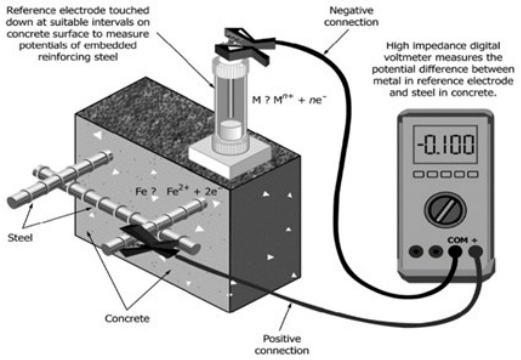


Figure 17 *Half Cell Potential Mapping*

4. Preservation, Repair and Protection of Rebars

Principle 1 to 6 in BS EN1504 covers principles and methods of repair and protection for concrete (aggregates, cement, water and sand) and Principle 7 to 11 refers to principles and methods in mitigation and remedy against corrosion of rebars.

- Principle 1 [PI] Protection against Ingress refers to stoppage of water intrusion.
- Principle 2 [MC] Moisture Control refers to control of dampness.
- Principle 3 [CR] Concrete Restoration refers to Non-Structural Repairs.
- Principle 4 [SS] Structural Strengthening refers to Structural Repairs.
- Principle 5 [PR] Physical Resistance aims to increase resistance to damage caused by impact.
- Principles 6 [RC] Resistance to Chemicals aims to increase resistance to chemical attack.

The focus in this article is Principle 7 to 11 that elaborates on the methods of preservation, repair and protection of rebars by influencing the components needed in corrosion cell.

Principle 7 [RP] covers the Re-Passivation of contaminated concrete without corrosion by increasing the alkalinity of contaminated concrete by topping new mortar with high level of alkalinity.

Principle 8 [IR] Increasing Resistivity aims to block the moisture to reach the rebars with impermeable coating derived from epoxy, poly urethane or acrylic.

Principle 9 [CC] Cathodic Control aims to block the oxygen from reaching the rebars with cathodic areas with impermeable coating.

Principle 10 [CP] Cathodic Protection (CP) applies electrical potential to retard the corrosion reaction at the potentially anodic areas of reinforcement. CP is particularly suitable in severely contaminated areas due to the presence of chlorides.

Principle 11 [CA] Control of anodic areas by using coating with active pigment, barrier coating or rust inhibitor.

These measures in corrosion control are ideally complimented by crack treatment, concrete restoration and surface coating in order to limit moisture and prevent further contamination.

4.1 Preserving and Restoring Passivity [RP]

4.1.1 Increasing cover with additional cementitious mortar or concrete

This method works if the corrosion has not started and the initiation of corrosion can be delayed by hindering Carbonation and Chloride attack by increasing the thickness of concrete cover.

Figure 18 *Adding mortar or concrete*
Source:https://www.youtube.com/watch?v=3mhrGshlgul

4.1.2 Replacing contaminated or carbonated concrete

When Carbonation and Chlorides reach the rebars, de-passivation film is broken down and corrosion is triggered. The contaminated concrete need to be physically removed with mechanical force, i.e. hacker or high pressure jetting, up to the depth where such contaminants exist in the concrete and replaced with fresh repair mortar or concrete.

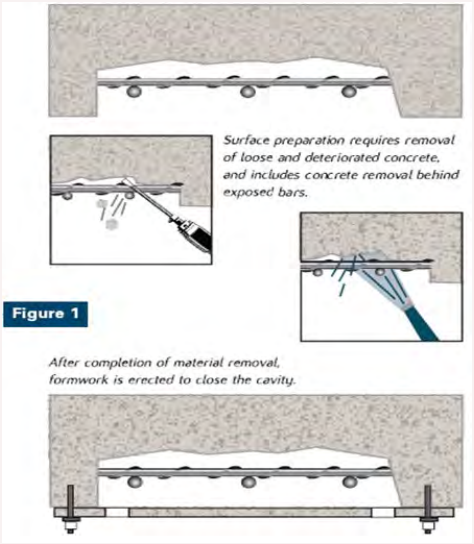


Figure 19 *Replacement of contaminated concrete*
Source: https://precast.org/2010/05/concrete-repairs/

Carbonated concrete is relatively harder and micro cracking is a major concern when hacking takes place. High pressure jetting or hydro demolition on the other hand, does not cause micro cracking but it is a very slow process involving removal of sludge which is very troublesome in occupied buildings.

Corroded rebars with diameter loss above 25% must be replaced. Then, new rebars are tightened or welded to the adjoining rebars. In order to prevent secondary corrosion at the joints between the existing concrete and new concrete, sacrificial anodes must be installed or coating with active pigment (Zinc or highly alkaline cement) must be applied to the exposed rebars.

4.1.3 Re-alkalisation of carbonated concrete by diffusion

By applying a thick layer of highly alkaline concrete or mortar on damp carbonated concrete, the high concentration of OH^- from the new cement diffuse to the existing concrete with low OH^- concentration via osmosis. The success of such method relies on the thickness of new mortar or concrete and the dampness in the concrete that enables successful diffusion. Nevertheless, the major pitfall is the additional dead load to the existing structure.

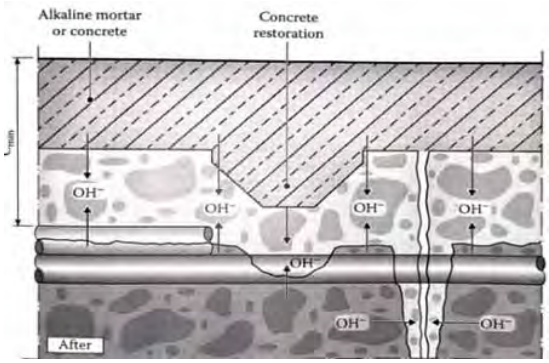


Figure 20 *Re-alkalisation of carbonated concrete by diffusion*

4.1.4 Electrochemical chloride extraction

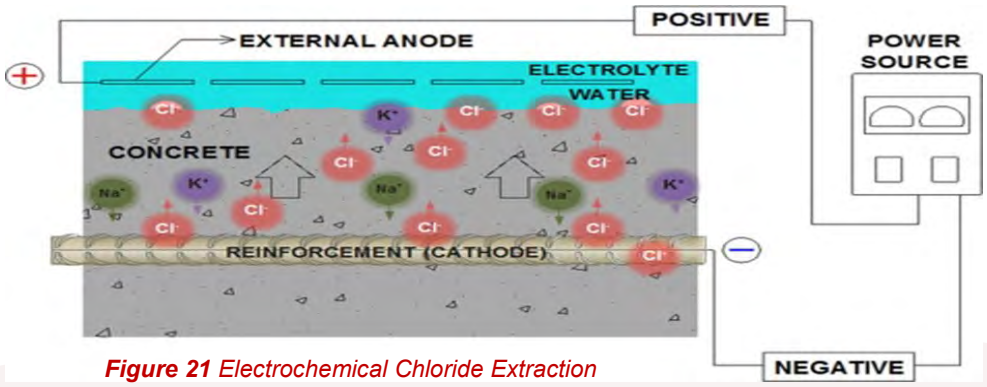


Figure 21 *Electrochemical Chloride Extraction*

At electrical potential of 4 Volts, the impressed current can extract negatively charged Chloride ions to move away from the rebars toward the temporary anodes, hence ceasing the chloride attack and corrosion thereof.

