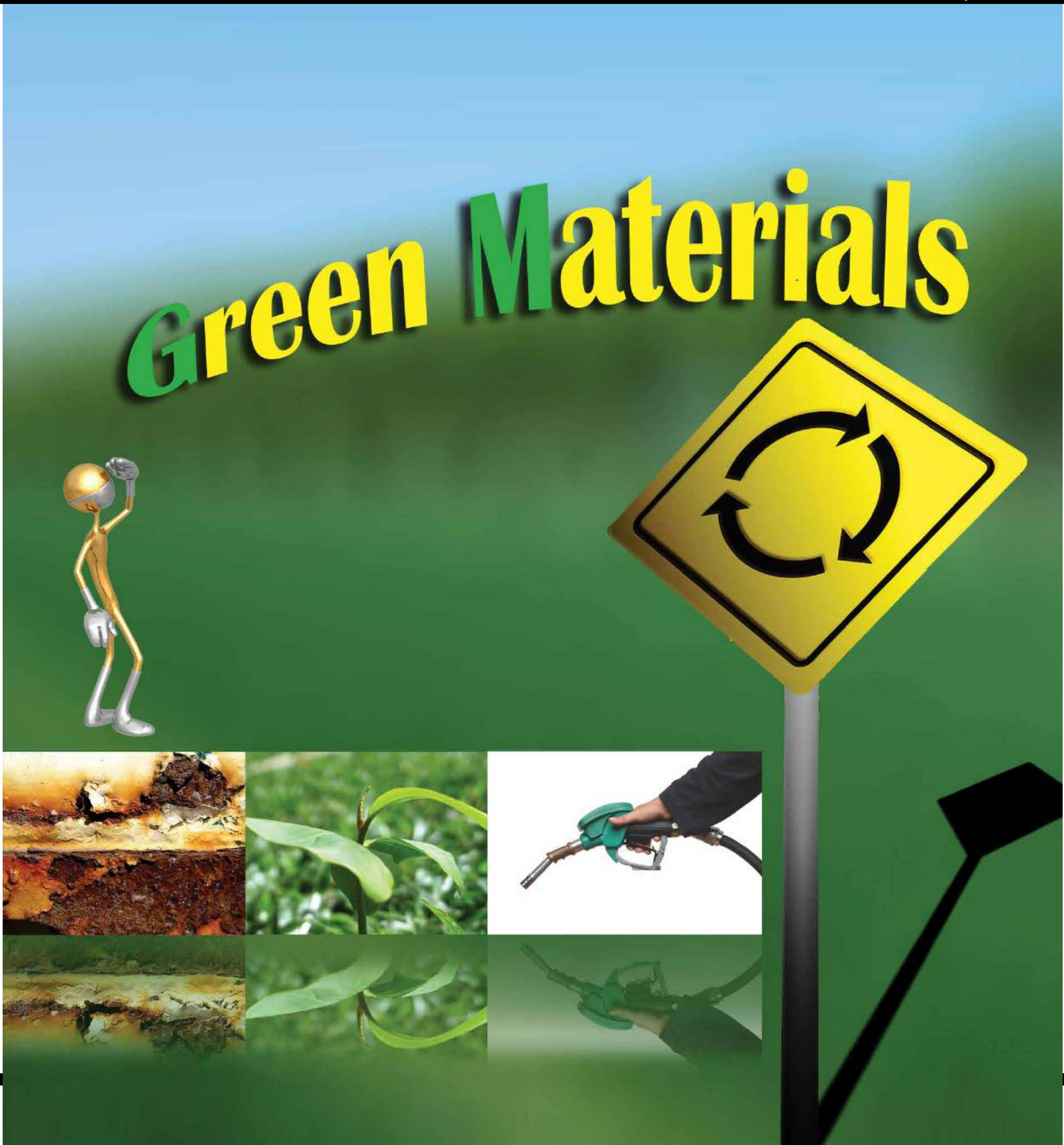
For Members Only

MATERIALS MIND

APRIL 2013

www.iomm.org.my

Institute of Materials, Malaysia



ABOUT IMM

The 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 4000. The objectives of the 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 the Authorized Certification Body (ACB) for Malaysia for the Asian Welder Federation Common Welder Certification Scheme (AWF-CWCS). The ACB will qualify and certify welders in the Malaysian Oil & Gas Industry in accordance to ISO-9606-1 standard. Such welders will be certified as AWF Certified Welders and must be registered in the Manpower Optimization System (MOS) in order to maintain their certification.

ABOUT MTE

The Materials Technology Education (MTE) was founded to operate the various educational activities of IMM. MTE offers technical certificate and diploma including general courses in metallurgy, welding, corrosion and coatings. IMM accredited courses, recognised in the oil and gas, shipbuilding and construction industries are endorsed by PETRONAS. Graduates of these courses get supplementary knowledge in materials technology and engineering, and are better placed for employment and enjoy higher remunerations usually.

INSTITUTE OF MATERIALS MALAYSIA
No. 10-1, Jalan Bandar 3, Pusat Bandar Puchong,
47160 Puchong, Selangor
Tel : 03-5882 3574/3584 Fax : 03-5882 3524
Website : www.iomm.org.my
Email : iomm@po.jaring.com

MATERIALS TECHNOLOGY EDUCATION SDN BHD
No. 10-1, Jalan Bandar 3, Pusat Bandar Puchong,
47160 Puchong, Selangor
Tel : 03-5882 3574/3584 Fax : 03-5882 3524
Website : www.mte.com.my
Email : info@mte.com.my

MATERIALS MIND
APRIL 2013 Issue 3

materials mind

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 : iomm@po.jaring.com

contents

Message from the President

It is with great pleasure that we welcome Datuk Ir. (Dr) Abdul Rahim Hj. Hashim as the new Advisor to the Institute of Materials, Malaysia (IMM). His expertise, experience and knowledge will help IMM to greater heights and achievements. At the same time, IMM thank the immediate past Advisor, Dato' Yeow Kian Chai, for his leadership and guidance over the last three years.

I am glad to note the new IMM magazine, Materials Mind, is now is in its third edition. The magazine was a changeover from the IMM Newsletter which was published on a half yearly basis for the past four years. News articles in the newsletter have served to keep IMM members informed of the many events and activities of the institute. It will continue to be part of the new publication. Materials Mind will serve a wider spectrum of members, with information on product updates and new technological innovations.

Another project of IMM will be the International Journal of Institute of Materials, Malaysia (IJIMM). IJIMM will be a platform that will serve academically-inclined members and prepares the institution in one of its mission to become the centre for materials information in Malaysia. We aim to project the journal to be amongst the elite international journals by being indexed by SCOPUS, in which a large number of peer-reviewed papers are stored in its database where researchers can refer to. A forerunner of the journal will be the 1st International Materials Symposium (IMS), from where papers are will be selected and published in IJIMM.

IMM continues to provide technical skills certification and educational programmes in materials science, technology & engineering. For the first time, a 5-day Blaster & Painter training course was conducted last year. This course aimed to provide new or inexperienced workers with the basic skills before proceeding to be assessed and certified. The Blasting and Painting assessment was held at the Sabah Skills and Technology Centre, Kota Kinabalu for first time at the end of 2012. Since then more than 60 personnel have been certified. The Welding Engineer training courses has gained tremendous popularity amongst the local welding community.

Fingerprinting of epoxy coatings has evoked controversies and contentions amongst manufacturers and users for many years. With advanced technology, modern measuring instruments and methods, this subject was broached with IMM organising the forum on "Towards Fingerprinting of Polymeric Coatings" in late March. Following exceptional interest in this subject, IMM is acceding to calls to hold a similar forum in Johor in October.

Being an active and progressive society, IMM will hold several seminars and conferences to promote awareness and education of materials science, engineering and technology in the country. The flagship of IMM, the 9th International Materials Technology Conference and Exhibition (IMTCE2014) will be held in May 2014 in Kuala Lumpur. The Materials Lecture Competition (MLC2013) received blessings from PETRONAS who will be the sponsor for this event. For details of all IMM events and activities, please see the information contained within issue of Materials Mind.

Happy reading!

