

Introduction

Many years ago, the Oil & Gas industry discussed the idea of establishing a QA/QC system to check on the quality of paints supplied to the oil & gas industry. There were concerns then regarding the cost reduction initiatives that paint manufacturers may supply "cheapened formula" products labelled as the actual high quality products approved by the oil companies. Scientific testing technologies then were not available for the protective coatings to be "fingerprinted" like metals & alloys which can be checked against its mill certificates obtained via spectrometers and in-house laboratory QC tests. The idea naturally died off. It is believed that the oil & gas industry continues to be plagued with supply of non-conforming protective coatings due to fierce price competition. Materials testing technologies have advanced exponentially over recent years that it may be possible for polymers to be "fingerprinted" in the near future.

IMM Polymer Committee will organise a half-day Forum titled "Towards Fingerprinting of Polymeric Coatings" in conjunction with the IMM Annual General Meeting on Friday 22nd March 2013. This will be the first of a series of such forums as the initiative towards "fingerprinting" technology for polymeric coatings will require many rounds of discussion amongst interested parties.

Objective

The forum is aimed at dispelling the notion that there is no way to identify polymer products in the same way as metallic products like the mill certificate, etc. Polymers should have their own "Mill Certificates & QC test reports" so-to-speak, so that customers and users can be assured that the contents of the polymer product are as per specifications. The first step towards this initiative will focus on the more common product used in the oil & gas industry i.e. the epoxy coatings, as a basis for discussion. Of course, "Fingerprinting" involves more than just the mill certificate e.g. inspection & test reports, production QC reports, raw materials inspection reports, etc. This Forum is aimed at brainstorming the possibilities of using the latest scientific technologies and materials testing technologies during the paint manufacturing & in-house laboratory QC testing process to establish some form of "Fingerprinting" for polymeric coatings. The ultimate objective is to provide assurance that protective coating products have been manufactured according to original product formula specifications.

The forum will kick-off with 4 presentations of 15 to 20 minutes each followed by 45 minutes for open discussion

Components of Epoxy Polymeric Coatings including additives, etc and their identification – this is to provide information to the audience on what the raw material ingredients of an epoxy coating are made of e.g. organic/inorganic components, resin, curing agent, fillers, solvents, and what current methods are used to detect each individual component separately.

Speaker : Professor Dr. Mohd. Kamal Harun (Coatings Researcher - UTM)

Manufacturing Process of an Epoxy Polymer Coating for Oil & Gas Industries – this is to provide an understanding of the entire paint manufacturing and QC testing process including in-coming raw materials, product formula, mixing & compounding process, in-house laboratory testing methods, and what parts of the process are deemed trade secret and what are not.

Speaker : Mr. Frankie Chua (Managing Director - PLC Laboratory Sdn Bhd)

Spectroscopic Fingerprinting in Polymer Coating that Potentially Useful in Quality Control/Quality Assurance (QC/QA) of Raw Materials and Finished Products in Oil and Gas Industry – this is to provide the audience with information about the new techniques of polymer testing which may offer fingerprinting opportunities. Materials Testing technology has advanced exponentially over recent years that many industry professionals may not have kept themselves up-to-date and are unaware of newer technologies which may assist the industry to improve QA/QC in their industry.

Speaker : Mr. Kenneth Way (Materials Characterisation Specialist - Perkin Elmer Sdn. Bhd.)

User experience on quality issues with Polymeric Coatings in the Oil & Gas Industry – representatives from the Oil & Gas industry will highlight the paint product qualification and approval process and show how good quality epoxy coatings can perform compared to poor quality epoxy coatings. Qualified & approved products are expected to be supplied to the project job sites by the paint manufacturers. Without a fingerprinting system currently, there is no way of assurance that the delivered product is the same as the approved product even though the paint drum can bear the same product name. No "Batch quality certificates" similar to metal mill certificates are supplied to customers currently.

*Speaker : Mr. David Lim (Coatings QA/QC Specialist – ExxonMobil Malaysia) and/or
Encik Zamaluddin Ali (Corrosion Specialist – PETRONAS GTS Dept)*

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Institute of Materials, Malaysia

Towards Fingerprinting of Polymeric Coatings

2.30pm - 6.00pm : Friday 22nd March 2013
(Dewan Presiden) Kelab Golf Negara Subang,
Kelana Jaya, Selangor



Towards Fingerprinting of Polymeric Coatings



Abstract - Components of Epoxy Polymeric Coatings including additives, etc and their identification

Epoxy resins are primarily polyether resins that may contain more than one epoxy group. The resins are capable of being converted into the thermoset form. Curing of epoxy based coatings are usually done through the opening up of the epoxide ring by reacting it with compounds like amine or amide groups and others and in most cases, do not create volatile products in spite of the

presence of a volatile solvent. The epoxies are also oxides, such as ethylene oxides (epoxy ethane), or 1,2-epoxide. The epoxy group are also referred to oxirane that contains an oxygen atom bonded with two carbon atoms, which in their turn are bound by separate bonds, Approaches in performing epoxy polymer identification through the use of modern spectroscopic methods like the Fourier Transform Infra-Red Spectrophotometer, Nuclear magnetic Resonance spectroscopy and X-Ray Photoelectron Spectroscopy shall be discussed. The basic components of epoxy, the epoxy resin chemistry and the reactions of epoxies in the formation of coatings shall also be presented.