4.2 Increasing Resistivity [IR]

The objective of increasing resistivity is to enhance resistance against dampness, water ingress and environmental pollutants like Carbon Dioxide Gas and Chloride Attack. It includes surface treatment, coating and sheltering.

Figure 22 *Single ply membranes against water ingress*

4.3 Cathodic control [CC]

Principle 9 Cathodic Control [CC] requires the access of oxygen to all potentially cathodic areas to be restricted in order to retard an anodic reaction. In marine environment, saturation of the entire self-contained reinforced concrete structures under water can restrict access of oxygen when it is isolated electrically from all other concrete members above the water. Alternatively, full surface coating with impermeable resins can also effectively isolate the rebars against oxygen needed for triggering or sustaining the oxidation process.

Figure 23 *Anti Carbonation Paint on the Piers of MRT in Bangsar*

4.4 Cathodic Protection [CP]

4.4.1 Applying electrical potential

Cathodic Protection and Electrochemical Chloride Extraction is similar to electrochemical process of the electrolysis of water.

Traditionally, activated titanium meshes or drilled-in core anodes are installed on the concrete elements with topped up mortar in order to complete the circuit. New technology with application of Conductive Coating like carbon containing paint on the concrete elements has substantially improved the affordability and workability of this method.

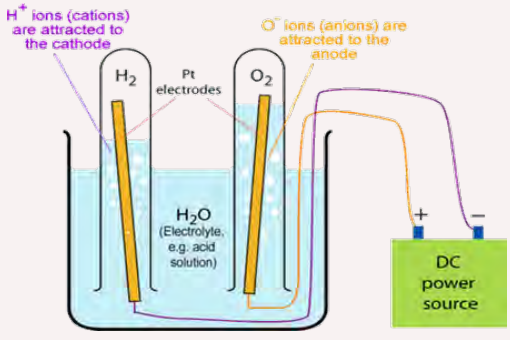


Figure 24 *Electrolysis of Water*
Source:https://www.cyberphysics.co.uk/topics/electricity/static/electrolysis.htm

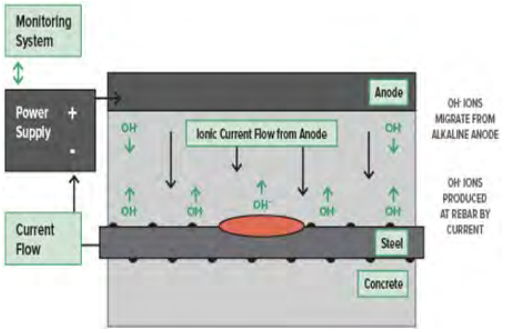


Figure 25 *Electrochemical realkalisation of carbonated concrete*

Cathodic Protection works particularly well in chloride contaminated concrete with no physical damage or spalling. It breaks down water into hydroxyl ions under the oxygen reduction and electrolysis.

$$\tfrac{1}{2}\, O_2 + H_2O + 2e^- \rightarrow 2\, OH^-$$
$$2\, H_2O + 2e^- \rightarrow H_2 + 2\, OH^-$$

By introducing Direct Current to the contaminated concrete, water is broken down to form hydrogen gas and hydroxyl (OH^-) when the rebars are connected to the Cathode with specific voltage. The additional hydroxyl re-alkalines the contaminated concrete. At different voltage, Direct Current can extract negatively charged Chloride ions to the direction of the temporary anode in similar manner.

4.4.2 Sacrificial anodes

Although, this method is not covered in BS EN1504, it has been applied widely especially in small scale concrete repairs.

It harnesses the gradient in the potential of different metals with the flow of electrons from less noble metal (sacrificial anode) to the more noble metal (protected cathode). In the protection of steel rebars, Zinc based sacrificial anodes are commonly adopted .

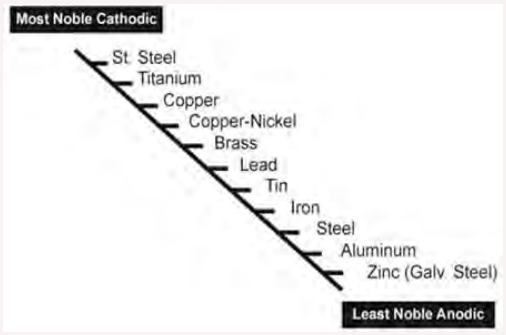


Figure 26 Nobility table
Source:http://www.eurotubieuropa.it/english/NL/2014/09/nl_09_5.html

The major pitfall in such method is the small coverage of protection with short limited lifespan. The durability depends on the size of the anodes and the moisturizer that conduct the flow of electrons.

4.5 Control of Anodic Areas [CA]

4.5.1 Active coating of the reinforcement

In this method, commonly adopted active ingredients include high pH cement based and zinc-based materials.

Figure 27 *Zinc based sacrificial* ***anodes***
Source:https://www.vectorcorrosion.com/blog/cathodic-protection-concrete-corrosion-prevention

Firstly, the rebars must be exposed and cleaned thoroughly. Then, active coating with high pH cementitious product or zinc-based coating is applied in order to repassivate the contaminated concrete. Lastly, the affected concrete is restored based on the principles in Concrete Restoration, accordingly.

The durability of this method depends heavily on the thickness of the active coating and regular monitoring is important due to the varying thickness in actual application.

4.5.2 Barrier coating

By applying barrier coating with epoxy resins, the rebars can be insulated and protected against corrosion. This method can only be applied during the construction stage after placing the rebars in the formwork. The effectiveness depends on the surface preparation, bonding of the coating to rebars and completeness of coating, including the congested and bottom side of the rebars. The major consideration in this method is the bonding of the coated rebars to the concrete mortar.

Figure 28 *Epoxy coated rebars*

4.5.3 Corrosion inhibitors

Corrosion inhibitors are chemicals that are capable of promoting a reduction in corrosion rate without significantly altering the concentration of any corrosion agent. There are number of inhibitors, ranging from organic based to inorganic based inhibitors with different active ingredients that can either retard the anodic reaction or cathodic reactions or both, depending on the type of active ingredients and the quantity used.

Absorption is the key performance criterion and it depends on the porosity and the thickness of the concrete cover. Since no standard has been developed in the use of inhibitors, understanding the chemistry of