Prof. Dr. Mohd. Kamal Harun
President
Institute of Materials, Malaysia

2012 - 2014
IMM COUNCIL MEMBERS

Advisor:	DATUK IR DR ABDUL RAHIM HJ. HASHIM - Universiti Teknologi PETRONAS
President:	PROF DR MOHAMAD KAMAL HARUN - Universiti Malaysia Kelantan/UiTM
Dep. President:	PROF DR CHE HUSNA AZHARI - Universiti Kebangsaan Malaysia
Hon. Secretary:	IR MAX ONG CHONG HUP - Norimax Sdn Bhd
Dep. Hon. Sec:	IR ABDUL RAZAK HURAIRAH - Morecap Sdn Bhd
Hon. Treasurer:	IR MOHD SURADI YASIN - Materials Technology Education Sdn Bhd
Imm. Past President:	DATO' DR ONG ENG LONG - Kossan Rubber Industries Bhd
Council Members:	DATO' IR MOHD JAI SUBOH - Velosi (M) Sdn Bhd
	DATUK IR WAHIRUDDIN WAHID - PRA Services Sdn Bhd
	PROF DR AHMAD FAUZI MOHD NOOR - Universiti Sains Malaysia
	PROF DR ESAH HAMZAH - Universiti Teknologi Malaysia
	PROF DR SAIFOLLAH ABDULLAH - Universiti Teknologi MARA
	ASSOC PROF DR ANDREW SPOWAGE - U of Nottingham M'sia C
	IR DR EDWIN JONG NYON TCHAN - Jurutera Perunding Akal Sdn Bhd
	DR AARON GOH SUK MENG - Curtin University
	IR LAI KAH CHIUNG - PETRONAS RAPID
	IR LEE HUNG SANG - Petra Resources Sdn Bhd
	IR PAU KIEW HUAI - PETRONAS GTS
	DAVID LIM CHEE CHEONG - ExxonMobil E & P (M) Inc
	ENG KIM LENG - Bina-Goodyear Sdn Bhd
	FRANKIE CHUA CHENG HUAT - PLC Laboratory Sdn Bhd
	HARRY WOON - Bredero Shaw (M) Sdn Bhd
	KANG KIM ANG - Corrtrol Corrosion Sdn Bhd
	MAIMUNAH ISMAIL - Lloyds Register of Shipping (M) Bhd
	MOHD AZMI MD. NOOR - PETRONAS
	MOHD RAZIFF EMBI - Malakoff Power
	NIGEL PATRICK BREWITT - MTIS Sdn Bhd
	NOOR HISHAM ABDUL HAMID - UTM - PJSB
	SITI HASLINA - PETRONAS Research Sdn Bhd
	TUNGKU NOR MANIRA - Norimax Sdn Bhd
	YII MING SING - Malaysia LNG Sdn Bhd
Committee Chairmen:	
Advanced Materials	DR LIANG MENG SUAN - UTAR
Coatings	DAVID LIM CHEE CHEONG - ExxonMobil E & P (M) Inc
Composites	SITI HASLINA - PETRONAS Research Sdn Bhd
Corrosion & Materials Degradation	HALIMAH PIT - Shell
Education	IR MAX ONG CHONG HUP - Norimax Sdn Bhd
Green Materials	PROF DR SAIFOLLAH ABDULLAH - UiTM
Nanomaterials	DR AZMI IDRIS - SIRIM
Polymers	DR CHAN CHIN HAN - UiTM
Rheology	DR AARON GOH - Curtin University
Technical Publications	DR KAREN WONG MEE CHU - UTAR
Vibration	NOOR HISHAM ABDUL HAMID - UTM
Welding	IR DR EDWIN JONG NYON TCHAN - Jurutera Perunding Akal SB
Chapter Chairmen:	
East Coast	HARRY WOON - Bredero Shaw (M) Sdn Bhd
Southern	PROF DR ESAH HAMZAH - UTM
Northern	PROF DR HANAFI ISMAIL - USM
Kuching	NUZUL ADZWAN SULAIMAN - Brooke Dockyard
Bintulu	YII MING SING - Malaysia LNG Sdn Bhd
Miri	IR DR EDWIN JONG NYON TCHAN - Jurutera Perunding Akal SB
Sabah	IR LUIZ LIEW - Shell Sabah

EDUCATION
Chairman: Ir Max Ong Chong Hup
Committee: Prof Dr Che Husna Azhari
Prof Dr Mohd Kamal Harun
Assoc Prof Dr. Andrew Spowage
Dr Astuty bt Amrin
Dr Chan Chin Han
Dr Rajkumar Durairaj
Ir Lai Kah Chung
Ir Pau Kiew Huai
Siti Haslina Ramli

COATINGS
Chairman: David Lim Chee Cheong
Dep.: Zamaluddin Ali
Sec.: Yeoh Tian Hock
Committee: Dato' Udani bin Dato' Seri Mohd Daud
Prof Dr Mohd Kamal Harun
Chong Horng Yih
Frankie Chua
Gary J Bennett
Junaidy Abdullah
Lim Wai Bin
Muhammad Hawari Hasan
Roslan Ismail
Tan Ju Liang
Ting Lai Liong
Wong Ing Chiew

CORROSION & MATERIALS DEGRADATION
Chairman: Halimah Pit
VC: Kang Kim Ang
Sec.: Nor Aida Mohd Hussin
Committee: Dr Lee Chee Hong
Ir Dr Mokhtar B Che Ismail
Eric Lay
Elizah Samat
Junaidy Abdullah
Kenny Siew
Mohd Rais Sabiyah
Mohd Hafiz Zakaria
Mohd Khairi Kadir
Mohd Azlisham Mohd Yusof
Muhamad Paizal Othman
Nurfuzlilah Bakarudin
Syarifah Nazliah Syed Abdul Rahman
William Lim

TECHNICAL PUBLICATIONS
Chairman: Dr Karen Wong Mee Chu
Dep.: Dr Liang Meng Suan
Sec.: Dr Rajkumar Durairaj
Committee: Prof Dr Ahmad Fauzi
Dr Leong Kok Hoong
Dr Ramesh Subramaniam
Dr Sharon Teh Geok Bee
Tian Yee Kai

COMPOSITES
Chairman: Siti Haslina Ramli
Sec.: Razman Marsoff Johar
Committee: Dr Caroline Jee
Dr Leong Kok Hoong
Dr Roslina Ismail
Elizah Samat
Zulkarnain Mohamad

GREEN MATERIALS
Chairman: Prof Dr Saifollah Abdullah
Sec.: Abd Razak Hurairah
Committee: Dr Ang Bee Chin
Dr Amalina Muhammad Afifi
Arnold Denes
Eng Kim Leng
Frankie Chua
Hahnas Mahbut
Hussein Mahmat
Yeoh Eng Huei
Zamaluddin Ali

WELDING
Chairman: Ir Dr Edwin Jong
Dep. : Abdul Ghani & Ghalib Tham
Secretary: Md Hafidzuddin Mohd Salleh
Asst Sec.: Mohd Shahrizal PKM Seeni Mohd
Treasurer: Dr Samsul Bahar Sadli
Committee: Dr Andrew Spowage
Abu Bakar Mohd Arif
Barry Edmonds
Ismail Abu Bakar
Kelvin Chan
Nigel Brewitt
Tan Yew Min
Thomas Teo
Zamaluddin Ali

ADVANCED MATERIALS
Chairman: Dr Liang Meng Suan
Dep.: Dr Karen Wong Mee Chu
Sec.: Dr Chen Kah Pin
Committee: Dr Muhammad Azmi Abdul Hamid
Dr Rajkumar Durairaj
Ms Chew Chee Sean
Mr King Yeong Jin
Dr Khaw Chwin Chieh
Mr Yeo Wei Hong
Mr Kelvin Hoh Chee Wai

NANOMATERIALS
Chairman: Dr Azmi Idris
Dep.: Prof Dr Ahmad Fauzi Mohd Noor
Sec.: Dr Talib Ria Jaafar
Committee: Dr Aziz Mohamad
Dr Mat Husin Saleh
Dr Mohd Radzi Mohd Toff
Dr Teng Wan Dung
Dr Ang Bee Chin

POLYMER
Chairman: Dr Chan Chin Han
Dep.: Dr Chia Chin Hua
Secretary: Dr Tan Winie
Committee: Dr Chew Khoon Hee
Casey Teh King Chong
Imizan B A Bakar
Shamsul Farid Samsudin
Xu Chun
Yeoh Eng Huei

RHEOLOGY
Chairman: Dr Aaron Goh
Dep.: Dr Azuraien Jaafar
Committee: Prof Dr Abdul Karim Alias
Dr Chew Kong Chin
Dr Chin Nyuk Ling
Dr David Hassell
Dr Ngu Joo Ding
Dzulkifly Mat Hashim

MIRI
Chairman: Ir Dr Edwin Jong
VC.: Giridharan Anandan &
Wong Siong Pin
Sec.: Bernard Sim
V. Sec.: Derick Ung
Treasurer: Lee Chung Khiong
Committee: Dr Aaron Goh
Dr Beena Giridharan
Andrew Ling
Daniel Liau
Liew Wei Yiew
Liew Shann Ching
Teng Hui Chung

BINTULU
Chairman: Yii Ming Sing
VC. : Leong Yin Chin
Sec.: Felix Bantin Ak Amit
Committee: Chung Yih Yenn
Steward Siran

