IMM STANDARD

IMM FP02:2020

PAINT RAW MATERIAL FINGERPRINTING OVERALL PROCEDURES USING FTIR AND OTHER RELATED METHODS

INSTITUTE OF MATERIALS, MALAYSIA

Disclaimer

Whilst every effort has been made to ensure the accuracy of the information contained in this publication, neither IMM nor any of its Members past present or future warrants its accuracy or will, regardless of its or their negligence, assume liability for any foreseeable or unforeseeable use made thereof, which liability is hereby excluded. Consequently, such use is at the recipient's own risk on the basis that any use by the recipient constitutes agreement to the terms of this disclaimer. The recipient is obliged to inform any subsequent recipient of such terms.

This publication is made available for information purposes and solely for the private use of the user. IMM will not directly or indirectly endorse, approve or accredit the content of any course, event or otherwise where this publication will be reproduced.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

Copyright notice

These Terms and Conditions shall be governed by and construed in accordance with the laws of Malaysia. Disputes arising here from shall be exclusively subject to the jurisdiction of the courts of Malaysia.

For further information on this Standard, please contact:

Institute of Materials, Malaysia
Suite 515, Level 5, Block A, Kelana Centre Point,
No. 3, Jalan SS7/19, Kelana Jaya,
47301 Petaling Jaya, Selangor, Malaysia

Tel: +603 7880 1753

https://www.iomm.org.my
Email: secretariat@iomm.org.my

Contents

Contents *(continued)*

Foreword

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 the IMM include the following:

- Training and development of individuals and companies in Malaysia to attain professional recognition in various fields of materials science, technology and engineering.
- Development of IMM standards as recommended guidelines for good technical practice for consideration and implementation by various industries of materials science, technology and engineering.

IMM FP02:2020, P*aint raw material fingerprinting overall procedures using FTIR and other related methods* was developed by the IMM Task Force on Coating Fingerprinting.

This standard will be subjected for review to reflect current needs and conditions. Users and other interested parties may submit comments on the contents of this standard for consideration in future versions.

Compliance with this Standard does not of itself confer immunity from legal obligations.

PAINT RAW MATERIAL FINGERPRINTING OVERALL PROCEDURES USING FTIR AND OTHER RELATED METHODS

1. Scope

This Standard emphasizes the evaluation of paint raw material fingerprint, with the aim of reaffirming the consistency of the raw materials supplied with reference to the qualified raw materials for paint products. This Standard covers the fingerprint requirement of all paint raw materials (for examples: solvent, pigment, binder, additive etc) for qualification, quality control and verification, except inorganic materials (for examples: zinc metal and titanium dioxide). For inorganic components, the mill certificate or the certificate of analysis (COA) shall be supplemented.

This Standard includes:

i. Fingerprinting qualification for paint raw materials
ii. Test method to fingerprint the raw materials received in container
iii. Criteria and execution of Raw Material Fingerprint Certificate

NOTE. The requirement of coating fingerprinting is stated in various specifications and standards, namely ISO 12944-9:2018, *Paints and varnishes- Corrosion protection of steel structures by protective paint systems-- Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures*, ASTM D7588-11(2018) *Standard guide for FTIR fingerprinting of a non-aqueous liquid paint as supplied in the manufacturer's container*, and ASTM D2621-87 *Standard test method for infrared identification of vehicle solids from solvent-reducible paints*. However, all of these standards are limited into inspection and test methods of paint system. IMM FP01:2019 *Coating fingerprinting overall procedures for paints using FTIR and other related methods* was developed with respect to the interpretation of FTIR spectra or the estimation of the degree of similarity between two FTIR spectra. The application of interpretation of FTIR with estimation of the degree of similarity between two FTIR spectra is extended to paint raw materials in IMM FP02:2020 and dried coatings in IMM FP03:2020.

2. Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1. 3rd-party laboratory

laboratory independent of the manufacturer, supplier, designer of the tested items, nor the authorized representative or a subsidiary of any of these parties.