Biodata - Professor Dr. Mohd Kamal Harun

Professor Dr Mohamad Kamal is currently the Assistant Vice Chancellor (Research, Innovation and Entrepreneurship) and head the Global Entrepreneurship Research and Innovation Centre at University Malaysia Kelantan. He was the Deputy Vice Chancellor (Industrial and Community Networking at University Teknologi MARA from 2007 – 2010, Dean of the Faculty of Applied Science, UiTM from 2005 – 2007, and the Director of the UiTM Malacca Branch Campus (2002 – 2005). Dr Mohamad Kamal Mohamad Kamal is also the President and Fellow of the Institute of Materials Malaysia, Fellow of the International Institute of Plantation Management, Chairman of the Malaysian Accredited Certification Body for the Asian Welding Federation, Member of the Industrial Consultative Council, Malaysian Petroleum Resource Cooperation under Pemandu and currently is also the Cluster Head for Industry and Innovation, National Council of Professors.

Dr Mohamad Kamal is a Professor of Chemistry and earned his PhD from the University of Manchester, Institute of Science and Technology specializing in the areas of Corrosion and Adhesion Science. His areas of research are in corrosion protection by paints and inhibitors including the study of polymeric barrier coating degradation under atmospheric conditions. He has been awarded the e-science grants, fundamental research grant scheme, university grants and others for his research and has published more than 60 publications which include journal publications, several chapters in books and reviewed journals for international publications, proceedings, mainly focussing on the corrosion protection by novel inorganic Schiff based compounds as inhibitors, under film corrosion, adhesion modifiers, electro-polymers and electronic and ionic conductivity of polymers and polymer electrolytes and barrier protection degradation dependency on ionic resistance of polymeric coatings. Besides teaching and research, Dr Mohamad Kamal also contributes his expertise through training and consultancies mainly within the paint industries, government research agencies, and module fabricators for off shore platforms.

Prof Dr Mohamad Kamal has been the key note and invited speakers to several national and international conferences such as the International Conference on Traditional & Renewable Energy, & Nanomaterial Technology, China, International Materials & Technology Conference & Exhibition, International Conference on Functional Materials & Devices and The Science & Technology, International Conference on Plantation Industries and Industry Linkage Round Table Forum, Academy Science Malaysia. Nationally, Prof Dr Kamal was also invited to represent several panels at the ministerial level.



Abstract - Manufacturing Process of an Epoxy Polymer Coating for Oil & Gas Industries

The process of paint manufacturing will be covered from the raw materials to the finished product including the in-house production quality control tests. Paints are essentially made up of the polymer resin, additives (including pigments, extenders, fillers, property-modifying agents, etc) and solvents. An overview of the manufacturing process will include the review of the paint formulation, raw

materials storage and sourcing, paint mixing, production QC tests, packing and delivery. The production QC tests include viscosity, solids, specific gravity, opacity, finess-of-grind, pigment-volume-concentration (PVC), adhesion test, pencil hardness test, color, etc and are performed in the in-house laboratory during the paint manufacturing process. Special tests such as the salt-fog test, cathodic disbondment test, chemical resistance tests, etc will be carried out where required by the customers, and will generally be a once-off test carried out by a third-party laboratory. No spectroscopic testing has been carried out on polymer coatings to-date due to the lack of technological capabilities of spectroscopy.

Biodata - Chua Cheng Huat, Frankie

Mr Frankie Chua Cheng Huat graduated in 1986 with B.Sc.(Hons) in Chemistry. He has more than 25 years of experience in Corrosion Control covering Protective, Architectural, Marine and Industrial Coatings, Fire Proofing and Waterproofing - as a manufacturer, service contractor, and technical consultant. Mr Chua founded PLC Laboratory Sdn. Bhd. in 1995 and is the Managing Director and Chief Chemist overseeing Research and Development.

He is a Fellow of the Institute of Materials Malaysia (IMM), an Associate in the Technology of Surface Coatings (ATSC) - Oil & Colour Chemist Association (OCCA) UK as well as a Protective Coatings Specialist and Senior Corrosion Technologist of NACE.

He has served as Chairman of the IMM Coatings Committee (2004-2009) and as a committee member of the OCCA Kuala Lumpur and Selangor Section (2006-2007).

Towards Fingerprinting of Polymeric Coatings



Abstract - Spectroscopic Fingerprinting in Polymer Coating that Potentially Useful in Quality Control/Quality Assurance (QC/QA) of Raw Materials and Finished Products in Oil and Gas Industry

Various materials of polymer coatings have been extensively used in enhancing the durability and shelf life of certain materials. In oil and gas industries, epoxy polymer coating was laminated on petroleum refinery pipelines for providing protection to

harsh environment. For the past decades, due to limited technology in analytical instrumentations, QC/QA in epoxy coatings and raw materials relied heavily on physical testing which could be potentially insufficient in ensuring consistence batch-to-batch quality assurance of raw materials. With the rapid advancements in analytical instrument technologies in Fourier Transform Infra-Red (FTIR), inclusion of Microscopic or Imaging System, namely FTIR-Microscope and FTIR-Imaging, chemical property studies in epoxy coating and any other raw materials such as paints and additives could further enrich the QC/QA results in raw material checking apart from physical tests. Furthermore, FTIR method is not only rapid, robust, non-destructive, but also simple in instrument operation and IR spectra data analyses.