KUCHING
Advisor: Andrew Ronggie
Chairman: Nuzul Adzwan Sulaiman
Sec. : Wan Mohd Naguib
Committee: Biran ak Atu
Dominic Christopher ak Keli
Gary ak John
Ir Dr Mohamad Sharil Osman

SOUTHERN
Chairman: Prof Dr Esah Hamzah
Dep. : Mohd Khairul Mohd Nazor
Sec.: Dr Tuty Asma Abu Bakar
Committee: Dr Ali Ourdjini
Dr Muhammad Azizi Mat Yajid
Engku Mohd Nazim Engku Abu Bakar

SABAH
Chairman: Ir Luiz Liew
Dep.: Ahmad Tirmizi Ali Amat
Sec.: Dr Chong Siaw Fung
Treasurer: Natalie Fung
Committee: Ir Joe Chow Wai Ming
Chung Tze Kong
Mohd Khairudin Mohd. Naser
Simon Thien
Valarie Fung
Vanessa Foo

NORTHERN
Chairman: Prof Dr Hanafi Ismail
Dep. : Dr Shah Rizal Kassim
Secretary: Assoc. Prof. Dr. Hasmaliza Mohamad
Committee: Assoc. Prof. Ir Dr. Mariatti Jaafar
Dr Norazharuddin Shah Abdullah
Dr Zuratul Ain Abdul Hamid

EAST COAST
Chairman: Harry Woon
Sec. : Azman Bidin
Committee: Vincent Owi Fong Keong
Cheong Kok Loong
Ang Hui Kiang
Soo Shiaw Yee

GOLF COMMITTEE
Chairman: Ir Abdul Razak Hurairah
Sec.: Junaidy Abdullah
Committee Prof Mohd Kamal Harun
Dato Ir Jai Suboh
Datuk Ir Wahiruddin Wahid
Ir Azmi Mohd Noor
Ir Lai Kah Chung
Ir Max Ong
Ir Pau Kiew Huai
Ir Tiong Huo Chiong
Ir Mohd Suradi Yasin

VIBRATION
Chairman: Noor Hisham Abdul Hamid
Committee: Gary Lee

TECHNICAL & ASSET INTEGRITY
Chairman: Maimunah Ismail
Secretary: Nor Fazri Nordin


INTEGRATED MATERIALS
ENGINEERING SPECIALIST
CORROSION MANAGEMENT
CATHODIC PROTECTION
SACRIFICIAL ANODES
AUV CATHODIC PROTECTION INSPECTION
THERMAL SPRAY COATINGS
FIRE PROOFING COATING SERVICES
BLASTING & PAINTING
COMPOSITE CLADDINGS
MATERIALS PRESERVATION
FLUOROCARBON COATED BOLTS & NUTS
WELL INTEGRITY MANAGEMENT
RISK BASED INSPECTION
FAILURE ANALYSIS
MATERIALS TESTING

INSTITUTE OF MATERIALS, MALAYSIA

ANNUAL REPORT OF THE COUNCIL FOR THE FINANCIAL YEAR ENDING 31ST DECEMBER 2012

Dear IMM Members,

On behalf of the IMM Council, I am pleased to present the Report of the activities of IMM covering the period from 1st January 2012 to 31st December 2012 plus activities prior to this AGM in early 2013.

I. IMM COUNCIL AND IMM MANAGEMENT COMMITTEE MEETINGS.

For the year under review, the IMM Council held 4 meetings while the IMM Management Committee held 2 meetings.

Date	Event
2 Mar 2012	IMM Council Meeting no. 10 for 2010-2012 session at KGNS.
25 May 2012	Council Meeting no.1 (2012-2014 term) at KGNS
8 June 2012	IMM Management Committee meeting no.1 at KGNS
15 June 2012	IMM Council Meeting no.2 at KGNS
7 Sept 2012	IMM Management Committee meeting no.2 at Glenmarie Golf Club
27 Sep 2012	IMM Council Meeting no.3 at KGNS

II. THE ACTIVITIES CARRIED OUT BY THE VARIOUS IMM WORKING COMMITTEES AND REGIONAL CHAPTERS ARE LISTED BELOW:-

DATE	ACTIVITY	COMMITTEE
13 & 14 Jan	AWF & IMM meeting with Petronas on the CWCS at KLCC	Welding
17-02-12	IMTCE2012 Organizing Committee meeting	IMTCE
24-02-12	IMM Career Talk in UTM Johor	Southern
24-02-12	IMTCE sub-comm meeting on Materials Lecture Competition in UTM Johor	Southern
12-26 Feb	IMM-MWJS-JWES courses on Welding Engineer and Senior Welding Engineer at Petronas Leadership Centre in Bangi.	Welding
21-02-12	Briefing and appointment of Authorized Testing centres held at Petronas Leadership Centre in Bangi. Attended by DNV, SIRIM, Velosi, PTS, SGS, SSTC, Metacos, & Nusatek.	Welding
24-02-12	IMM Seminar on Materials Expertise for the Oil & Gas Industry held in Faculty of Mechanical Engineering, UTM, Skudai, Johor.	IMM Southern Chapter
02-03-12	IMM Council Meeting no. 10 for 2010-2012 session at KGNS.	Secretariat
07-03-12	IMM-MPRC Meeting at Plaza Sentral	Council
20-03-12	MOS On-boarding Session at Shell Refinery Port Dickson	Welding
21-03-12	IMM Career Talk at UTAR by Kang, Frankie, Edwin	Education Committee
26&27 March	IMM Council visit to IMM Sabah Chapter & SSTC for promotion of IMM Courses.	Council
28-03-12	Prof Hanafi represented IMM to attend BIM Professional Forum in Traders Hotel, Penang	Secretariat
30-03-12	IMM-AGM Seminar on Coatings & Composites at KGNS attended by 100 participants. Signing of MOU between IMM and UTAR for IMM-UTAR Student Chapter.	Coatings & Composites/ Education Committee
30-03-12	IMM 22nd AGM at KGNS attended by 62 members	Secretariat
06-04-12	IMTCE2012 Organizing Committee meeting at KGNS	IMTCE
09 & 10 April	IMM Council participation in Sabah Oil & Gas Conference in Kota Kinabalu to support IMM Sabah Chapter and SSTC.	Council
13-04-12	Interview of IMM President, Hon. Sec and Hon. Treasurer by NSTP for special supplement in NST newspaper.	Council
20-04-12	IMM Sabah Seminar on Materials Degradation at SSTC Kota Kinabalu.	Sabah Chapter & Corrosion & Materials Degradation Committee
27-04-12	Green Materials Committee Meeting	Green Materials
27-04-12	Appreciation Dinner for Immediate Past President, Dato' Dr. Ong Eng Long	Secretariat
30-04-12	Article on skills training in NST Postgraduate Newspaper	Education Committee
07-05-12	Kuching Chapter Chairman & Advisor attended BIM Professional Forum	Kuching Chapter
15-05-2012	Article on IMM in NST Postgraduate Newspaper	Education Committee
25-05-12	Council Meeting no.1 (2012-2014 term) at KGNS	Secretariat
02-06-12	IMM Golf Invitational Tournament at Kelab Golf Sultan Abdul Aziz Shah in Shah Alam	Golf Committee
08 June 2012	IMM Management Committee meeting no.1 at KGNS	Management Committee

9 July 2012	1st IMM Materials Lecture Competition	MLC Working Committee
10 July 2012	IMM Nanomaterials Committee meeting in Sunway Resort & Spa, Selangor	Nanomaterials Committee
9-12 July	IMTCE 2012 Conference & Exhibition at Sunway Lagoon Resort & Spa, Selangor.	IMTCE Committee
9th & 12th July 2012	IMM Masterclasses on Microbial Corrosion, Welding, Composites, Coatings and Rheology.	IMTCE Committee
15-06-12	IMM Council Meeting no.2 at KGNS	Secretariat
3-08-12	IMM Education Committee meeting no.1 at Malaysian Petroleum Club, KLCC	Education Committee
7th August 2012	Technical Presentation on AWF-CWCS welder certification programme and iMOS scheme to Kencana-Supura in Lumut	Welding Committee
8th August 2012	Technical Presentation on AWF-CWCS welder certification programme and iMOS scheme to KNM in Malacca	Welding Committee
4th to 5th Sept 2012	Technical Presentation on AWF-CWCS welder certification programme and iMOS scheme to MLNG, Bintulu and Offshore Contractors in Miri.	Welding Committee
7 Sep 2012	IMM Management Committee meeting no.2 at Glenmarie Golf Club.	Management Committee
20-09-12	IMM Materials Lecture Competition meeting at Malaysian Petroleum Club.	Education Committee & MLC Working Committee
20-09-12	IMM Pipeline Integrity Networking Seminar at Malaysian Petroleum Club, KLCC	IMM Council
24 Sep – 2nd Oct	JWES Associate Welding Engineer and Welding Engineer Certification Courses at Petronas Leadership Centre, Bangi, Selangor.	Welding Committee
27 Sep 2012	IMM Council Meeting no.3 at KGNS	Secretariat
16-18 Oct 2012	Career Talks in Kuching at Poly Kuching, UNIMAS and Visit to Sarawak Timber Industry Development Corporation (STIDC) and Pusat Pembangunan Kemahiran Sarawak (PPKS).	Council & Kuching Chapter
19-10-12	IMM Education Committee meeting no.2 at KGNS	Education Committee