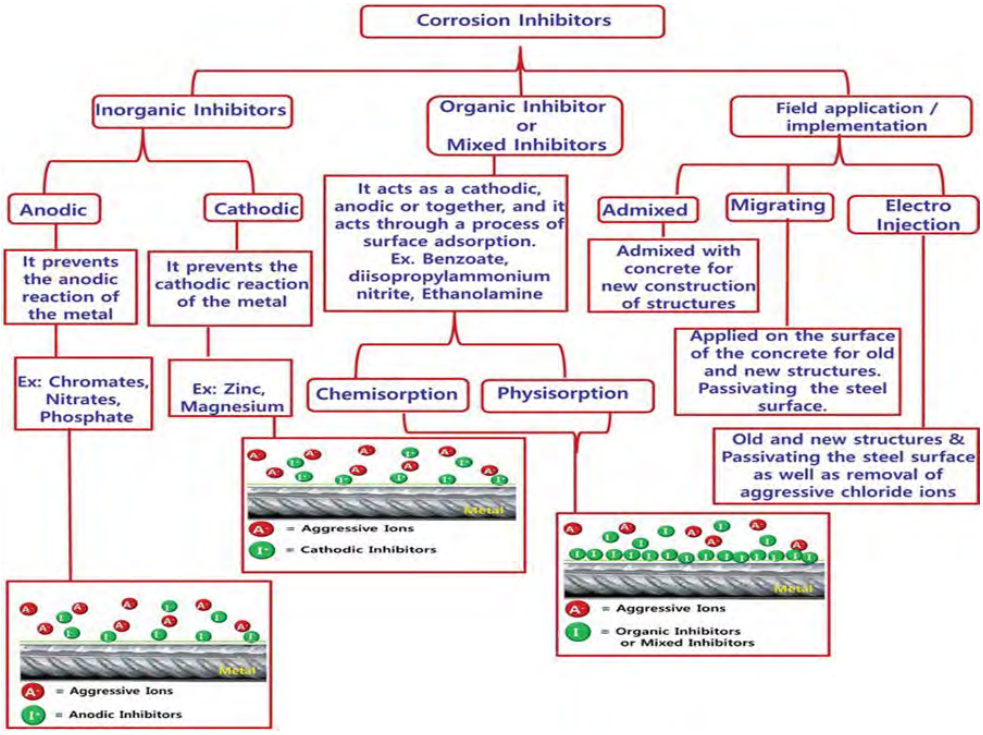


Figure 29 *Classification of Corrosion Inhibitors*
Source:https://www.intechopen.com/books/corrosion-inhibitors-principles-and-recent-applications/corrosion-inhibitors-for-reinforced-concrete-a-review

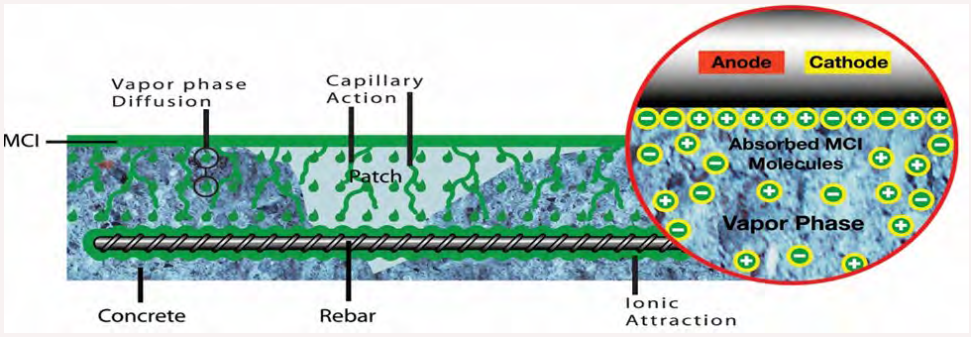


Figure 30 *Migrating Corrosion Inhibitors*
Source:https://www.concreteconstruction.net/products/decorative-concrete-surfaces/organic-corrosion-inhibitor-from-cortec_c

the active ingredients and pollutants at sites is of the utmost importance. It is recommended to carry out experiments in some trial areas prior to any mass application at sites.

5. Recommendations

The awareness in diagnose, repair and protection of rebars against corrosion is in its infancy in Malaysia. The technology mentioned in the article has been used widely in the oil and gas industry. In the maintenance of building structures, the costs in corrosion control once corrosion occurs are relatively high. Nevertheless, it is critical in restoring the affected structures into the original performance and service lifespan.

Although there are numerous methods in corrosion control and mitigation, these methods have their respective pitfalls and criteria for performance. For instance, use of stainless steel rebars is ideal but it costs 2.5 to 3 times more expensive than ordinary carbon rebars. Coating and sacrificial anodes has limited service lifespan. Coating must be thorough. Uncoated areas become anodes with small areas subjected to high level of corrosion, if the corrosion cell is developed. Cathodic protection does not involve hacking and removal of contaminated concrete, it increases the acidity of concrete at the cathodic terminals.

Thus, selection of corrosion control and mitigation strategies must be done with due care with consideration to the criteria needed for optimal performance and the maintainability thereof.

In the case of rebars, protection is better than cure, especially in the protection against dampness.

6. References

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TECHNICAL ARTICLE 2

THE EFFECT OF STORAGE DEVICE OF FTIR SPECTRA ON THE DEGREE OF SIMILARITY USING *COMPARE* ALGORITHM FOR PAINT FINGERPRINTING

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Introduction

Progressive work concerning the implementation of "*Coating Fingerprint Certificate*" in order to monitor the batch-to-batch consistency of protective paints has resulted in the release of the Institute of Materials, Malaysia (IMM) standard FP01:2020 [1]. In this standard, which will be migrated to Malaysian Standard in 2021, a degree of similarity (*r*) is obtained by comparing the Fourier-transform infrared (FTIR) sample spectrum to a Reference spectrum. The acceptance threshold of *r* values for the wet paints that are supplied to the oil and gas industry shall be equal or greater than 0.900 ± 0.002 [2]. This FTIR fingerprinting procedures for batch-to-batch consistency of materials are applicable to polymeric paints [2-5] and raw materials [6, 7]. It is also possible to differentiate counterfeit products (cosmetic and plastic bottles) from original products sourced from unauthorized and authorized seller, respectively [8].

We would like to highlight one potential technical issue during 3rd-party inspection. For a particular brand of the FTIR software, the storage device of the FTIR Reference or sample spectrum may influence the generated *r* values. Schematic representation of the first issue is illustrated in **Figure 1**. To review this issue, we first store the spectra files in different storage devices, namely harddisk (HDD) and thumbdrive, and the selected FTIR software was used to call out the files and the *compare* algorithm was adopted to generate *r* values. Spectra from different spectrophotometers were studied. Since these spectrophotometers use different file extensions (*i.e.* Thermo Scientific uses *.spa, Bruker uses *.0, Perkin Elmer uses *.sp and Agilent uses *.spc and *.a2r), it is also important to explore if the *r* values, generated from the *compare* function of spectra files from different storage devices, may differ across different spectrophotometers.

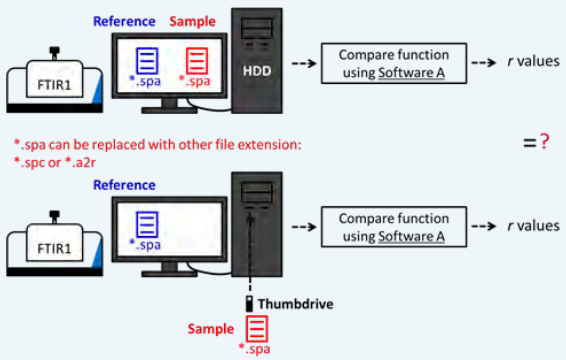

Figure 1 *Schematic representation of possible issue (storage devices) that may arise during data processing.*

Experimental

Glass flake epoxy (coded as 'EpoxyFlake'), part A and part B, from paint manufacturer 5 (the identity of paint manufacturer was concealed due to competing business entities) and epoxy (coded as 'Epoxy') sample, also part A and part B from paint manufacturer 2 were used in this study. The sample was analyzed using four FTIR spectrophotometers of different brands and labeled as 'A', 'B', 'C' and 'D' with 32 number of scans at a resolution of 4 cm^{-1} from 4000-700 cm^{-1}. Detailed method about *compare* function can be found in ref. [9].

