



## Rapporteurs' Report of Final Forum on "Towards Fingerprinting of Polymeric Coatings" III

Compiled by Assoc. Prof. Dr. Chia Chin Hua, Universiti Kebangsaan Malaysia

Edited by Ir. Max Ong Chong Hup and Assoc. Prof. Dr. Melissa Chan Chin Han, Editors of Materials Mind

Date	: 20 <sup>th</sup> June 2014
Time	: 2:30 pm - 6.00 pm
Venue	: <b>Glenmarie Golf and Country Club, Shah Alam, Selangor</b>
Jointly organised by	: IMM Polymer Committee IMM Coatings Committee Universiti Teknologi MARA
Participants	: 124 representatives from Petronas, Shell, MMHE, KCC Coating, Jotun, Kansai Coatings, International Paint, Nippon Paint, PPG, Berkers Group, QES (Asia-Pacific), Dyna Segmen, DuTech, CTRM Aero Composites, Technip, SIRIM, MOCA, ETC-CP, ECMI, UiTM, UKM, USM, UPM, UTM, UiTM, UniMAP, TAR UC, TNB Research, etc.
Co-sponsored by	: Research Instrument (M) Sdn. Bhd. Agilent Technologies Sales (M) Sdn Bhd Perkin Elemer (M) Sdn. Bhd. PPG Sigma Sdn. Bhd.

### Introduction:

This is the final forum on "Towards Fingerprinting of Polymeric Coatings". The first and second forums were conducted on 22<sup>nd</sup> March 2013 and 11<sup>th</sup> October 2013, respectively. The main objective of this final Forum is to present the outcome of the IMM Task Force on Coatings Fingerprinting, i.e., tentative Coating Fingerprint Certificate for 2-component intermediate materials of epoxy coatings.

The third forum was attended by 124 participants from oil and gas companies, paint manufacturers, fabricators, blasting and painting contractors, scientific instrument specialists, academicians, researchers and university students .

### the presentation session :-Summary of

Speaker 1	: <b>Mr. Muhd Hawari Hassan, PETRONAS GTS Dept</b>
Topic	: <b>Qualification for New Maintenance Painting System and Products for Offshore Application</b>



The objective of the presentation is to share with audience the progress of previous initiative done by the GTS group in qualifying new coating system to improve the coating performance. Paint failures continue to plague the industry with real-life examples of how corrosion on offshore oil-rig topside facilities, which has a devastating impact to the oil and gas production. Due to this issue, PETRONAS has looked into application and surface preparation of external

coating extensively to resolve one aspect of these problems. PETRONAS is looking seriously into coating issues and trying to cover all possible aspects. PETRONAS GTS with collaboration from SIRIM and Petronas Carigali has encouraged paint manufacturers to propose new methods/options in coating technology for better coatings perform and reducing maintenance cycles. The main key criteria of improvement were to establish a system which has the following features:

- Short time application, e.g. better spread rate
- Simple surface preparation (light blast or power tool)
- On stream application (sweating condition, wet condition and elevated temperature)
- Flexible (no restriction to number of layers, thickness and formulation type)

The speaker closed out his talk by notifying audience that there were successful systems which have passed the acceptance criteria and many more systems are undergoing trial and evaluation.

Speaker 2	: <b>Ms. Michelle Lee Jia Yin, Research Instruments (M) Sdn. Bhd. Assoc. Prof. Dr. Melissa Chan Chin Han, Universiti Teknologi MARA &amp; IMM</b>
Topic	: <b>FTIR Spectroscopic Method for Laboratory Analysis for Polymeric Coating.</b>



In this session, Ms. Lee covered the theoretical explanation about how FTIR works, its principle and simple demonstration on how sample of coating was tested to obtain its fingerprint signature. After that, Dr. Chan co-presented the FTIR results for samples of epoxy and hardener obtained from the many trials conducted on different epoxy and hardener samples supplied by local paint manufacturers. The presentation also covered the interpretation of all of the obtained spectra on the following hypothesis:

1. To check if FTIR can confirm homogeneity of epoxies and hardeners obtained from the top, middle and bottom of mixing tank using QCheck High sensitivity feature.
2. To check if FTIR can produce reproducible fingerprint of epoxies and hardeners of different batches.
3. To check if FTIR can provide signature print and correlation between different type of epoxies and polyurethane and hardeners.

The speaker concluded that reference FTIR spectra for epoxies and hardeners can be easily generated; homogeneity of epoxies and hardeners can be observed at the top, middle and bottom of the paint mixing tanks; results are batch-to-batch reproducible and FTIR could differentiate different types of epoxies and hardeners. This presentation

highlighted that fingerprinting of epoxies and hardeners using FTIR in the paint laboratory is possible, simple, reliable, and the results are reproducible.

Speaker 3	: Ms. Chow Mee Ling, Agilent Technologies Sales (M) Sdn. Bhd.
Topic	: Advanced Technology for Polymeric Coatings – What is FTIR Mobile Measurement?