6-8 Nov 2012	IMM co-sponsored and participated in the 8th Asian-Australasian Conference on Composite Materials ACCM-8 at KLCC Convention Centre, Kuala Lumpur.	Composites Committee
9-11-12	Talk by CSIRO at UiTM, Petaling Jaya.	Composites Committee
21-22 Nov 2012	Workshop on Characterization of Nanomaterials organized jointly by IMM NanomaterialsCommittee and the SIRIM Advanced Materials Research Centre (SIRIM-AMREC) at AMREC facility in Kulim Hi-Tech Park, Kedah.	Nanomaterials Committee
21-24 Nov	18th AWF & 11th Task Force Meeting in Bangkok	Welding Committee
6 Dec 2012	Evening Talk on Good and Bad Practice in Fabrication & Use of Stainless Steels by Dr. Liane Smith, Intetech Ltd UK at the Malaysian Petroleum Club, PETRONAS Twin Tower.	IMM Corrosion & Materials Degradation Committee
7 Dec 2012	IMTCE2014 – inaugural meeting of the Technical Symposiums Organizing Committee at Holiday Villa, Subang Jaya, Selangor.	IMTCE2014 Technical Symposiums Organizing Committee
14 Dec 2012	IMTCE2014 – inaugural meeting of the Events Management Organizing Committee at MTE office, Puchong, Selangor.	IMTCE2014 Events Management Organizing Committee
15 Dec 2012	IMM Year-end Networking Golf Game at Bukit Unggul Golf Club, Selangor.	Golf Committee
5 Jan 2013	IMM Management Committee meeting no.3 at Holiday Inn Glenmarie	Management Committee
7 – 15 Jan 2013	JWES Welding Engineer & Senior Welding Engineer Course at Seri Pacific Hotel, K.L.	IMM Welding Committee
11 Jan 2013	IMM Council Meeting no.4 at KGNS	Secretariat
18 Jan 2013	IMM Materials Lecture Competition MLC2013 Briefing to all participating universities at UTM, Jalan Semarak Campus, K.L.	MLC Organizing Committee
18 Jan 2013	IMTCE2014 Technical Symposiums Organizing Committee meeting no.2 at KGNS	IMTCE2014 Technical Symposiums Organizing Committee
22 March 2013	IMM Forum on "Towards Fingerprinting of Polymeric Coatings" at KGNS.	IMM Polymers Committee

22 March 2013	IMM 23rd Annual General Meeting at KGNS	Secretariat

IMM Certification and educational courses:

Dates	Programs conducted by the IMM Coatings Committee
Jan 6, 16 and 29	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
Feb 18	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
Mar 14, 17, 23 and 31	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
Apr 1,7, 14, 24, 27 and 30	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
May 12, 19 and 25	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
June 27and 30	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
July 2	Protective Coatings Technician (Blaster & Painter) at Syarikat Bersaudara Lutong, Miri
Aug 27, 29	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
Sept 26	Protective Coatings Technician (Blaster & Painter) at Century Consultation Services, Miri.
Oct 4, 13, 18	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
Nov 3, 23	Protective Coatings Technician (Blaster & Painter) Various locations around Malaysia.
19 Mar, 16 July, 2 Oct, 5 Dec	Coatings Inspector Level 2 (1 day) at IMM Training Room, Puchong, Selangor
27 Feb - 1 Mar 28 Sept - 1 Oct 10 - 13 Sept 27-30 Nov	Coatings Inspector Level 1 (4 days) at IMM Training Room, Puchong, Selangor

Dates	Programs conducted by the IMM Welding Committee
12-26 Feb 2012	IMM-MWJS-JWES courses on Welding Engineer and Senior Welding Engineer at Petronas Leadership Centre in Bangi.
24 Sep – 2nd Oct 2012	JWES Associate Welding Engineer and Welding Engineer Certification Courses at Petronas Leadership Centre, Bangi
3 Oct 2012	Welding – Joining Technology for Non-Welding Personnel

INTERNATIONAL MATERIALS TECHNOLOGY CONFERENCE & EXHIBITION " IMTCE "

The signature event of the IMM is the IMTCE conference & exhibition which held its 8th IMTCE in July 2012. The IMTCE event had traditionally been dominated by the industry players, particularly from the oil & gas, marine, and energy sectors due to the high degree of interest in Materials Science & Technology from these sectors. For the first time in 2012, the academia participated in larger numbers which imposed a greater demand on the IMTCE Conference Organizing Committee and Conference Secretariat to meet the academic standards of an international conference. IMTCE2012 was a good success in terms of academia-industry participation with over 300 delegates.

With the lessons learnt, it is anticipated that IMTCE2014 will be an even better event with the joint involvement of the industry and academia to offer greater intellectual and commercial value to delegates and participants with the theme " Synergizing Industry & Academia – Innovations for Industrial Applications ". The Event Organizer, Materials Technology Education Sdn. Bhd. represented by General Manager, Mr. Kirk Keng Chuan and his team had a steep learning curve to appreciate the requirements for Scopus Index papers and Impact Factors which will bring the IMTCE technical conference to world-class standard.

IMM MATERIALS LECTURE COMPETITION

The inaugural competition for university postgraduate students in the field of Materials Science & Engineering was held on 9th July 2012 in conjunction with IMTCE2012. Under the co-chairmanship of Professor Dr. Esah Hamzah and Professor Dr. Ali Ourdjini, the first IMM Materials Lecture Competition "MLC" event was participated by 5 students from Universiti Teknologi Malaysia (UTM), 2 students from Universiti Sains Malaysia (USM), and 2 students from Universiti Putra Malaysia (UPM). The students had 12 minutes each to present their technical research to an audience from industry and academia followed by 3 minutes for Q&A. The students were judged not only on their technical content but more importantly on their communications skills and confidence level in answering questions.

The winners were:-
First prize (Postgraduate) : Muhammad Ghaddafy Affendy (USM).
Runner-up (Postgraduate) : Nor Aqilah Mohd Fadzil (UPM).

First prize (Undergraduate) : Mohamad Danial Shafiq (USM).
Runner-up (Undergraduate) : Gary Yeow Wen Jie (UTM).

The 2nd MLC will be held on 30th May 2013 at the Seri Pacific Hotel, Kuala Lumpur and will be for postgraduates only. The winner will represent Malaysia at the IOM3 Young Persons Lecture Competition (YPLC) Grand Finals in Hong Kong in July 2013 under the sponsorship of the Institute of Materials, Minerals & Mining UK (IOM3).

IMM GREEN MATERIALS AWARD

The 1st IMM Green Materials Award was organized by the IMM Green Materials Committee under the chairmanship of Dr. Chen Sau Soon. The winners were presented their awards during the IMTCE2012 Banquet Dinner. The winners were:-

(1). Universiti Sains Malaysia for project on the use of fruit skin waste from rambutan and banana as an industrial biodegradable plastic product.

(2). Norimax Sdn. Bhd. for project on the replacement of solvent-based coating (environmentally hazardous materials) with water-based fluorocarbon coating as an anti-corrosion and torque-enabling coating on bolts & nuts for the oil & gas industry.

(3). Curtin University Sarawak for project on the use of Oil Palm Shell (waste material) as partial replacement for sand in the masonry blocks as a building material.

The next IMM Green Materials Award is scheduled in conjunction with IMTCE2014 in May 2014. The IMM Green Materials Committee will embark on soliciting applications from industry and academia.

to be continue page 11

IMM Advisor 2013 - 2015

Kuala Lumpur 26 Mar 2013

The Institute of Materials, Malaysia (IMM) is pleased to announce that Datuk Ir. (Dr) Abdul Rahim Hj Hashim, Vice Chancellor and Chief Executive Officer of Universiti Teknoloji Petronas (UTP) will serve as the Advisor of IMM from 2013.

Datuk Rahim has been involved in the oil and gas industry for more than 36 years. He has been a member of the Board of Engineers Malaysia and served as Chairman of the Engineering Accreditation Council of Malaysia. He is a director of several companies including PETRONAS subsidiary companies and SIRIM.