Results and discussion

After the epoxy flake samples were analyzed using spectrophotometer A, the generated *.spa sample spectra were stored in HDD and thumbdrive. The averaging of nine FTIR spectra from **T**op, **M**iddle and **B**ottom of the mixing tank yields a Reference spectrum and this spectrum was stored in HDD. The *r* values were then generated using *compare* function (available in Software A) on the *.spa sample spectra in the HDD in reference to the *.spa Reference spectrum. Likewise, the same process was repeated for the sample spectra that are stored in thumbdrive. Besides *.spa format, the spectra generated from spectrophotometer D running on different file formats (*.spc or *.a2r) were also tested.

Results from **Table 1** show that there is no significant distinction between the *r* values estimated using *compare* algorithm of Software A, when the sample or Reference files are stored in HDD or in thumbdrive. All the *r* values within the entire FTIR region (4000-700 cm^{-1}) and universal fingerprint region (2000-900 cm^{-1}) are above the acceptance threshold at 0.900 ± 0.002. Other results of wet paints from different paint manufacturers analyzed with spectrophotometers B and C (data not shown) are similar to the results obtained by using spectrophotometer A and software A. We suggest that that there is no significant difference of *r* values either storing the sample files in HDD or thumbdrive.

However, precaution must be taken when analyzing the spectra using spectrophotometer D. There are at least two file formats for FTIR spectra in spectrophotometer D such as *.spc and *.a2r. If both Reference and sample files with *.spc file format were stored in either in thumbdrive or HDD, the files have to be imported into the software and this occasionally leads to lower *r* values as compared to the values determined using *.a2r files that were stored in HDD. The *r* values from *.spc files are similar in HDD and thumbdrive. This can be observed in epoxy flake part B sample over the entire region (4000-700 cm^{-1}) of FTIR spectra, with the average *r* values reported to be around 0.660.

Table 1 *The r values for EpoxyFlake5$_B$ (part A and part B) spectra stored in (a) HDD and (b) thumbdrive, collected using spectrophotometer A (*.spa analyzed using software A) and spectrophotometer D (*.spc or *.a2r analyzed using software D)*

Sample	Reference	*.spa (spectrophotometer A; software A)				*.spc or *.a2r (spectrophotometer D; software D)			
		HDD		Thumbdrive		HDD		Thumbdrive	
		4000 - 700 cm^{-1}	2000 - 900 cm^{-1}	4000 - 700 cm^{-1}	2000 - 900 cm^{-1}	4000 - 700 cm^{-1}	2000 - 900 cm^{-1}	4000 - 700 cm^{-1}	2000 - 900 cm^{-1}
EpoxyFlake5$_A$_A_B1B1	EpoxyFlake5$_A$_A_Ref	0.9991	0.9994	0.9991	0.9994	0.9997	0.9997	0.9224	0.9775
EpoxyFlake5$_A$_A_B1B2		0.9997	0.9998	0.9997	0.9998	0.9999	0.9999	0.9218	0.9740
EpoxyFlake5$_A$_A_B1B3		0.9995	0.9997	0.9995	0.9997	0.9998	0.9998	0.9206	0.9723
EpoxyFlake5$_A$_B_B1B1	EpoxyFlake5$_A$_B_Ref	0.9987	0.9993	0.9987	0.9993	0.9998	0.9930	0.6597	0.9545
EpoxyFlake5$_A$_B_B1B2		0.9994	0.9997	0.9994	0.9997	0.9999	0.9932	0.6581	0.9531
EpoxyFlake5$_A$_B_B1B3		0.9989	0.9994	0.9989	0.9994	0.9998	0.9932	0.6609	0.9538

Other results from epoxy part A/part B from manufacturer 2 as well as universal fingerprint region (2000-900 cm^{-1}) are well above the acceptance threshold (0.900 ± 0.002). This suggest that the process, either calling out the spectra files from HDD or thumbdrive of specific extension file from spectrophotometer D, may have impact on the *r* values generated using software D. If the 3rd-party inspector does not pay attention to this possible technical issue, the inspector may falsely reject the paint sample. In the case of FTIR spectra with *.a2r file extension, the spectra can only be detected if they were saved in HDD. Otherwise, this *.a2r has to be also imported into the software and have lower *r* values than that from *.a2r file extension that is saved in HDD. The IMM Certified Coating Fingerprint Quality Controller Level 2 course is going to give a gimmick to troubleshoot this

Conclusion

In general, the *r* values estimated using *compare* algorithm of FTIR software has no correlation to the storage devices of the FTIR spectra for most of the brands of the spectrophotometers. It may have impact for one brand of the spectrophotometer (*i.e.* Spectrophotometer D). The *r* values generated by files extension *.spc in thumbdrive are always lower than the files extension *.a2r in HDD. Thus, it may lead to unnecessary rejection of the paint samples. Analyst should be made aware when choosing these files extensions for determining the *r* values using this particular brand of FTIR spectrophotometer and software.

Acknowledgement

The authors gratefully acknowledge Serba Dinamik Holdings Bhd. [100-IRMI/PRI 16/6/2 (024/2018)] for the financial support of the research works.

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Note: all the publications related to the coating fingerprint can be viewed at https://www.iomm.org.my/related-publications-on-coating-fingerprinting/

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TECHNICAL ARTICLE 3

FTIR QUALITATIVE ANALYSES FOR QUALITY ASSURANCE AND QUALITY CONTROL OF PROTECTIVE PAINTS

ABD RASHID Norsyazlin[1], **SALIM** Yoga Sugama[1], **ABDUL HALIM** Suhaila Idayu[1], **HARUN** Mohammad Kamal[1], **ONG** Chong Hup[2], and **CHAN** Chin Han*[1]

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Introduction

Fourier-transform infrared (FTIR) spectroscopy equipped with attenuated total reflectance (ATR) has been used to monitor the batch-to-batch consistency and authentication of paint and coating materials. This technique is fast, reliable and requires little or no sample preparation. However, it requires skilled and trained analysts to analyze the overlapping absorption bands associated to the functional groups of the chemical mixtures in the paints or coatings. During FTIR analyses, the functional groups of the sample associated with wavenumbers of the FTIR spectroscopy need to be firstly identified and compared (using the assignment band table found in many chemistry books) or with the assistance from FTIR software (using spectral search and interpretation) (technique **I**, a common practice in testing laboratory). The assigned bands are set based on the effects of atom relative mass, bond force constant and atom geometry [1,2]. Next, (technique **II**, a common approach for academic research) a curve fitting can be performed after the assignment of absorbance bands for the functional groups of the interest or (technique **III**) spectra matching.

The curve fitting coupled with deconvolution technique provides valuable qualitative information on compositional variation of known components in a sample. This technique is possible but may not be practical for the batch-to-batch consistency or authentication of paint samples. There are few critical parameters that must be taken into account during the deconvolution of FTIR bands, which include distinguishing the band shape, numbers, position, bands width as well as the baseline [3,4]. The band shape can be usually fitted with Lorentzian, Gaussian or Voigt (a convolution of Lorentzian and Gaussian) depending on the type of sample, principal effects of (Doppler, collision, proximity) broadening and instruments used [5]. In this study, the polymeric paint resin was characterized using FTIR spectroscopy. Based on the above criteria, the FTIR spectrum of polymeric resin has a distribution that inclines towards a Gaussian distribution. Curve fitting can be done by a random or an automatic selection of band positions and numbers without band assignments, thus it may lead to different and possibly unreliable interpretation of results by different analysts. For spectral matching, a degree of similarity (indicated by *r* values) between two FTIR spectra can be estimated using a *compare* algorithm that is available in the FTIR software. This paper aims to compare the efficiency and practicality between techniques **II** and **III** for quality assurance and quality control (QA and QC) for routine batch-check and authentication of paints.