2.2. attenuated total reflectance (ATR)

measures the changes that occur in an internally reflected IR beam when the beam comes into contact with a sample.

2.3. auditor

a person who conducts a systematic review on the execution of Raw Material Fingerprinting Certificate.

2.4. certificate of analysis (COA)

document that confirms a product meets its product specification, as obtained from testing performed.

2.5. container

an object used for or capable of holding, especially for transport or storage, such as bottle, can, bag, drum and so on.

2.6. correlation

the interdependence of the spectra from sample to that of Reference.

2.7. Fourier-transform infrared (FTIR)

when infrared radiation is passed through a sample, some radiation is absorbed by the sample and some is transmitted. The resulting signals are generated at the detector. The Fourier-transform converts the detector output to an interpretable spectrum that may provide molecular structural insights.

2.8. material safety data sheet (MSDS)

document that provides information regarding safety and health of related substances and products.

2.9. owner

a person who acquire possession, ownership or rights of the use or services of the raw material by payment.

2.10. paint

pigmented coating material in liquid form that when applied to a substrate, forms a solid film having protective, decorative, or specific technical properties.

2.11. raw material

the material/ingredient (for examples: solvent, pigment, additive, binder etc) from supplier for paint manufacturing, could be in liquid form, paste form or powder form.

2.12. Reference sample

the sample that has been subjected to qualification test and referred to as standard.

2.13. shall

expressing an instruction, command or a strong assertion.

2.14. should

used to indicate obligation, duty, or correctness.

2.15. technical data sheet (TDS)

document that provides information regarding a specific product.

2.16. triplicate

the repetition of the set of experiment by means of same sample in three replications.

3. Raw material fingerprinting qualification

Raw material fingerprinting qualification shall be imposed for incoming raw material by batches as sampling plan required by the paint manufacturer. The raw material has to pass all the physical tests, as agreed by the paint manufacturer. The raw material formulation that has changed after qualification shall be requalified. The raw material formulation after qualification shall be consistent for batch-to-batch raw material supplied or production.

The qualification tests shall be carried out or witnessed and certified by an independent 3rd-party authority, or to be agreed by the paint manufacturer. The recommended 3rd-party testing laboratory shall be recognized by the paint manufacturer for a grace period of at least 3 years prior to accreditation by authorized body.

Fingerprint check may serve as a verification tool to confirm that the raw materials supplied are identical to those subjected to qualification test, by means of the degree of similarity (*r*) of FTIR spectra.

Routine batch check shall be carried out on the first and every subsequent batch of the raw material supplied in a qualified raw material database library to substantiate the accuracy of batch-to-batch supplied or production.

NOTE. Routine batch check discloses the distinction between the raw material supplied with qualified raw material.

Raw material fingerprinting qualification shall be made to the raw material supplied in the *as-is* basis but not solvent-reducible to ensure the consistency of the solvent component for batch-to-batch production. In addition, raw material fingerprinting qualification shall be applicable to all paint raw materials (for examples: solvent, pigment, binder, additive etc), in liquid form, paste form or powder form.

4. Sample collection (by raw material supplier)

For every new raw material supplied, three random homogenous samples shall be collected from each batch to be kept in three containers (marked as Sample 1, Sample 2 and Sample 3). Subsequently, one homogenous sample shall be obtained from the top of the Sample 1 container for each batch. It is recommended that the sample collection and analysis are conducted on the same day upon receiving of raw material. For detail sampling procedures, one may refer to ISO 15528:2013.

5. FTIR test method

5.1. FTIR spectrophotometer

Both mobile and handheld FTIR spectrophotometers are suitable for on-site analysis, while the benchtop spectrophotometer shall be used for laboratory analysis. The results obtained from benchtop, mobile and handheld spectrophotometers should be comparable.