At a welcome lunch in his honour, Datuk Rahim stressed the importance and role of materials science, engineering and technology in the oil & gas industry. The President of the Malaysian Gas Association and Immediate Past President of the International Gas Union is a keen supporter of the several initiatives of the institute, especially in the education, upskilling and development of human capital in materials study.

IMM records its gratitude to Dato' Yeow Kian Chai for guiding and advising the institute during his term as Advisor from 2010 to 2012.

Welcome!

Ms. Talat Anwar has joined the Materials Technology Education Sdn Bhd Secretariat as the Assistant Manager. She is an experienced professional with global exposure and has worked for reputed companies like Tata Consultancy Services (TCS) and Sutherland Global Services –Microsoft. She graduated with a Bachelor of Engineering in the Electronics and Communication discipline and followed it with a Masters in Human Resource Management.

Her skills include Human Resource Planning and Development, Competency Management, Training and Development, Business Communications, Programme Development, Data Analysis, Organizational Leadership Development, Customer Retention, Events Organization, Learning Effectiveness and Team Building. She has won awards throughout her career in various organizations. She is passionate about Performance improvement, reading, music and travelling.

continue from page 10

IMM INTERNATIONAL MATERIALS SYMPOSIUM & IJIMM

In conjunction with the publication of IMM's International Journal of the Institute of Materials Malaysia (IJIMM), the IMM Technical Publications Committee will organize regular technical symposiums to gather high quality technical research publications for IJIMM. The 1st International Materials Symposium will be held on 30th May 2013 at the Seri Pacific Hotel, Kuala Lumpur. Both academic and industry researchers are encouraged to present their work at this symposium and offer their papers for publication in the IJIMM journal.

III. MEMBERSHIP

Total number of members as at 31st December 2012 = 4256

The IMM continues to encourage members of other professional societies and associations to join as Ordinary Members with no annual subscriptions. Materials Science & Technology is essential to everyone and IMM welcomes the sharing of knowledge & experience amongst professionals from all disciplines (medical, dental, nursing, architectural, engineering, science, arts, physics, biology, chemistry, banking, finance, accounting, legal, insurance, marine, oil & gas, petrochemical, geology, etc).

IV. PUBLICATIONS

The IMM Secretariat published the first issue of the quarterly IMM magazine called Materials Mind in June 2012 to replace its newsletter. The magazine will contain technical articles, product write-ups, materials technological updates, news of IMM activities and advertisements. Companies are encouraged to advertise in this IMM magazine which is distributed to its 4,000-plus members and other organizations throughout Malaysia.

Besides the above activities, the IMM is fortunate to receive strong support from new Council Members and new Committees which are listed in the IMM Handbook for the 2012-2014 Council Session. The Polymers Committee, the Advanced Materials Committee, the Nanomaterials Committee, the Rheology Committee, and the Composites Committee are also important committees which can bring about greater awareness of such technologies to the public. An Education Committee has been established to monitor the standards of IMM educational and certification programs.

The IMM Council thank all members of the Working Committees, Regional Chapters, and staff of the IMM Secretariat at the office of Materials Technology Education Sdn. Bhd. (MTE) in Puchong, Selangor for their tireless efforts to promote and fulfill the objectives of the IMM.

On behalf of the Council

Ir. Max Ong Chong Hup
Honorary Secretary

Date : 22nd March 2013

Blasting & Painting Certification in Sabah

IMM and Sabah Skills & Technology Centre (SSTC) entered into a partnership on 25 November 2011 and conducted their first Protective Coatings Technician (Blasting & Painting) Competency Certification Scheme in Sabah on 13th October 2012. Since then, IMM and SSTC have trained and certified a total of 64 participants in the Protective Coatings Technician (Blasting & Painting) Competency Certification Scheme with a passing rate of 96 percent.

SSTC is currently planning to build a blasting & painting yard to support the needs and high demand of blasters and painters as well as welders in the Sabah Oil & Gas Terminal project in Kimanis.

SSTC currently offers fully sponsored youth programs by the Federal Government comprising of IMM certified programs:

- Workforce Technical Transformation Program (WTTP) for school-leavers to equip them with the skills and knowledge in the Protective Coatings Technician (Blasting & Painting) Competency Certification Scheme.
- Industrial Skills Enhancement Program (INSEP) for re-skilling graduates in the areas of Coating Technology (Coatings Inspection) Certification Program.

INNOVATIVE GREEN MATERIAL FROM NATURAL FIBER REINFORCED BIO–PLASTIC COMPOSITE

By; Dr. Siti Norasmah Surip
Bio-Composites Technology Programme, Faculty of Applied Sciences, Universiti Teknologi MARA.

Environmental consideration has been taken into account for the development of plastic composites. The addition of natural fibre to natural or bio-plastic appears very promising for the development of environmental friendly materials with its unique ability of bio-degradable and promising strength properties. Bio-plastics are a form of plastics or polymer that been derived from renewable biomass sources, such as vegetable, corn and soy beans. Synthetic plastics, such as fossil-fuel plastics are derived from petroleum. These plastics rely more on scarce fossil fuels and non-renewable resources. The production and use of bio-plastics is generally regarded as a more sustainable activity when compared with plastic production from petroleum, because it relies less on fossil fuel as a carbon source and also introduces fewer, net-new greenhouse emissions if it biodegrades. They significantly reduce hazardous waste caused by oil-derived plastics, which remain solid for hundreds of years.

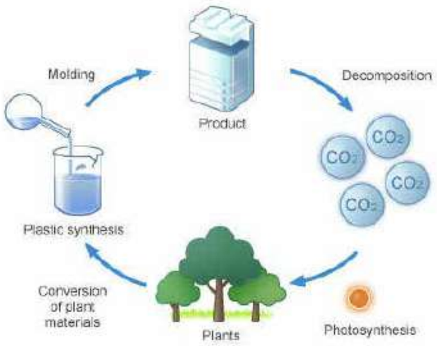


Figure 1: life-cycle of bio-plastics
Source: www.sunpack.com

Today, leading bio-plastic used is polylactic acid (PLA). Industrial lactic acid is derived from many starchy sources including wheat, beets, potatoes, soy beans and corn. The lactic acid, simple organic chemical that is a by-product of fermentation is converted to lactide, and lactide molecules are linked into long chains or polymer, to produce polylactic acid.

Natural fibre reinforced polylactic acid is categories as green composites material. It was manufactured for an alternative product for disposable packaging such as agriculture bag, kitchen utensils and medical apparatus. The incorporation of natural fiber such as kenaf in PLA matrix will improve their physical & mechanical strength performance thermal stability and at the same time reducing the production cost.

Bio-Plastics are one of the alternative materials that derived naturally and eco- friendly. In order to ensure preservation of our green-world, extensively research on renewable materials and green technology should be explored and implemented. Let's protect our earth today, for our children's tomorrow!

Figure 2: Flow chart of producing natural fiber reinforced polylactic acid green composite

Figure 3: Products made from bio-plastics

IMM Fingerprinting Forum

Taking questions: The panel of speakers headed by Dr. Chia Chin Hua (5th from left), with Dr. Chan Chin Han, Chairman of IMM Polymer Committee (3rd from left).

Kelana Jaya 22 March 2013

Interest was very high in the IMM forum on "Towards Fingerprinting of Polymeric Coatings" which attracted a large crowd comprising of manufacturers of coatings, suppliers of testing instruments, researchers and users of coatings. Participants want to know if fingerprinting of polymeric coatings is possible in this present time with new and advanced technology available.

Organised by the IMM Polymer Committee, four papers representing the observations of the speakers were presented during the forum. Components of epoxy polymers were made known, the feasibility of fingerprinting was questioned, how new instruments can play a role in fingerprinting and how the industry seeks concrete answers to quality of paints used in projects were discussed in detail.

Such was the importance of fingerprinting that there were calls for another forum to be held soon.

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.

Note: Another session on this topic will be held in Johore in October 2013.