Experimental

Titania pigment [Titanium dioxide (TiO_2) rutile-anatase mixtures, *i.e.* R20-A80 and R40-A60 *wt*:*wt*] and epoxy resin (Epikote828 and Epikote1001) were used in this study. The FTIR measurement and evaluation method were according to IMM FP01:2020 [6]. The spectra collected using Invenio (Bruker, Massachusetts, USA) and Nicolet iS10 (Thermo Scientific, Madison, USA) respectively, were analyzed using three FTIR qualitative analyses, such as identification of functional groups (**I**), curve-fitting (**II**) and spectra matching (**III**). A specific region of IR spectrum was chosen and curve-fitted with a suitable number of bands depending on the pre-identified wavenumbers of functional groups. Before the curve fitting, baseline correction was performed to eliminate the effect of scattering [7]. The *r* values of sample were generated by comparing the two spectra using the built-in *high sensitivity compare* algorithm of the OMNIC software Suite (Thermo Scientific, Madison, USA). This algorithm depends on *x*- (wavenumber) and *y*- (absorbance) vectors. If $r = 1$, it means a complete matching between the sample spectrum and Reference spectrum.

Results and discussion

Technique II: There are three overlapping absorbance bands in TiO_2 spectra detectable at 872-360 cm^{-1} fingerprint region. These bands, identified as Ti-O stretching vibrations, were fitted with 3 bands at wavenumbers 621 cm^{-1}, 454 cm^{-1} and 404 cm^{-1} [8]. **Figure 1** shows the curve fitting result of TiO_2 rutile-anatase mixture. The total curve-fitted line (red dashed line) matches well to the curve of spectrum (black solid line). Area under the curve-fitted absorbance bands for R20-A80 was estimated to be 111, 18, 24 auc ('auc' stands for area under the curve), while the area under curve-fitted bands for R40-A60 was 103, 18 and 22 auc, respectively. The areas of two absorption bands at 621 cm^{-1} and 404 cm^{-1} in the rutile-anatase mixture decrease with increasing rutile content.

Technique III: Similar observation can be seen when R40-A60 spectrum was compared against R20-A80 spectrum at the same fingerprint region using *high sensitivity compare* algorithm. Low *r* value recorded for R40-A60 when compared to R20-A80 ($r = 0.878$).

Summary: This suggests that both techniques (**II** and **III**) are capable to differentiate two mixtures/compounds with different compositions in one sample. The reproducibility of two samples with the same composition by using both techniques will be deliberated next.

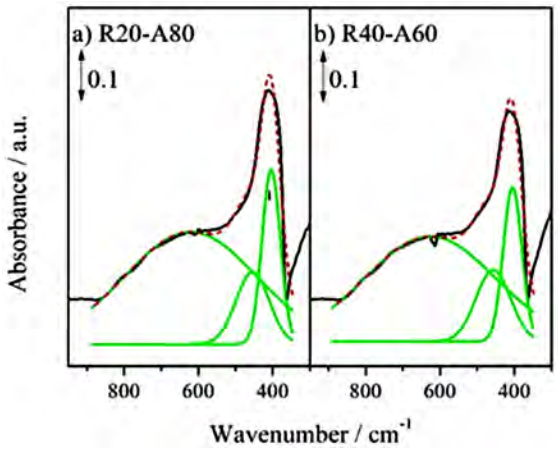

Figure 1. *The curve fitting of TiO_2 rutile-anatase mixture centered at 621 cm^{-1}, 454 cm^{-1} and 404 cm^{-1}.*

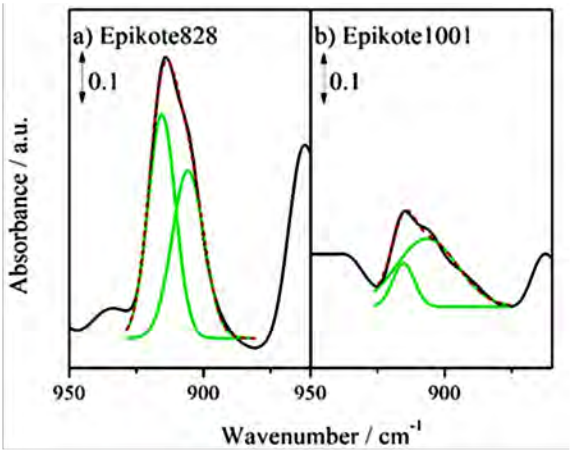

Figure 2. *The curve fitting of Epikote828 and Epikote1001 centered at 915 cm^{-1} and 906 cm^{-1}.*

Figure 2 shows the curve fitting result of two epoxy resins, Epikote828 and Epikote1001, at 930 cm^{-1} to 880 cm^{-1}. Salim *et.al.* (2020) commented that both epoxy resins have similar chemical structures but differ in the number of repeating monomer units. The difference can be seen at the intensity of absorption band around 900 cm^{-1} [9]. This absorption band is in fact the overlapping absorption bands of (C-O-C) and (C=C) of saturated epoxide [2]. Thus, the bands were fitted with two peaks centered at 915 cm^{-1} and 906 cm^{-1}, respectively. Areas under the two curve-fitted bands for Epikote 828 are estimated to be 1.51 and 1.31 auc respectively, while the areas for two curve-fitted bands for Epikote1001 are 0.23 and 1.06 auc, respectively. The overlapping band areas of Epikote1001 are significantly lower than that of Epikote828. The consistency of these values is further verified by doing replication. **Table 1** shows three attempts of the curve fitting by different analysts on Epikote 828 from batch 2 that result in different area values. The inconsistency of values from curve fitting implies that the analysts need to be skillful and careful on choosing the right band positions and center bands during curve fitting.

Besides curve fitting, the sample spectra of Epikote828 was also compared against Epikote1001 using the *compare* function. The *r* value of Epikote1001 in reference to Epikote828 is 0.635. This number ($r << 1$) indicates dissimilarity between the two resins. The consistency of *r* values generated by different analysts on epoxy resin with the same formulation was also attempted. The degree of similarity values remain constant at $r = 0.999$ across three different analysts on the three FTIR scans of the same epoxy resin sample. It has been shown that the results of technique **III** is reproducible and its evaluation protocol is more efficient than technique **II**.

Conclusion

FTIR analyses of TiO_2 mixtures and epoxy resins were conducted. The degree of similarity approach (technique **III**) is deemed practicable and feasible for the implementation of '*Coating Fingerprint Certificate*' in the oil and gas industry as compared to curve fitting (technique **II**) after functional group identification (technique **I**). IMM FP01:2020 [6] relies on degree of similarity for the batch-to-batch consistency checking for wet paints. This standard has been made suitable for skilled personnel in the oil and gas industry to interpret the testing results by "accept" or "reject" the sample with the acceptance limit of $r \leq 0.900 \pm 0.002$ for full and fingerprint regions.