The objective of this presentation is to highlight to the participants that it is possible for onsite assessment of polymeric samples by handheld FTIR spectrometer. Traditionally, polymeric samples are collected and brought to a laboratory for FTIR analysis. The rationale for the development of handheld FTIR spectrometer, i.e. a mobile measurement approach is to enable the analysing instrument to be brought directly to the site and the samples can then be assessed non-destructively. The software and hardware design of a handheld FTIR spectrometer enable both experienced and less experienced users to obtain the required data easily and quickly.

Speaker 4	: Ms. Nurul Asni Mohamed, Chairperson of IMM Task Force on Coatings Fingerprinting
Topic	: Coatings Fingerprint Certificate for Every Batch Manufactured



The objective of the presentation is to present to the audience a template of the Coating Fingerprint Certificate prepared by the Fingerprinting Task Force committee which was formed in April 2013.

The speaker shared the chronology of event on how Task Force on Coatings Fingerprinting was formed in 2013 and how the members have evolved where active participation was sought from various relevant stakeholders. Members of the task force committee consist of representatives from Oil and Gas companies (Petronas, Shell and ExxonMobil), paint manufacturers, SIRIM and scientific instrument specialists. Academicians from Universiti Teknologi MARA, Universiti Kebangsaan Malaysia and IMM are taking part as advisors for the task force. The speaker touch based on the available international standards and specification requiring fingerprinting of polymeric coatings and highlighted that the absence of clear guide in the existing standards on how and what should be reported in the coating fingerprint certificate which fits and satisfies all the key stakeholders.

The speaker presented that the results for different batches of samples are highly reproducible with 90.0% matching criteria. Additional tests were conducted for samples of different shelf life, different priced epoxies and pigments. The speaker presented a matching percentage of 75% for different grades of epoxy with small price difference and a matching percentage of 6% for different grades of epoxy with large price difference. In addition, a matching percentage of 49% was found for epoxy with 3 months and >2 years shelf lives. Thus, the speaker concluded that significant reduction in FTIR matching percentage can be attributed to the use of different grades and different shelf lives of epoxies. The speaker again proposed that the level of acceptance for QA & QC control is 90.0%.

Lastly, the tentative Coating Fingerprint Certificate for 2-

component intermediate materials of epoxy coatings was presented. The speaker proposed that the FTIR testing shall be included in addition to the existing QA & QC tests.

### Q&A Session



Q1. Assoc. Prof. Dr. Melissa Chan Chin Han from IMM asked paint manufacturer attendees about their opinion of adopting the Coating Fingerprinting Certificate into their future quality control procedure. Mr. Robert Lo Tung Ming (KCC) had responded that the FTIR method is indeed easy and doable.



Q2. Dr. Chew Khoo Hee (TAR-UC) asked the purpose of checking the homogeneity of the paint in the mixing tank using FTIR. Assoc. Prof. Dr. Melissa Chan Chin Han from IMM explained that the purpose of doing this is to double confirm the homogeneity of the mixing tank in the paint manufacturing process, in which paint samples collected for various analyses and tests. In fact, the FTIR scan results obtained from paint samples provided by a paint company confirmed that the mixing is indeed homogeneous. Ir. Max Ong Chong Hup from IMM also added that the paint manufacturers would have focused very well in keeping the homogeneity of the paint mixing in the production.

**The task force committee believed that homogeneity of the paint mixing is not an issue. However, the collection of paint samples from top, middle, and bottom of mixing tank is required for the FTIR scans, which can be a good reference if failure happens in future.**



Q3. Ir. Max Ong Chong Hup (IMM) asked opinion from Mr. Muhd Hawari Hassan (PETRONAS GTS Dept), why despite all the vigorous checking and testings on the paints for prequalification by the oil companies there continue to be many paint failures prematurely on the oil & gas structures and facilities? Mr. Muhd Hawari answered that the reason of conducting various prequalification tests on the paints is to ensure that the correct paint systems will be specified for the designed applications. However, what is actually supplied to a project site has been assumed to be the correct type of paints specified. Now that the issue of possible incorrect paints being supplied to the project site has been highlighted, the initiative to fingerprint paints is most welcomed by the industry. Once the quality of paint is assured to be good through fingerprinting, then focus can be enforced on other aspects which need to be addressed more thoroughly, such as paint applications and so on.

**The task force committee strongly believed that this Fingerprinting will help the paint user monitor the quality of paint supplied. At the same time, it can also help in eliminating problem and ensure good quality of paints and application.**



Q4. Ms. Teng Hui Chung from Sarawak Shell Bhd. raised her concerns about the passing rate of more than 90.0% and the basis behind. Ms. Nurul Asni Mohamed, chairperson of IMM Task Force on Coatings

Fingerprinting, answered that the passing rate 90.0% was decided after many cycles of discussion among the task force members, including paint manufacturers, paint users, FTIR specialists, and academia. This passing rate is not available in any standard and IMM is the first party to initiate this standard. The task force committee believed that 90.0% would be a good starting point and it is subjected to further adjustment for better quality control in near future. Assoc. Prof. Dr. Melissa Chan Chin Han from IMM added that the random errors, such as sampling and handling of samples are taken into account. She emphasised that the correlation search algorithm of the FTIR software must depend on both  $x$ - (wavenumber) and  $y$ - (absorbance) vectors. In other words, the wavenumber represents structural components for organic materials, while the absorbance represents concentration of the organic materials. Ir. Max Ong Chong Hup from IMM added that currently they are looking at individual component of the intermediate materials of epoxy and hardener only.