CorrTrol

We are Specialised in:

* Cathodic Protection System
* Corrosion Consultancy
* Corrosion Failure Analysis
* Corrosion Training
* Thin Film Zinc Anode
* Electrolytic Anti-Fouling System
* Corrosion R & D

Our Special Services:

* MTM Magnetometry Tomography Method
* ECDA External Corrosion Direct Assessment
* DCVG Direct Current Voltage Gradient
* CIPS Close Interval Potential Survey
* CDS Current Drainage Survey
* NDT All Methods – Advanced NDT Method
Crane Inspection

CORRTROL Group of Companies:

CORRTROL SYNERGY SDN. BHD. (983692-V)
CORRTROL VENTURE SDN. BHD. (976972-A)

No. 14, Jalan BP 6/6, Bandar Bukit Puchong
47120 Puchong, Selangor Darul Ehsan, Malaysia.
Tel: +603-80682616 Fax: +603-80603816
Email: corrtrol@streamyx.com
Website: www.corrtrolgroup.com

Materials Lecture Competition 2013

MLC2013 Committee: *Prof. Dr. Esah Hamzah (seated 3rd from left), with Prof. Dr. Ali Ourdjini (Standing 2nd from left).*

Kuala Lumpur, 18 January 2013

IMM and the Institute of Materials, Minerals and Mining, Malaysian Chapter (IOM3-MC) will jointly organise the 2013 Materials Lecture Competition (MLC2013) in conjunction with the 1st International IMM Materials Symposium scheduled on 30th May 2013.

The MLC2013 is a competition that will judge the oral presentation and communication skills rather than technical content. It is open to students from universities in Malaysia who is to deliver a 15-minute oral presentation on a topic related to materials engineering. The topic may be on the student's current research work or project from, but not limited to materials development, characterization, processing and applications. The finals will be held on Thursday 30th May 2013 in Kuala Lumpur. The first prize winner of the MLC2013 will represent Malaysia at the IOM3's annual Young Persons Lecture Competition (YPLC) to be held in Hong Kong in July 2013.

Representatives from ten universities attended a meeting to discuss the organisation and rules of the competition. MLC 2013 is organised IMM under the chairmanship of Prof.Dr. Esah Hamzah and Prof. Dr. Ali Ourdjini.

WE/SWE Training

Kuala Lumpur, January 2013

Members of the welding community in Malaysia continue to enjoy the benefits of learning in Welding Engineering from the Japan Welding Engineers Society (JWES) which provided the knowledge and expertise. The program has been supported by the Japanese Ministry of Economy Trade and Industry (METI) since 2011. The Institute of Materials, Malaysia (IMM), in collaboration with the Malaysian Welding and Joining Society has provided local engineers the same opportunities as their counterparts in Thailand, Philippines and Indonesia.

The 5th training of Welding Engineers and Senior Welding Engineers conducted was held in January 2013 in Kuala Lumpur. A total of 11 Welding Engineers and 8 Senior Welding Engineers were trained in a local hotel.

IMM Roadshows in MIRI and KOTA KINABALU

IMM promoted several forthcoming events during a 5-day visit to Miri and Kota Kinabalu in March 2013.

IMM Miri Chapter Members L-R: Giritharan Anandan, Andrew Ling, Bernard Sim (Secretary) & Beena Giridharan at the dinner

Miri

A IMM team led by the Honorary Secretary, Ir. Max Ong, met with the IMM Miri chapter during a dinner hosted by IMM. During this meeting, the chapter under the chairmanship of Ir. Dr. Edwin Jong Nyon Tchan, agreed to organise the 2nd International Materials Symposium cum 4th Regional Materials Technology and Conference (4RMTC) which shall be held on 12th September 2013. The 4RMTC is expected to attract 15-20 presentations.

At the invitation of Dr. Aaron Goh, the team also visited Curtin University. Students of Materials and Engineering in the new intake heard of the career opportunities in the Oil and Gas industry as well as the IMM courses that can help them in their work in the industry.

The team received a very warm welcome from PETRONAS Carigali Sdn Bhd (SKO) and Shell Sarawak. Ruzlan Bin Hashim, Head of Materials Corrosion Inspection PCSB SKO in efforts to train their staff on a continuous basis, was interested on IMM Welding Inspection, IMM Welding for Non-Welding Personnel as well as IMM Corrosion Technician training courses. The 6-month Welder training course that prepares a welder for the industry also attracted their interest. Mohamad Adaham and Woo Kok Low and their teams in Shell were similarly keen enthused about the IMM Courses.

Intense interest: Ruzlan Bin Hashim (R) shows interest in IMM matters

Personnel from both companies registered for the forum on Fingerprinting of Polymeric Coatings, which discusses the possibility of fingerprinting of coatings used in the oil & gas industry. It was once not possible, but with new, advanced and sophisticated technology, such is the possibility that it has now been in ISO. (See accompanying article on page 15)

Kota Kinabalu

The IMM Sabah Chapter, currently under the Acting Chairman, Ir. Ahmad Tirmizi Ali Amat, decided to organise a seminar on "Materials Technology Skills for The Oil & Gas Industry". Following the seminar, a Technical Visit to Sabah Skills & Technology Centre was held. Three papers covering Corrosion in the Oil & Gas Downstream Industry, Welding in the Oil & Gas Industry and Fabrication of Oil & Gas Facilities were presented by Yii Ming Sing, Ir. Dr. Edwin Jong and Nuzul Adzwan Sulaiman.

Listening intently: Ir. Ahmad Tirmizi Ali Amat (L) and Max Ong

Resounding support for IMM: Edward Anyek (seated 2nd from Right), and Jeffrey Uvang (seated 3rd from Right) with the rest of the Integrity and Engineering Department and IMM team.

Edward Anyek, Head of Integrity & Engineering Dept, PETRONAS Carigali Sdn Bhd (SBO) and his team welcomed the IMM team who visited the Integrity and Engineering Department in Kota Kinabalu. Members of the SBO were similarly keen to participate in the events and activities of IMM, which include the 9th International Materials Technology Conference and Exhibition (IMTC2014).

WELDER TRAINING IN SABAH

In another development, IMM, together with Sabah Skills and Technology Centre (SSTC) and KNMPetrosab, will collaborate to conduct a 6-month welder training in Sabah. Sabahans will be provided opportunities to learn the welder skill set, and be gainfully employed in the fast growing oil and gas industry in the state.

Welder Collaboration: Wong Kin, Ahmad Fairuz Yunus (3rd and 2nd from right) with IMM Council members and staff of SSTC

IMM COURSES

COATINGS COURSES	DURATION (DAYS)
▪ Diploma of Applied Science (Coatings Technology)	10
▪ Coatings Quality Control Technician (QC)	2
▪ Blasting & Painting Supervisor	2
▪ Corrosion Control by Protective Paint	2
▪ Marine Painting Inspection	3
▪ Coatings Inspection Certification Scheme	4
▪ Protective Coatings Technician Certification Scheme	1
▪ Thermal Spray Coatings Applicator	2
▪ Thermal Spray Coatings Inspector	4
WELDING COURSES	
▪ Welding Inspection Scheme	5
▪ Associate Welding Engineer (JWES) *	7
▪ Welding Engineer (JWES) *	7
▪ Senior Welding Engineer (JWES) *	8
▪ Calculation of Strength of Welded Members	1
▪ Cost & Estimation of Welding Projects	1
▪ Interpretation of Weld Quality by Welding Codes	1
▪ Interpretation of Weld Quality by Radiographic Method	1
CORROSION COURSES	
▪ Corrosion Control By Cathodic Protection	2
▪ Cathodic Protection Technologist	4
▪ Corrosion Technician	4
VIBRATION SPECIALISTS	
▪ Level 1 - 4	
COURSES AVAILABLE UPON REQUEST	
▪ Blasting & Painting Course	5
▪ Welding – SMAW, GMAW, GTAW (1G - 6G)	5
▪ API-570 Piping Inspector	
▪ API-510 Pressure Vessel Inspector	
▪ API-653 Above Storage Tank Inspector	
▪ Microbiologically Influenced Corrosion (MIC)	2
▪ Management of MIC	1
▪ Welding and Joining Technology for Non Welding	
▪ Personnel	1

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 : iomm@po.jaring.com

IMM Technical Forum on

Specialty Polymers for High Temperature and High Pressure Applications in the Oil & Gas Industry

sponsored by SOLVAY and organised by the IMM Polymer Committee

Date: **Friday 14th June 2013**

Time: **3.00 pm - 7.00 pm**

Venue: **Lobby Lounge of Malaysia Petroleum Club (MPC), PETRONAS Twin Towers, Tower 2 (Level 41), KLCC**

Background

The development in the Oil & Gas industry is raising its standard and calling for equipment and pipeline systems that can sustain High Temperature and High Pressure (HT/HP) conditions. Novel materials will enable new technology for HT/HP applications. The fluorinated polymer has been recognized as the material of choice for risers and been proven by countless projects around the world. Solef® PVDF material has been selected for riser under 130 °C condition. With the fast evolution of the industry, higher grade of material is under evaluation and testing for 200 °C and for the above applications. Will higher grade fluorinated polymer meet the requirement from the industry? Furthermore, will other ultra polymer materials come into the game, to enable polymeric material in HT/HP applications?