The FTIR spectrophotometer shall encompass a wavenumber range of at least 4000 cm^{-1} – 700 cm^{-1} with resolution of no less than 4 cm^{-1}. In addition, the FTIR spectrophotometer shall be equipped with single or multi-bounce ATR with horizontal arrangement. The common ATR crystal materials are diamond, zinc selenide (ZnSe) and germanium (Ge), with the spectral range of 4000 cm^{-1} – 650 cm^{-1}, 4000 cm^{-1} – 650 cm^{-1}, and 4000 cm^{-1} – 700 cm^{-1} respectively. The ATR crystal material shall be compatible and not react with the respective raw material sample. The finite comparison of the spectra is recommended (but not essential) to be obtained with same ATR crystal material.

5.2. Sample preparation

The raw material sample shall be stirred and the **T**op of the raw material sample shall be withdrawn and applied on the ATR crystal.

5.3. Sample annotation

Sample annotation is required to reproduce the spectrum and the information shall include:

a) Sample name;
b) Batch number;
c) Date and time being analyzed;
d) Analyst and/or company name;
e) FTIR brand and model, spectral range, number of sample scans (min 32), number of background scans (min 32), resolution;
f) ATR crystal material; and
g) Spectral correction (if any).

5.4. Instrumental analysis

The analyses are recorded in absorbance mode by averaging 32 scans at a maximum resolution of 4 cm^{-1}. Each sample is required to have a minimum of triplicate analyses. A background infrared spectrum shall be collected prior to each sample analysis.

The raw sample is applied on the ATR crystal and the spectrum is collected immediately. A sufficient amount of sample shall be used as the sample volume of less than 1 mL or 1 g is prone to solvent loss and/or reaction with atmospheric component.

5.5. Spectra analysis

A comprehensive examination of the original spectrum is required prior to spectrum processing. It is recommended to retain the original spectra for further deliberation. The spectra shall not be baseline corrected or subjected to any other types of spectral correction.

The commercially available FTIR software contains different algorithms for processing FTIR spectra. For the Raw Material Fingerprint Certificate, only the *compare* function is involved. A *compare* function or equivalent shall be used in all cases.

The range of wavenumbers as fingerprint region for raw material is as shown in Annex A.

5.5.1. Reference spectrum

Reference spectrum shall be generated from the average spectra of three samples (Sample 1, Sample 2, and Sample 3) of the containers (refer Clause 4).

Raw material supplier shall average a minimum of nine spectra from **T**op of the three containers (with minimum of three spectra from each container).

5.5.2. Degree of similarity (*r*)

The degree of similarity, which is termed correlation (*r*), of the spectra is generated by comparing the spectra of the sample to that of the Reference spectrum using *compare* features of the FTIR software.

The degree of similarity is directly proportional to quantities of *r*, i.e. $r = 1$ represents the complete matching of the sample spectrum to that of the Reference spectrum. The acceptance criterion is set at $r \geq 0.900$, with tolerance of ± 0.002 (or the range of 0.898 – 1.000).

It is to be noted that the degree of similarity has no correlation with the performance of the raw material. The *r* ≥ 0.900 (with tolerance of ± 0.002) is only an indication that the batch of the raw material supplied has high degree of similarity as compared to the Reference raw material that passed the qualification test.

6. Qualification of raw material

6.1. Qualification of Reference sample (new formulation)

The qualification of the Reference sample is approximated by degree of similarity (*r*) from the in-house and 3rd-party testing laboratories, as given by Equation 1.

$$r_{\mathrm{Ref}} = \sqrt{r_{\mathrm{Ref_{in-house}}} \times r_{\mathrm{Ref_{3rd-party}}}} \qquad \text{(Equation 1)}$$

The Reference spectrum for 3rd-party testing laboratory ($\mathrm{Ref_{3rd-party}}$) is obtained by averaging nine spectra generated from the **T**op of Sample 1, Sample 2 and Sample 3 of the containers. The $r_{\mathrm{Ref_{3rd-party}}}$ can be estimated by referencing $\mathrm{Ref_{3rd-party}}$ to $\mathrm{Ref_{in-house}}$, which is submitted by the 3rd-party testing laboratory to raw material supplier.