Biodata - Way Chiang Poh, Kenneth

Kenneth Way obtained his Bachelor and Master degree of Science from Universiti Putra Malaysia (UPM) in both Biochemistry and Molecular Biology and Genetic Engineering respectively. He works in Sigma-Aldrich as the application specialist in molecular and cell biology division for 3 years before continued his post-graduate research, which is research project collaboration between Sigma-Aldrich and Massachusetts Institute of Technology (MIT) in cancer research for genetic therapy. He has published a few technical papers in established journals. Meanwhile, he is also the member for the professional body of Malaysia Society for Biochemistry and Molecular Biology (MSBMB) since 2004. Currently, he is the product manager for spectroscopy and chromatography products, FTIR, Thermal analyzers (TGA, DSC, STA), LC-TOF-MS and Hyphenation Techniques (TG-IR, TG-MS, TG-GCMS, TG-IR-GCMS, DSC-UV, DSC-NIR, DSC-Raman).

PROGRAMME

- 2:30pm : Registration (Coffee/tea & light snacks)
- 3:00pm : Opening Remarks by Dr. Chia Chin Hua (Forum Chairman)
- 3:10pm : Components of Epoxy Polymeric Coatings including additives, etc and their identification (Professor Dr. Mohd Kamal Harun)
- 3:30pm : Manufacturing Process of an Epoxy Polymer Coating for Oil & Gas Industries (Mr. Frankie Chua)
- 3:50pm : Spectroscopic Fingerprinting in Polymer Coating that Potentially Useful in Quality Control/Quality Assurance (QC/QA) of Raw Materials and Finished Products in Oil and Gas Industry (Mr. Kenneth Way)
- 4:10pm : User experience on quality issues with Polymeric Coatings in the Oil & Gas Industry (Mr. David Lim/En. Zamaluddin B Ali)
- 4:30pm : Open Discussion
- 5:15pm : Summary & round-up by Forum Chairman
- 5:20pm : Closing Remarks by Dr. Chan Chin Han (Chairman, IMM Polymer Committee)
- 5:30pm : Coffee Break
- 6:00pm : IMM 23rd Annual General Meeting
- 7:00pm : Adjournment

Abstract - User experience on quality issues with Polymeric Coatings in the Oil & Gas Industry

The existing problem faced on-site when the quality of the epoxy coatings varies from project to project for the same product brand from the same supplier. This can be due to process of application of the epoxy coatings or the inherent problem of the raw materials of the epoxy coatings or the reformulation of the product brand. Application QC has been tackled by the Oil & Gas operators with the IMM Blaster & Certification Scheme introduced in year 2000. Raw materials QC issues should be tackled by the paint manufacturers during their in-coming QC and they should provide end-users with these QC records. End-users cannot understand why a same product brand which performed very well many years ago now performs poorly in actual oil & gas facilities. End-users want a form of mill certificate from paint manufacturers similar to what they get when they purchase metal products and cannot understand why paint manufacturers are unable to do so. Epoxy coatings make up 80% of the supplies and will have a major bearing on the QA issue highlighted. End-users want paint manufacturers to justify why polymers cannot have some form of a fingerprinting system so that a "manufacturing certificate" similar to metal's "mill certificate" can be produced and submitted with every purchase order. The metal's mill certificate contains the chemical composition of the metallic elements, results of in-house laboratory tests such as hardness test, microscopy test, tensile test, compression test, impact test, heat treatment parameters, etc. All these results within the mill certificate provide quality assurance to the customer and offers traceability, if something go wrong. Polymer coatings must be able to offer similar quality assurance to customers, if not now, maybe in the near future.



Biodata - David Lim

Mr. David Lim Chee Cheong is the Chairman of the IMM Coatings Committee and has been actively involved in the IMM Coatings & Corrosion committees since 1990. David is responsible for QA/QC in protective coatings in ExxonMobil Exploration & Production Malaysia and has over 25 years' experience with protective coatings technology. He is a Fellow of the Institute of Materials, Malaysia and has been involved in numerous coatings talks, seminars and conferences over the past 20 years.



Biodata - Zamaluddin B Ali

En. Zamaluddin Ali is the Deputy Chairman of the IMM Coatings Committee and has been actively involved in the IMM Coatings and Corrosion committees since 1996. Zamaluddin is the Technical Authority in Materials, Corrosion & Inspection for PETRONAS Group Technology Solutions Department and has over 20 years experience with protective coatings technology. He is a Fellow of the Institute of Materials, Malaysia and has presented numerous technical

papers at national and international conferences & seminars on asset integrity, corrosion & coatings.

Please register with the IMM secretariat at iomm@po.jaring.my by 15 March 2013