Table 1. *Results after deconvolution and spectra matching of two batches (batch 1 and batch 2) Epikote 828*

Sample code	Wavenumber (cm^{-1}) (left column) and Deconvolution area (auc) (right column)				*r* value
	C-O-C		C=C		
Epikote828-1	915.6	1.51	905.8	1.31	Ref
Epikote828-2a	915.7	1.43	906.1	1.37	0.999
Epikote828-2b	915.5	1.52	905.8	1.30	0.999
Epikote828-2c	915.2	1.15	905.2	1.65	0.999

a,b,c represent three different analysts
Epikote828-1 means Epikote828 from batch 1
Epikote828-2 means Epikote828 from batch 2

Acknowledgment

The authors gratefully acknowledge the research funding from Serba Dinamik Holdings Bhd. [100-IRMI/PRI 16/6/2 (024/2018)] for the financial support of the research works.

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Note: all the publications related to the coating fingerprint can be viewed at https://www.iomm.org.my/related-publications-on-coating-fingerprinting/

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STUDENT EDITORIAL

DEVELOPMENT OF COMPOSITE BOARD AND CHAIR USING INDUSTRIAL FIBER BY-PRODUCTS

Introduction

The reinforcement of the composite fibreboard is typically using the synthetic fibre which might affect the environment adversely and generally are not biodegradable [1]. Furthermore, the massive quantities of the industry by-products have raised an important issues regarding the environmental problems due to large amount of residues and the long degradation time. Therefore, industry by-products are proposed to be the alternative reinforcement for composite fibreboard [2]. Natural fibres reinforced composite provide with interesting properties especially those related to the sustainability and the protection of the environment such as the ability to be recyclable, renewable raw material, and less abrasive and harmful behaviour to the ecosystem [3]. In this study, Oil Palm Empty Fruit Bunch (OPEFB) and Palm Kernel Shell (PKS) fibres were implemented as fibres/reinforcement, epoxy resin was applied as matrix, eggshell powder was used as filler, and hardener was used as additives. The goal of this research is to study, formulate, design, fabricate, test, and evaluate the chair prototypes (fibreboard) using the industrial by-products. The performance of the composite boards was evaluated by mechanical, water absorption, and corrosion properties. Hence, tensile test, static immersion test and corrosion test were carried out.

Result and Discussion

Seven formulations of test samples were fabricated to carry out tensile test, static immersion test, and corrosion test, as shown in **Table 1**. These formulations were then applied to each layer of the fireboard of the chair prototypes. The formulations for the prototypes are shown in **Table 2**. The tensile test (ASTM D638-03) results were summarized in **Figure 1**. Bartoli (compare sample) was tested and compared with seven test samples. Based on the stress-strain graph, the fabricated samples have a better yield strength, ultimate tensile strength, and Young's modulus as compared to Bartoli. However, Bartoli has the best elongation as compared with the fabricated samples. In practical applications, Bartoli is able to have sufficient elongation before a failure occurs, which is safe for the applications. However, the performance of the fabricated sample is more than adequate for chair applications. For instance, the sample with the worst performance of yield strength and ultimate tensile strength is Sample 5, which is 21.73 MPa, also equivalent to 97.86 kg of load. When used as fibreboard, the thickness is increased, which will improve its load bearing capacity (in the unit of kg), so it is definitely safe for the application [4]. Among the samples reinforced with fibres, Sample 2 shows a better performance in yield strength, ultimate tensile strength, elongation, and Young's modulus, with the value of 39.73 MPa, 39.73 MPa, 1.00 %, and 35.52 MPa, respectively. This indicates that the eggshell as a filler will improve the compatibility between fibre and matrix, and most importantly eggshell is able to disperse homogeneously in the matrix phase to form isotropic composite materials.

Table 1 *Composition of natural fibres composite samples (weight percentage)*

Weight Percentage (% wt)					
Specimen	Fibres		Matrix	Additives	
	OPEFB	PKS	Epoxy Resin	Eggshell	Hardener
1	-	-	80.00	-	20.00
2	-	-	64.80	19.00	16.20
3	4.00	-	64.80	15	16.20
4	-	9.00	64.80	10.00	16.20
5	-	19.00	64.80	-	16.20
6	-	30.00	56.00	-	14.00
7	1.00	25.00	56.00	4.00	14.00

Table 2 *Composition of natural fibres composite prototypes (weight percentage)*

Weight Percentage (% wt)							
Specimen		Fibres		Matrix	Additives		Ratio
		OPEFB	PKS	Epoxy Resin	Eggshell	Hardener	(Fibre:Matrix)
Prototype 1 (S7)		1.00	25.00	56.00	4.00	14.00	(30:70)
Prototype 2	Aesthetic	-	25.00	60.00	-	15.00	(25:75)
	Layer 2 (S7)	1.00	25.00	56.00	4.00	14.00	(30:70)
	Layer 3 (S3)	4.00	-	64.80	15	16.20	(19:81)

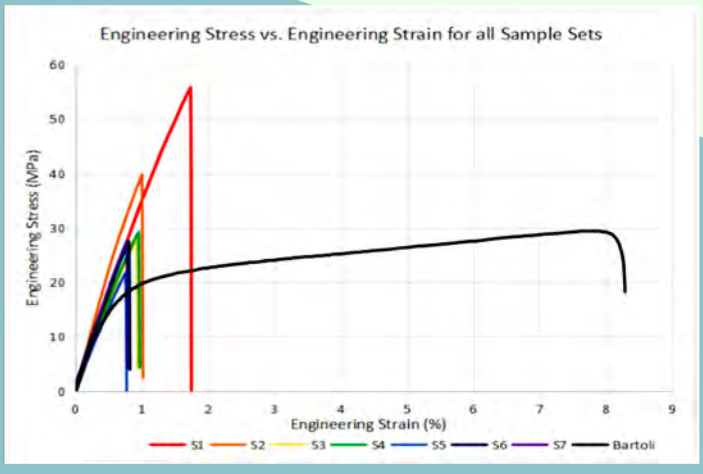

Figure 1 *Representative tensile engineering stress vs. engineering strain responses for all sample sets*

In this project, two prototypes were fabricated. Prototype 1 was made according to the formulation of Sample 7, while the three layers structure were applied on Prototype 2 (first layer: aesthetic layer, second layer: Sample 7, and third layer: Sample 3). As aforementioned, the tensile properties for the fabricated samples with fibre reinforcement are sufficient for application as a chair. Therefore, the goal of the prototype formulations is to apply various type of fibres (PKS and OPEFB) and filler (eggshell) into the chair seat board. Moreover, these prototypes demonstrate that the industrial fibre by-products of Malaysia have the potential to be used for the production of chairs, which maximize the value of wastes. The fabricated prototypes are shown in Figure 2.

The corrosion test was carried out by immersing test samples into the salt water for three weeks and the surface morphology was observed. The samples have excellent corrosion performance, where no obvious changes were observed from the surface as shown in **Figure 3**. Static immersion test was carried out by soaking the test samples into water for three weeks and difference of weights were measured. These samples possessed excellent water resistance property as well, where the percentage weight increment is below 2.5 %, as shown in **Figure 4**.