The Reference spectrum for in-house ($\mathrm{Ref_{in-house}}$) is obtained by averaging nine spectra generated from the **T**op of Sample 1, Sample 2 and Sample 3 of the containers. The $r_{\mathrm{Ref_{in-house}}}$ can be estimated by referencing $\mathrm{Ref_{in-house}}$ to $\mathrm{Ref_{3rd-party}}$, which is carried out in-house by raw material supplier.

The acceptance criterion for the qualification of Reference sample is r_{Ref} ≥ 0.90 ± 0.01 for the whole FTIR region. The successfully qualified Reference sample is employed as standard for in-house batch-to-batch monitoring, random/scheduled on-site analysis, and retained raw material sample analysis.

6.2. In-house raw material batch-to-batch monitoring (by raw material supplier)

For each batch of the raw material supplied, one sample from the **T**op of the container is obtained. The *r* is approximated by referencing the Reference sample to the sample collected from the **Top** of the container for every subsequent batch of raw material supplied.

If the *r* of the sample spectrum is ≥ 0.900 (with tolerance of ± 0.002) for whole FTIR region as compared to the Reference spectrum, then the sample is accepted.

If the *r* of the sample spectrum is < 0.898 for whole FTIR region as compared to the Reference spectrum, a verification test using Sample 1, Sample 2, and Sample 3 from the containers are required, prior to rejection of the whole lot of raw material.

NOTES.
1. The *r* of the sample spectrum is proposed to have threshold ≥ 0.950 (with tolerance of ± 0.002) for whole FTIR region as compared to the Reference spectrum, subjected to the requirement of paint manufacturer.
2. Analogue procedures as in clause (6.2) should be adopted by the paint manufacturer for the raw material received as paint manufacturer's in-house test for quality assurance.

6.3. Random/scheduled on-site analysis by paint manufacturer

For the on-site raw material sampling (using handheld or mobile FTIR spectrophotometer), one sample from the **T**op of the randomly selected container is required. The *r* for on-site sample spectrum is approximated by referencing the Reference sample to the on-site collected raw material sample.

If the *r* of the sample spectrum is ≥ 0.900 (with tolerance of ± 0.002) for whole FTIR region as compared to the Reference spectrum, then the sample is accepted.

If the *r* of the sample spectrum < 0.898 as compared to the Reference spectrum for whole FTIR region, verification test of the on-site raw material shall be carried out by 3rd-party testing laboratory (recommended by the paint manufacturer).

If the 3rd-party analysis of on-site raw material sample demonstrated *r* < 0.898 as compared to the Reference spectrum, (an additional verification test of the retained raw material sample shall be carried out by 3rd-party testing laboratory, prior to rejection of the whole lot of raw material.**)**

6.4. Retained raw material sample (by paint raw material supplier)

The raw material supplier shall retain one sample from every new batch of raw material supplied and submit for 3rd-party testing laboratory (recommended by the paint manufacturer) to act as a verification tool whenever there is a dispute on the raw material supplied to the paint manufacturer (i.e. on-site). For each batch of the raw material supplied, one sample is randomly collected following pre-identified sampling procedures is kept as retained sample.

The *r* is approximated by referencing the Reference sample to the retained raw material sample from **Top** of the container. If the *r* of the sample spectrum is ≥ 0.900 (with tolerance of ± 0.002) for whole FTIR region as compared to the Reference spectrum, then the sample is accepted.

If the *r* of the sample spectrum is < 0.898 for whole FTIR region as compared to the Reference spectrum, a verification test using Sample 1, Sample 2 and Sample 3, prior to rejection of the whole lot of raw material.

6.4.1. Dispute of results from 3rd-party testing laboratory

The 3rd-party laboratories (recommended by the paint manufacturer) yielding contrasting results shall complete the Test Method Assessment checklist (Annex B) in the presence of representatives from the respective laboratories. Upon completion of the checklist and site verification, the respective laboratories shall perform the testing of samples (not limited to certified reference material) prepared by the raw material supplier in the presence of representatives from all respective laboratories.