**The 90.0% is reasonable value as the matching ratio at this point in time. It is subjected to further revision in the future for further improvement by considering feedback from the paint manufacturers and users.**



Q5. Mr. Terence Wee from PPG Malaysia raised his concern that the Coating Fingerprint Certificate may force paint manufacturers to buy raw materials from a single supplier/source. Attempt to achieve the standard may lead to the price increment along the supply chain.. This standard is to maintain the consistency of the paint supplied; although the failure may not due only to the quality of the paint supplied. Mr. Muhamad Azmi Mohd Noor, IMM Deputy President and PETRONAS agreed that there are many factors causing failures in paint coatings, including human and technical errors. The paint users have been suffering from coating failures for many years; therefore, criteria and specification of the paint supplied has to be tightened. Paint manufacturers need to identify more than one supplier of raw materials of the same quality and standard to comply with fingerprinting specifications

**There are many factors affecting the failure of coatings. This is an issue of inconsistency; hence, this fingerprinting certificate is one way of reducing inconsistency. The price increment should be borne by the paint manufacturers.**



Q6. Dr. Mohd Firdaus bin Yahaya from USM asked about the mode of scanning using the handheld FTIR and the depth of scanning for cured/uncured portion. Ms. Chow Mee Ling, Agilent Technologies Sales (M) Sdn. Bhd., answered that the handheld FTIR is for surface analyses, which is about 1- 2 mm depth. For checking the uncured portion of the polymeric coating, other testings, such as DSC and HPLC, will be more suitable. In addition, Assoc. Prof. Dr. Melissa Chan Chin Han from IMM also added that the FTIR fingerprinting spectra presented were obtained using ATR-FTIR, so they are referring to surface analyses of the samples. **The curing degree of the coatings is not the objective of the forum and task force. It can be considered as one**

**of the future tasks.**



Q7. Mr. Theng Soo Siong from KCC Coatings Sdn. Bhd. mentioned that the tolerance can also be affected by the pigment, such as PVC. He asked the task force members whether the samples tested are verified on the pigment (PVC) content. Assoc. Prof. Dr. Melissa Chan Chin Han from IMM answered that there is no clear information of the paint samples supplied by the paint manufacturers. The task force committee had just received general information of the paint samples. Among the samples received, including high and low pigment contents, the samples were verified using FTIR, discrepancies were detected if different pigments were used.

**The Coating Fingerprinting Task Force acknowledges that there are many other factors to consider in the fingerprinting process and PVC is one of them. More areas need to be looked at in the future tasks of the Task Force. For the start, the implementation of the Coating Fingerprinting Certificate for Epoxy Coatings has been established and will form the basis for all other paints to be fingerprinted.**



Q8. Mr. Yip Han Wei from Sarawak Shell Berhad asked whether the paint will work as expected if the test result achieved 90.0%. Assoc. Prof. Dr. Melissa Chan Chin Han from IMM clarified that the high correlation is to make sure the paint manufacturers supply what they had promised, so they can comply with the promised criteria for next and future products with high consistency. This correlation will not able to tell the performance of the coatings. Ms. Nurul Asni Mohamed, chairperson of IMM Task Force on Coatings Fingerprinting, added that the fingerprinting only for the manufacturing standpoint, other performance tests shall not be eliminated as per usual practice.

**Fingerprinting is a QC tool like the Mill Certificate for Metal products. It will not guarantee the performance of the product. The Fingerprinting certifies that the product has been manufactured to the correct specifications. Performance of the product will depend on many other factors such as the correct application, environment, design, etc.**

**Rapporteurs:**

Assoc. Prof. Dr. Chia Chin Hua, Universiti Kebangsaan Malaysia (leader)  
Ms. Elizah Samat, Sarawak Shell Bhd.  
Dr. Tan Winie, Universiti Teknologi MARA  
Mr. Shahril Atiqi, PETRONAS GTS  
Ms. Rohana Jaafar, PETRONAS GTS  
Mr. Mohd Shaiful Sajab, Universiti Kebangsaan Malaysia  
Mr. Chook Soon Wei, Universiti Kebangsaan Malaysia



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HIGHLIGHTS



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Industry :**

Ir. Max Ong Chong Hup  
(Norimax Sdn Bhd)

**Academia:**

Assoc. Prof. Dr. Melissa Chan Chin Han  
(Universiti Teknologi MARA)

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**INSTITUTE OF MATERIALS, MALAYSIA**  
No 10-1, Jalan Bandar 3,  
Pusat Bandar Puchong, 47160 Puchong,  
Selangor Darul Ehsan,  
MALAYSIA  
Tel: +603-5882 3574  
Fax : +603-5882 3524  
Website : www.iomm.org.my  
Email : admin@iomm.org.my

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