Programme

2:30pm : Registration (Coffee/tea & light snacks)

3:00pm : Opening Remarks by Dr. Tan Winie (Forum Chairman)

3:10pm : Fluorinated Polymers for High Temperature and High Pressure Applications in Oil & Gas Industry (*Mr. Xu Chun, Solvay*)

4.10pm : Polyether Ether Ketone KetaSpire® PEEK for High Temperature and High Pressure Applications in Oil & Gas Industry (*Mr. Nicasio Messina - Solvay*)

5.10pm : Tea and Coffee Break

5:30pm : Characterization of High Temperature Polymer by Dynamic Mechanical Analyzer. (*Mr. William Lee, Research Instruments Sdn Bhd*)

6.00pm : User experience on quality issues with High Temperature and High Pressure Polymers (*To Be Identified by Harry Woon*)

6:30pm : Open Discussion

7:00pm : Closing Remarks by Dr. Chan Chin Han (Chairman, IMM Polymer Committee)

7:10pm : Adjournment

Please register with the IMM secretariat at iomm@po.jaring.my by 22th May 2013

IMM members pay RM 30 Non-members pay RM 40

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 : iomm@po.jaring.com

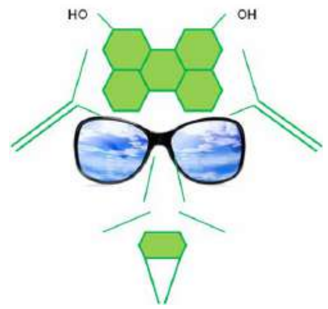
IMM

SOLVAY
asking more from chemistry®

Materials are Getting Smarter

#Mahesh Kumar Talari and Mohamad Kamal Harun
Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia
#Corresponding author. Tel.:+603-5521 1345; Fax: +603-5544 4562,
e-mail: talari@gmail.com

Abstract: It is not just humans evolved from 'stone age' to 'silicon age', but materials too seem to have followed humans in evolution. Now it can be categorically stated that the current advanced materials gave giant leap to humans in to next stage of civilization where we have materials which can react in response to an external stimuli. Scientific and technological exploitation of sensitivity of these materials to external stimuli such as, a pulse of light, changes in pH or temperature, reactive chemical species, has resulted in a new field of materials, which can be rightly named as 'Smart materials' or 'Intelligent materials'. Furthermore, understanding of quantum phenomena in nano sized quantum dots and other nano-structured materials has further widened the scope for the technological exploitation of materials to boost the quality of life for mankind. In this article, various smart materials are introduced with a special emphasis on application, along with a brief explanation of basic phenomena behind the material property



Materials are getting smarter

Introduction

Development and understanding of materials has been the driving force for the human civilization ever since the inquisitive ancient human started to look for better ways of living. Ancient human started with hunting and gathering and progressed to agriculture, tool making and finally to modern industrial and technical age where 'quality of life' and 'life expectation' has improved to present levels. Throughout this journey, material exploration and development has played vital role and thus civilizations were named after materials that were prominently used during that time viz., stone age, bronze age, iron age, silicon age, etc. Now we are in a transition phase to a new age which can be righty called as 'smart or intelligent materials age'. However, the term 'smart' or ' intelligent' with respect to materials doesn't refer to the logical capability that humans possesses, but these smart materials respond to a stimulus with an appropriate predictable action in contrast to a limited response displayed by conventional materials. By suitably manipulating these characteristic responses from smart materials to release a noticeable signal or to perform a predetermined action, new group of gadgets, sensors, actuators and processors are being developed by scientists and technologists. Systems that are biomimic in nature can be developed by exploiting the principles of nature that evolved through billions of years from these smart materials. Furthermore, such systems can effectively contribute to the improvement and repair of biological systems that are complex in nature. The main objective of this article to present a brief outline of working principle and proposed applications of various smart materials to encourage new researchers and technologists to innovate new devices that hold promise for many possible applications. These innovations could boost up the fields such as, but not limited to, medicine, energy, nanotechnology, green materials technology, biotechnology, food industries, process control, construction, military, information technology and communication industries. Few smart materials that have already come in to light in the recent past and potential smart applications are outlined in the following paragraphs.

Shape Memory Alloys and polymers

Shape memory materials posses ability to revert back to an original shape from deformed condition, when an external stimuli such as heat is applied. Few of the metallic alloys and polymeric compounds exhibit such memory effect. It is also reported that shape memory effect can also be triggered in shape memory polymers by applying electric and magnetic fields, light and solutions. There are two popular shape memory alloys viz., copper-Aluminum-Nickel (CuALNi), and Nickel-Titanium (NiTi), though shape memory alloys from other metallic elements are also being developed. The recoverable plastic strain in shape memory alloys is due to austenite-martensite transformation during heating and cooling of the alloy. At low temperatures the alloys is martensitic and as the material is heated to austenite transformation temperature, a pre-strained alloy remembers the original shape and recovers from the strain during the transformation to austenite. These shape memory alloys are being used in applications such as actuators, sensors, medical surgery, automobile and aerospace.

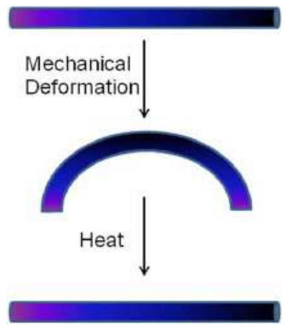


Figure 1 Shape Memory effect in materials

Shape memory polymers outrun the shape memory alloys in terms of recoverable strains reaching up to 800% in contrast to 8% for metallic alloys. These shape memory polymers consist of two phases, one with highest thermal transition, responsible for permanent shape and the other phase, termed as switching segment, which can easily softened and responsible for the temporary shape. When the pre-stressed shape memory polymer is heated above the transition temperature of the switching segment, it gets softened and allows the materials to assume original shape. Shape memory polymers are used in various applications such as, robotics, sportswear, building industry, and self repairing components. A schematic of shape memory effect is shown in figure 1.

Chromic materials

Chromic or chromogenic materials change colors with electrical, optical or thermal changes and are often reversible. This phenomenon is mainly attributed to changes in electron density of materials with the external stimuli. There are many natural compounds that exhibit this chromic behavior and many synthetic chromic materials being developed.

Thermochromism is the property of material that results in change in color with temperature. Temperature sensors, baby milk bottles and thermochromic dies are few of the potential applications for these materials. Photochromatic glasses are widely used as optical lenses and window screens to filter UV rays coming from the sun light. Photochromism can be defined as electromagnetic radiation assisted reversible transformation between two forms which absorb different absorption spectra. Pericyclic reactions, cis-trans isomerizations, intramolecular hydrogen transfer, intramolecular group transfers, dissociation processes and electron transfers are few of the suggested mechanisms behind the photo chromatic effect of the photochromic materials. Electrochromic materials change their color and texture with the application of charge or voltage. In electrochromic materials the color contrast can be closely controlled compared to other chromic materials and are widely used in automotive industry, building glasses as 'smart windows'. Depending on solvent polarity, solvatochromic materials change colors and find applications as environmental sensors and in molecular electronics for construction of molecular switches.

Piezoelectric Materials

Piezoelecric effect is defined as reversible conversion between strain and electrical charge by piezoelectric material. A piezoelectric material produces electric charge in response to applied stress and vice versa. There are many naturally available materials such as tendon, silk, wood, enamel, dentin and DNA in varying magnitudes of piezoelectric effect. Many synthetic piezoelectric ceramics are prepared among which most popular are Barium titanate ($BaTiO_3$), Lead titanate ($PbTiO_3$), Lead zirconate titanate ($Pb[Zr_xTi_{1-x}]O_3$), Potassium niobate ($KNbO_3$), Lithium niobate ($LiNbO_3$) and Lithium tantalate ($LiTaO_3$). Asymmetric charge distribution in the crystal lattice or molecular group charges is reported to be origin of piezoelectric effect. Off centered Ti^{4+} ion on the $BaTiO_3$ as shown in figure 2 results in electrical dipole which ultimately leads to the formation of randomly oriented electrical domain. Dipole alignment due to applied strain or applied electric field causes domain alignment and results in piezoelectric effect in the material. These piezoelectric materials are widely used as sensors, ultrasonic transducers, micro/nano manipulators, switches etc.

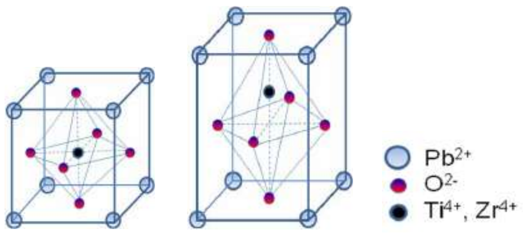


Figure 2. Mechanism behind piezoelectric response

Artificial muscles

Materials or assemblies that respond to external stimulus, such as voltage, temperature, pressure, chemical environment; with a reversible actuation viz., contraction, expansion and rotation, are called artificial muscles. Electroactive polymers (EAPs), conducting polymers, and ionic polymer metal composites (IPMC) respond to electric fields and currents. Polymeric materials that respond to applied pressure and temperature were also being researched. Shape memory alloys are also can be used as artificial muscles. These artificial muscles find wide applications in robotic arms, artificial arm replacements and bio medical devices.