7. Raw Material Fingerprint Certificate

The Raw Material Fingerprint Certificate is comprised of two parts, namely physical analyses and structural analyses, as shown in Annex A. This certificate is applicable for paint raw materials (for examples: solvent, pigment, binder, additive etc), in liquid form, paste form or powder form.

7.1 Physical analyses

Physical analyses are performed by in-house testing laboratory as required by paint manufacturer. The MSDS, TDS, COA and certificate of % purity by raw material manufacturer shall be appended whenever applicable. The raw material supplier shall either attach the original COA with Raw Material Fingerprint Certificate or reproduce the data from the original supplier without appending the COA. However, the latter shall be cross-referenced to the original supplier's COA document number for future traceability.

7.2. Structural analyses

Structural analysis is performed using FTIR. The inorganic components in the paint raw materials that are IR inactive shall be appended with other compliances such as certificate of percent purity by the (metal) manufacturer.

The FTIR analysis shall provide the spectrum that is properly identified and labelled, as listed in Clause 5.3. Other information necessary to duplicate the sampling and/or spectral collection shall be provided as well.

7.3. Confidentiality

The Raw Material Fingerprint Certificate shall be converted into non-editable digital format and/or encrypted, e.g. in PDF format and recommended to be with password protection. It shall not be circulated through social media which would violate the confidentially of the company or to the customers.

7.4. Signatory

The Raw Material Fingerprint Certificate shall be signed by a certified signatory (optional: who has passed the IMM Certified Fingerprint Quality Controller course). The certified signatory should include name, function, IMM membership number (optional) and Coating Fingerprint Quality Controller rubber stamp (optional). All pages of Raw Material Fingerprint Certificate/ COA shall be either signed or initialed by certified signatory.

The Raw Material Fingerprint Certificate can be signed by employee under the supervision of the certified signatory. The signatory (i.e. the employee) shall include name, function of the employee and shall be counter-signed by the same certified signatory giving his/her name, function, IMM membership number (optional) and Coating Fingerprint Quality Controller rubber stamp (optional).

8. Execution of raw material fingerprinting

8.1. Certified signatory for in-house Raw Material Fingerprint Certificate

The Raw Material Fingerprint Certificate shall be generated per batch basis by the raw material supplier for routine batch check on every subsequent batch of raw materials supplied, for the qualified raw material, for scheduled client's audit or random client's audit as requested by client as deem necessary, and for verification test of the retained raw material sample.

8.2. 3rd-party testing laboratory

The 3rd-party testing laboratory shall perform the qualification of raw material fingerprint and certify the on-site raw material sample on schedule or random basis. In addition, 3rd-party testing laboratory shall verify the retained paint sample whenever there is a dispute on the on-site raw material sample.

8.3. External auditor

The external auditor shall review and validate the Raw Material Fingerprint Certificate and raw material fingerprint (scheduled/random) monitoring report.

8.4. End user

The end user (paint manufacturer) shall review and validate the Raw Material Fingerprint Certificate and raw material fingerprint (scheduled/random) monitoring report.

Annex A
(informative)

Raw Material Fingerprint Certificate

Company name:	*e.g.* Company ABC	**Country:**	*e.g.* Malaysia
Certificate number:	*e.g.* epikote/001/02Jan2020	**Date:**	*e.g.* 2 Jan 2020
Number pages:	*e.g.* 05		

Section 1: General information			
Product name:	*e.g.* EPOXY123	**Product type:**	*e.g.* epikote, xylene, titanium dioxide, *etc*

Date of issue:	**Raw Material** (eg. Solvent Type Epoxy Resin)
Specify material	*e.g.* Epikote 123
Trade name Generic	e.g.BE-501X75H *e.g.* Epikote
Physical state	*e.g. Liquid*
Type of container sampled	*e.g. tank, drum, sack, bag*
Factory location	*e.g.* Shah Alam, Selangor
Batch number	*e.g.* 1234567A
Production date	*e.g.* 02 Jan 2020
Product technical data sheet number	*e.g.* TDS123A
Material safety data sheet number	*e.g.* MSDS123A
Shelf life	*e.g.* 24 months