Figure 2 *Prototype 1 (left) and prototype 2 (right)*

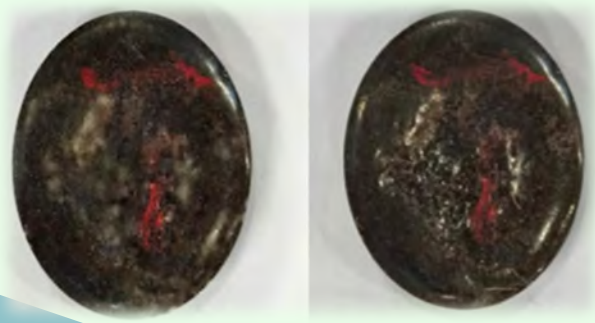

Figure 3 *Surface morphology comparison*

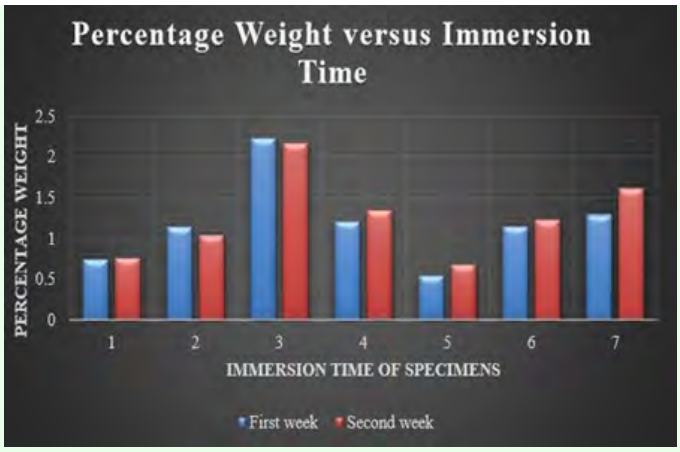

Figure 4 *The graph of the percentage weight vs. immersion time of the seven specimens*

Conclusion

This study shows the potential of the fabrication of fibreboard using industrial by-products (OPEFB, PKS, and eggshell powder). This has definitely reduced the amount of wastes generated, besides making them become valuable and usable. The mechanical, corrosion, and water absorption properties were tested and compared. In short, this research contributed to the effort of attaining a more sustainable and greener future.

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MALAYSIA FINALIST PARTICIPATION IN THE VIRTUAL 2020 YOUNG PERSONS' WORLD LECTURE COMPETITION (YPWLC 2020)


Reported by
Dr. Nur Farhana Hayazi, *UniMAP-MLC 2020 Committee Member, Universiti Malaysia Perlis (UniMAP)*

Edited by
Professor Dr. Esah Hamzah, *Chairperson, Materials Lecture Competition Committee, Institute of Materials Malaysia (IMM)*

Date: 27th August 2020
Venue: Google Meet Online Platform

On 27 August 2020, Ms. Tan Kai Xin, Metallurgical Engineering graduate 2020, Universiti Malaysia Perlis (UniMAP) has won first place in the virtual Materials Lecture Competition (MLC 2020) organized by Institute of Materials Malaysia (IMM), Universiti Putra Malaysia (UPM) and Institute of Materials, Minerals and Mining (IOM3, UK). UPM Serdang, Selangor was the host of the virtual competition event. As the first winner of MLC 2020, Tan Kai Xin became the Malaysia finalist to compete in the international event of 2020 Young Persons' World Lecture Competition (YPWLC 2020) organised by IOM3.

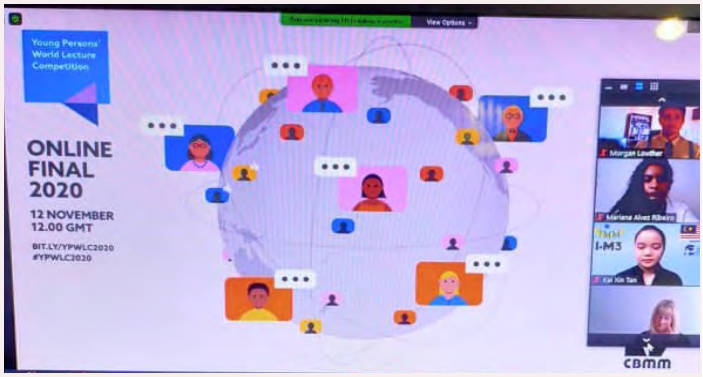

Figure 1: Tan Kai Xin with YPWLC 2020 finalists, judges and audience

YPWLC 2020 was a virtual competition which was held on the 12th November 2020 at 8 pm (Malaysia time) in London, United Kingdom. The seven finalists from around the World were Tan Kai Xin (Malaysia), Anand Jyothi (Australia), Morgan Lowther (UK), Bianca Gevers (South Africa), Wen Di Chan (Hong Kong), Andrey Polyakov (Russia) and Mariana Alver Ribeiro (Brazil). Each finalist presented their technical topic for 15 minutes virtually and answered questions from the three judges appointed by YPWLC 2020 organiser. All the finalists gave an excellent presentation and answered the questions well. Mr. Morgan Lowther from UK won the competition. The second winner was Ms. Bianca Gevers from South Africa and the third winner was Mr. Anand Jyothi from Australia. The YPWLC 2020 was initially planned to be held in Hong Kong. However, due to the Covid-19 pandemic, it was changed to a virtual competition organised from London, United Kingdom.

Figure 2: Tan Kai Xin with YPWLC 2020 finalists, judges and audience

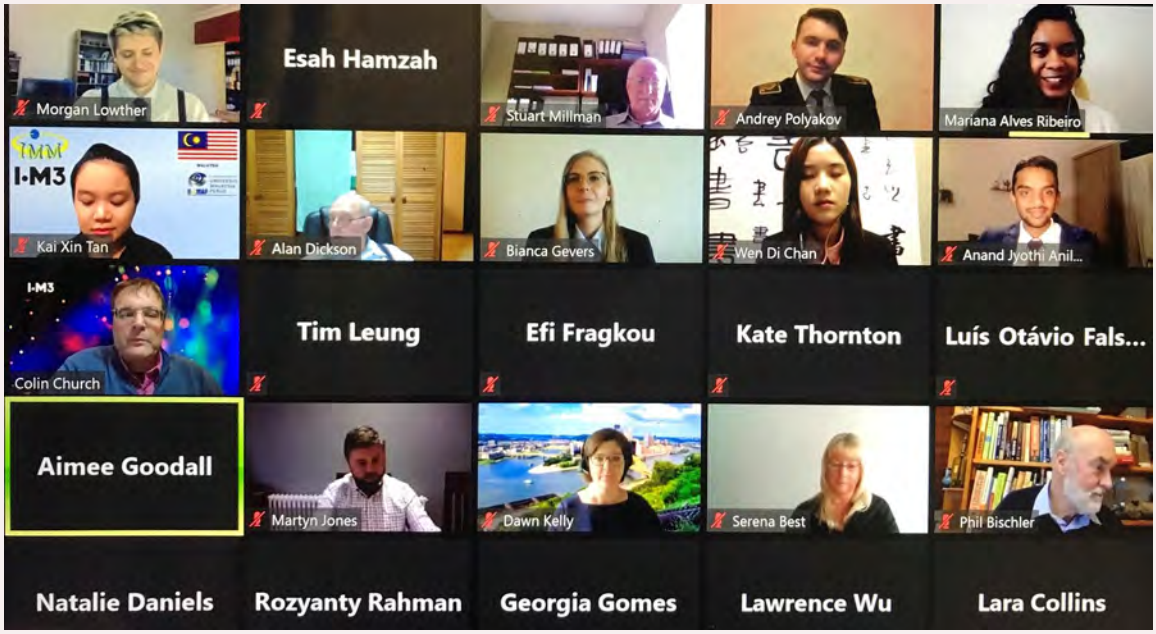

Figure 3: Tan Kai Xin with YPWLC 2020 finalists, judges and audience .