Section 2: Test methods and results

Physical analyses

Parameters	**Methods**	**Specific with tolerance**	**Test results**
Density	*e.g.* ISO 2811-4	*e.g.* …± 0.05 gcm^{-1}	*e.g.* 1.48± 0.03 gcm^{-1}
Please add			

Structural analyses

Infrared spectra	**Sample as supplied in container**		
	Method	**Wavenumber range**	**Degree of similarity (r) ≥ 0.900*** (tolerance = ± 0.002 or range of r = 1.000 – 0.898)
Material: *eg. Epikote*	IMM FP02	700-4000 cm^{-1}	e.g. 0.999 ± 0.005
		900 – 2000 cm^{-1}	e.g. 0.999 ± 0.005

*average results of triplicate analyses

Section 3: FTIR test details (as per IMM FP02)	
Analyst & company name	*e.g.* Name & Company ABC Sdn Bhd
Brand & model of FTIR	*e.g.* FTIR Brand XYZ & model: 2016
Type of FTIR spectrophotometer	*e.g.* benchtop / mobile / handheld
Benchtop: ATR crystal material	*e.g.* diamond, zinc selenide (ZnSe), germanium (Ge)
Spectral correction (circle) **Note:** correction is NOT recommended.	YES / NO [**Note**: if **YES**, please state the correction(s) made] *e.g.* automatic baseline correction

Spectral range (cm^{-1})	*e.g.* 700 - 4000 cm^{-1}			
No. of sample scans (min 32)	*e.g.* 32 scans			
No. of background scans (min 32)	*e.g.* 32 scans			
Resolution (min 4 cm^{-1})	*e.g.* 4 cm^{-1}			
High sensitivity compare algorithm for degree of similarity in absorbance mode	**Note:** Correlation *compare* algorithm of the FTIR software should depend on both ***x***- (wavenumber) and ***y***- (absorbance) vectors. *High sensitivity compare* algorithm, which analyzes the variations *via* summation of the squared differences of each variation from the overall mean OR equivalent, should be used.			
	Dependence on BOTH ***x***- and ***y***-vectors (circle)	YES / NO	*High sensitivity compare* algorithm (circle)	YES / NO
Trade name and batch number of Reference spectrum for raw material	*e.g.* Epikote123 & 1234567A-Reference			

Notes:
1. Full range of FTIR spectra without automatic baseline correction and in absorbance mode are to be attached with this report (raw data).
2. Compliance to matching criteria values does not exclude meeting the requirements of other QA/QC checks *e.g.* drying time, gloss, hiding power *etc*.
3. Methods used shall refer to the latest published document.
4. This certificate is applicable to all raw materials.
5. This certificate can be submitted in CD or other digital formats.

The undersigned hereby declare that all the analytical tests were performed according to the procedures specified herein and that this report represents a true and accurate record of the results obtained.

Authorized QA/QC Executive:	**Validated by (preferably by IMM certified Coating Fingerprint Quality Controller)**:
e.g. NAME Company ABC Sdn Bhd (123456-X)	*e.g.* COATING IMM Yoga Sugama Salim FP002 FINGERPRINT QC
Signature: *e.g.* Name	**Signature**: *e.g.* Yoga Salim
Date: *e.g.* 2 Jan 2020	**Date**: *e.g.* 2 Jan 2020
IMM membership member: (optional to be IMM member)	**IMM membership member** (optional to be IMM member): *e.g.* O-1234

Section 4: Compulsory appendices (to be submitted in CD or other digital formats)	
Appendix 1	Overlay Reference and sample FTIR spectra for raw material (**Note**: In addition, raw data of Reference and sample FTIR spectra must be provided in raw data files)
Appendix 2	Certificate of analyses which are relevant to the in-house standard testings
Appendix 3	Certificate of % purity of zinc by metal manufacturer for organic zinc paint & inorganic zinc paint **OR** certificate of analysis of alum paste for silicone-aluminum paint / glass flake for glass flake poyester / inorganic filler for any paint

END OF REPORT

Received & checked (preferably by IMM Coating Fingerprint Quality Controller):
Date: *e.g.* 15 Jan 2020

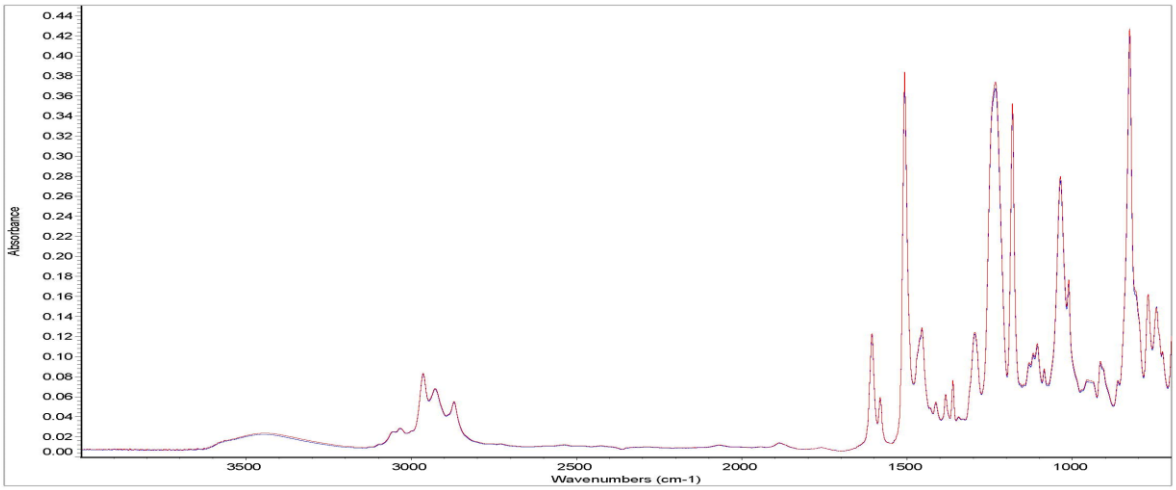
COATING IMM CHAN CHIN HAN FP001 FINGERPRINT QC

Melissa Chan

Appendix 1 Overlay Reference and sample FTIR spectra for raw material
Reference spectrum – red (generated by averaging the FTIR spectra from **T**op of containers for Sample 1, Sample 2 and Sample 3 sent for qualification.

Sample spectrum – blue (for each batch of raw material supplied, sample at the location of **T**op of the container)

Degree of similarity (*r*) = 0.999



Annex B
(informative)

Test Method Assessment of 3rd-Party Testing Laboratory in relation to dispute in Fingerprint Certificate for raw material, paint and dried coating samples

Test Method Assessment of 3rd-Party Testing Laboratory in relation to dispute in Fingerprint Certificate for raw material, paint and dried coating samples Attach all the analysis data as references.		
SECTION 1: Information of the 3rd-Party Testing Laboratory		
Name of the laboratory		
Representative of (which company)		
SECTION 2: Requirement of the laboratory		
SECTION 2.1: Accreditation		
Company/Institution is accredited to the following: [ ] SAMM/ MS ISO IEC 17025 [ ] Others (Specify_____)		
Date of last audit		
Pending/ Unresolved non-compliances report (If any)		
SECTION 2.2: Competency of FTIR Analyst		
Haw many years of experience? (Min: One year)		
Qualification		
Professional Membership		
SECTION 3: FTIR Spectrophotometer		
SECTION 3.1: Description of Benchtop FTIR		
Brand and Model		
ATR Crystal material		
No. of background scans (min 32)		
No. of sample scans (min 32)		
Resolution (4 cm^{-1})		
Spectral range (min 4000 – 700 cm^{-1})		
SECTION 3.2: Calibration and Maintenance		
Calibrated by [ ] In-house [ ] 3rd-party (Specify_____)		
Last calibration date		
Last Maintenance Record		
SECTION 3.3: Analysis		
Standard operation procedure (SOP)		
SECTION 4: Certified Coating Fingerprint Quality Controller (FPQC)		
Name of FPQC		
IMM membership number		
Certificate number		