HARI PROFESION TEKNIKAL NEGARA 2020 (HPTN2020)

Webinar Series: Leveraging Materials Technology for Sustainable Future

Reported by
Ts. Wan Mohd Arif W. Ibrahim, *Council Member & IMM-MBOT Assessment Panel Committee 2020-2022, Chairperson, Universiti Malaysia Perlis (UniMAP)*

Date: 14th December 2020
Venue: Google Meet Online Platform

A one and a half hour online technical talk entitled "Leveraging Materials Technology for Sustainable Future" was successfully held on 14th December 2020 through an online Google Meet platform. The talk scheduled in conjunction with the **Hari Profesion Teknikal Negara 2020 (HPTN2020)** that was organized by the Ministry of Works Malaysia. The talk attracted participants from various platforms – government, academia and industry.

Speaker, Ts. Wan Mohd Arif W. Ibrahim, who represented the Institute of Materials, Malaysia (IMM) was invited by the Malaysia Board of Technologist (MBOT) where IMM is the Technical Expert Panel (TEP) for MBOT. He shared his knowledge on how the materials and technology can help to sustain the world. Beside sharing on the general understanding of sustainability and the global Sustainable Development Goals (SDG), he also focused on the specific technical area of waste management – rice husk dump.

At the end of the talk, there was an interaction between speaker and participants through a Q&A session. The talk was also shared through Facebook Live View and received many good responses from the audience.

Figure 1: Ts. Wan Mohd Arif W. Ibrahim presented online technical talk entitled "Leveraging Materials Technology for Sustainable Future" through Google Meet Platform.

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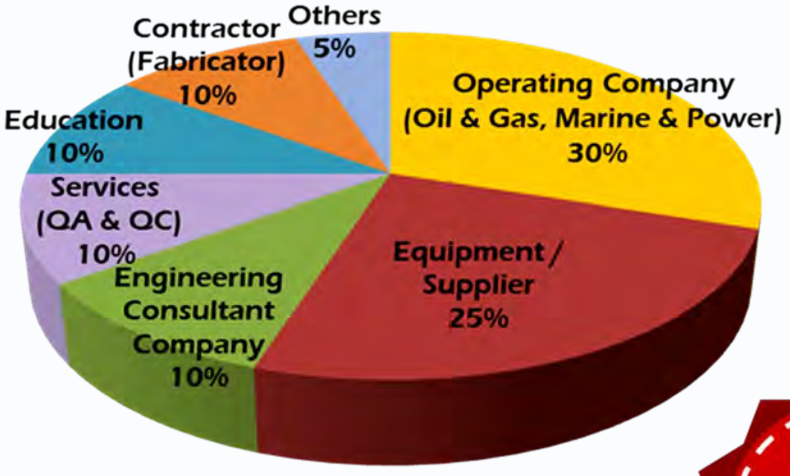

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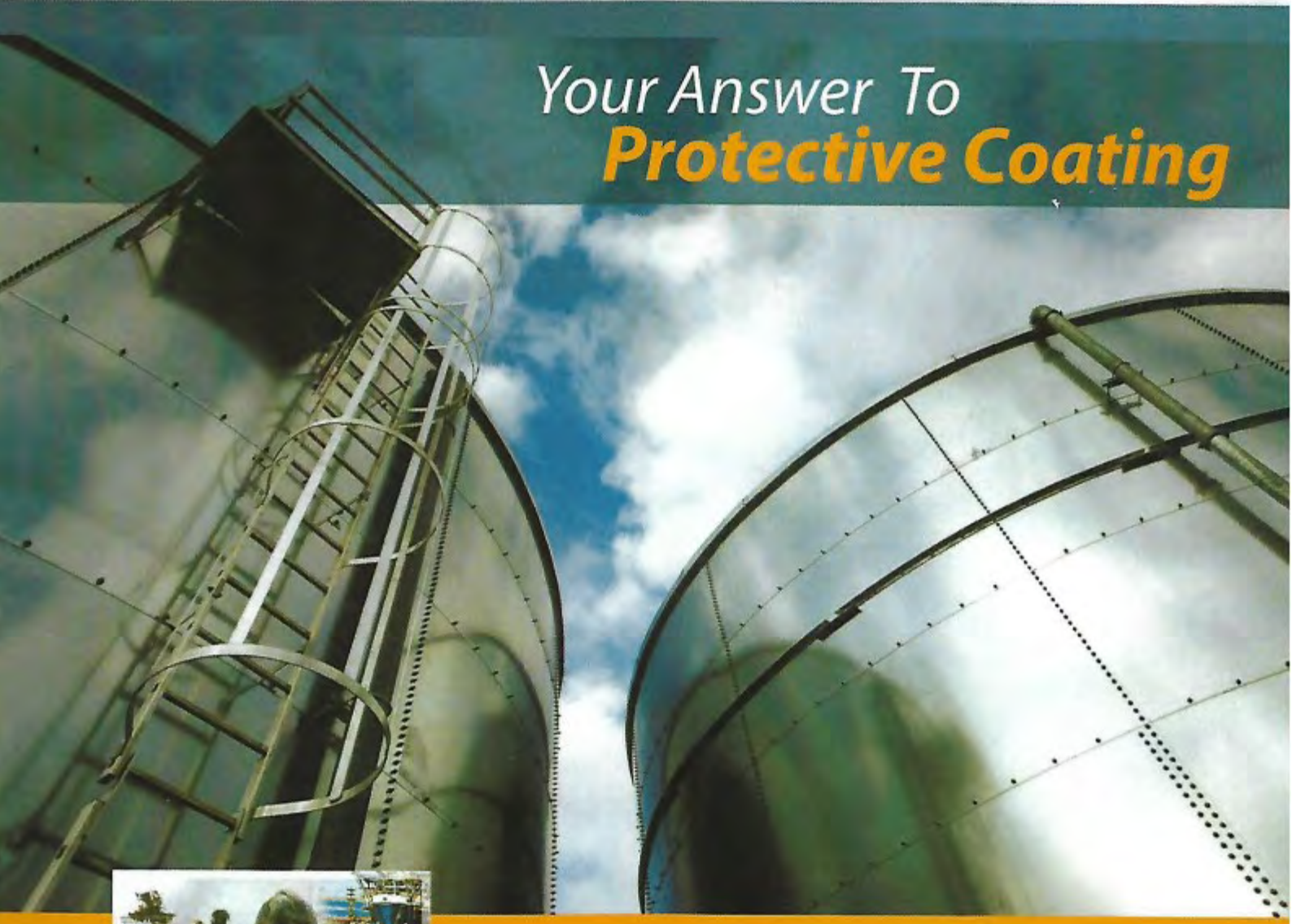

Blasting & Painting Services

STANDARDS MALAYSIA
ACCREDITED CERTIFICATION BODY

QS 04082009 CB 10

ISO 9001:2015
BUREAU VERITAS
Certification

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