Bibliography

[1] ISO 12944-9:2018, *Paints and varnishes - Corrosion protection of steel structures by protective paint systems -- Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures*)

[2] ASTM D7588-11(2018), *Standard guide for FTIR fingerprinting of a non-aqueous liquid paint as supplied in the manufacturer's container*

[3] ASTM D2621-87(2016), *Standard test method for infrared identification of vehicle solids from solvent-reducible paints*

[4] Shell Global Solutions International B. V. Design and Engineering Practice (Technical Specification) (DEP 30.48.0031-Gen) (2017). *Protective Coatings for Onshore and Offshore Facilities*.

[5] PETRONAS Technical Standards (Technical Specification) (PTS 15.20.03) (2016). *Protective Coatings and Linings*.

[6] NACE International Standard SP0108-2008, *Corrosion Control of Offshore Structures by Protective Coatings*

[7] ISO 15528:2013 *Paints, varnishes and raw materials for paints and varnishes - Sampling*.

[8] FP01:2019 *Coating fingerprinting overall procedures for paints using FTIR and other related methods.*

Acknowledgements

Members of Task Force on Coating Fingerprinting

Chairmen	Prof. Ts. Dr. Melissa Chan Chin Han Prof. Ts. Dr. Mohamad Kamal Harun	Universiti Teknologi MARA
Secretary	Suhaila Idayu Abdul Halim	Universiti Teknologi MARA
Treasurer	Nurul Fatahah Asyqin Zainal	Universiti Teknologi MARA
Members	Chow Mee Ling Phuah Shok Chan (Alternate)	Agilent Technologies Sales (M) Sdn Bhd
	Dr. Chew Kong Chin	Becker Industry Coatings (M) Sdn Bhd
	Renee Teo Yong Yin	Bruker (M) Sdn Bhd
	Dr. Mahmood Anwar	Curtin University, Sawarak
	Selvandran Vello Paramjit Singh Darjit Singh (Alternate)	Hempel (M) Sdn Bhd
	Ahmad Badli Shah Abdul Aziz Mokhtar Othman (Alternate)	International Paint Sdn Bhd
	Lee Choon Siong Quah Kean Gin (Alternate) Teh Tiong Poh (Alternate)	Jotun (M) Sdn Bhd
	Chang Yau Chong	Kansai Asia Pacific Sdn Bhd
	Ismaliza Ismail	Malaysian Rubber Board
	Kelly Hong Mun Key	Nexus Analytics Sdn Bhd
	Ir. Max Ong Chong Hup Prema Latha Suppiah	Norimax Sdn Bhd
	Patrick Lim Wye Kheong Elson Wah Eng Keong (Alternate)	Perkin Elmer (M) Sdn Bhd
	Muhammad Hawari Hasan Nurjami Ali	PETRONAS Group Technical Solution
	Terence Wee Tee Hin Mohd Wahidduzzaman Zainal (Alternate)	PPG-Sigma Coatings (M) Sdn Bhd
	Mohammad Ariff Sukur Leow Chun Ho (Alternate)	Sarawak Shell Bhd
	Lim Chuan Gee	SIRIM Bhd
	Abdul Aziz Haron Ir. Zarina Rasmin	SIRIM QAS International Sdn Bhd
	Assoc. Prof. Dr. Lim Teck Hock Ts. Dr. Chew Khoon Hee	Tunku Abdul Rahman University College
	Asst. Prof. Dr. Yu Lih Jiun	UCSI University
	Mark Hew Yoon Onn	Universal Corrosion Engineering (M) Sdn Bhd
	Hairunnisa Ramli Norsyazlin Abd Rashid	Universiti Teknologi MARA
Secretariat Coordinators	Noorul Shafika Misbah Norita Othman	Institute of Materials, Malaysia