Self healing and assembly

Machine components, mechanical and electrochemical systems often fail due to mechanical damage during service. Researchers and technologists took inspiration from biological systems and developed materials that can intrinsically heal the mechanical damages during service without needing to replace and extend the service life of the component. Molecular breakdown and bond cleavage due to service conditions is said to be the reason behind the mechanical failure of the polymeric materials. This kind of mechanical failure can be fatal and cause severe loss to property and human life. Many approaches were used to develop polymers that can heal the damage without any external action by humans. Sequence of actions can be divided in to three steps for self healing polymers similar to biological systems. Triggering or actuation is the first stage of healing process which happens after the damage of the polymer. Materials will be transported to the damaged area during the second stage of healing process. During the third stage a chemical reaction heals the damaged area restoring the original condition of the component before the damage. This third stage healing process display different chemical repair mechanisms in the damaged area depending on the curing agent used. In hallow tube and micro capsule healing, thermoset encapsulated monomers that are dispersed throughout the polymer matrix along with a polymerization catalyst. In the event of the mechanical damage by crack initiation and propagation, catalysts that are present in the matrix, polymerize the monomers released from the capsules in the cracked area and results in crack healing. Coating of self healing epoxies to prevent corrosion of metallic substrates are becoming popular as corrosion protection methods.

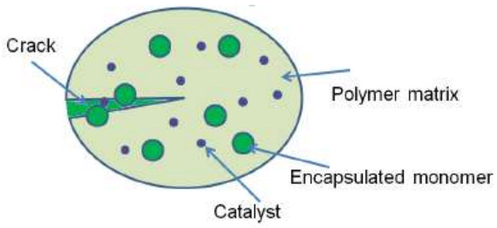


Figure 4. Self healing mechanism in a polymer

Summary

Multiferroic materials are defined as materials with more than one ferroic order in a single material which are ferromagnetic, ferroelectric and ferroelastic orders. In such material, one ferroic response can be triggered by applying the other ferroic stimuli. These materials promise high potential as sensors, transducers and dielectric materials. Molecular Machines are nanomachines that give quasi-mechanical movements in response to external stimuli. These complex nanomachines have various applications as molecular sensors, drug release agents, nano manipulators, molecular switches etc. Photomechanical materials that change shape with the application of electromagnetic energy, polymorphic materials that can be given any shape at ease are also being developed. With the development of new characterization tools and understanding the material behavior to external stimuli, new smart materials are being developed and used. There is a great potential for scientists and technologist to explore the vast field of materials and contribute to the better quality of life to the mankind.

References:

1. Mel Schwartz, Smart Materials, , CRC Press 2008
2. K Otsuka, CM Wayman, Shape Memory Materials, , Cambridge University Press, 1999
3. Wu, S; Wayman, C (1987). "Martensitic transformations and the shape-memory effect in Ti50Ni10Au40 and Ti50Au50 alloys". Metallography 20 (3): 359

"Towards Fingerprinting of Polymeric Coatings" II

Date	: *11th October 2013*
Time	: *2 - 6 pm*
Venue	: *Tanjung Puteri Golf Resort in Pasir Gudang, Johor*
Organised by	: *IMM Polymer Committee*
Jointly organized by	: *Malaysian Offshore Contractors Association (MOCA)*
Hosted by	: *IMM Southern Chapter*
Sponsored by	: *Research Instruments Sdn. Bhd.*

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 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 were not available then 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.

This will be the second 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.

There will be 4 presentations of 20 minutes each covering:-

a) Identification of essential components of epoxy polymer coatings by modern analytical instruments.
   (Prof. Kamal Harun, Universiti Teknologi MARA).

b) Existing quality control test for manufacturing of epoxy polymer coatings for the oil & gas industries. What be done further?
   (Mr. Frankie Chua PLC Laboratory Sdn Bhd)

c) Available identification techniques such as FTIR, Chromatography, etc.
   (Representative from Research Instruments Sdn Bhd)

d) Proposed elements to be listed in the first draft of the "Mill Certificate" of the fingerprinting of epoxy coatings for oil & gas industry.
   (Mr. David Lim Chee Cheong, Exxon Mobil E & P, Malaysia & En. Zamaluddin Ali,PETRONAS GTS Dept)

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 : iomm@po.jaring.com

FREE
For IMM MEMBERS!
Non-members pay
RM 40.00

Corrosion and Materials Selection Issues in Carbon Capture Plants

Dr M A Billingham
Intetech Ltd
Salmon Court, Rowton Lane, Rowton
Chester, CH3 6AT
UNITED KINGDOM

M Haines
Cofree Technology Ltd
Bricklehampton
Pershore WR10 3HQ
UNITED KINGDOM

Dr C-H Lee
Intetech Ltd
KH Tower, 8 Lorong P. Ramlee
Kuala Lumpur 50250
MALAYSIA

Dr L Smith
Intetech Ltd
Salmon Court, Rowton Lane, Rowton
Chester, CH3 6AT
UNITED KINGDOM

ABSTRACT

The construction of the process plant required for carbon capture in power generation and also other industrial processes will be among the most significant capital investments of the next 20-30 years. The correct choice of materials for piping, vessels and all types of equipment will be vital in ensuring the long-term performance, safety and high operational availability of the capture plants through their lifetime. Controlling materials related costs will help enable a wider and faster roll-out of carbon capture systems. In general, the carbon capture processes have so far only been operated on sub-commercial pilot-scale plants, and for a relatively short period, although there is much useful experience from other large-scale industrial processes with similar conditions, However, carbon capture processes do differ in some aspects which can be important for material performance and selection. This paper focuses on corrosion and materials degradation risks from the process streams and materials issues specific to the main proposed carbon capture processes (Post combustion, Pre combustion (IGCC) and Oxy-fuel). Some specific corrosion issues and problems are discussed. Areas where potential problems exist or where further studies are required are highlighted.

Key words: carbon capture, post-combustion, pre-combustion, oxy-fuel

INTRODUCTION

For most large CO^2 sources, including fossil fuel power plant, the cost of capturing and compressing the carbon dioxide is expected to be by far the largest component of the overall cost of carbon capture, transport and storage. This cost includes the capital costs of the capture plant, the direct operating costs of the plant and the loss of efficiency in the overall plant, i.e. lower usable power output in the case of electricity generation. Capture, including compression, may cost $ 20-45 / tonne CO_2 captured, while transport and storage combined may cost around $ 2-10 /tonne.[1] [2] The construction of these capture plants for power generation and also other industrial processes generating CO_2 will be among the most significant capital investments of the next 20-30 years: the European Commission anticipates total costs in the region of 1 billion Euro per full scale demonstration plant.[3] The correct choice of materials for piping, vessels and all types of equipment will be vital in ensuring the long-term performance, safety and high operational availability of the capture plants through their lifetime. Controlling materials related costs will help enable a wider and faster roll-out of carbon capture systems.

In general, the carbon capture processes have so far only been operated in sub-commercial scale pilot and demonstration plants, and for a relatively short period compared with the lifetime required for a typical power plant or industrial application. There is much useful experience from other large-scale industrial processes with similar conditions, for example flue gas desulphurization (FGD) plants and some gas processing applications. However, carbon capture processes do differ in some aspects which can be important for material performance and selection compared with comparable gas processing systems in other industries.

In some cases, there is an interaction between choices in the details of the process design and the corrosivity of the environment, and consequently the demands on materials. In particular cases, high-performance, expensive materials may have to be used if the environment is not controlled within suitable limits. The choice of materials also has to consider the functions of specific equipment, the options for construction for what is often very large scale plant, and the costs and practicality of maintenance or replacement. For some major items, there is a choice of potentially suitable alternatives, and the final selection would require finalising in the context of a specific plant design, considering factors such as plant availability and the balance between capital and operating costs.

This paper provides an overview of the corrosion and materials selection issues in the main alternative capture processes for power generation applications, including compression of the export gas. Typical process schemes for carbon capture in power generation using Oxy-fuel, Post-combustion and Pre-combustion processes are considered, including some process variations due to the effect of different fuel types.

OVERVIEW OF PROCESSES

The major alternative process anticipated for carbon capture in power generation are

- Post- combustion capture
- Oxy-fuel combustion capture
- Pre - combustion capture

Post-combustion Capture

Post-combustion capture refers to the processes in which CO_2 is separated from the flue gases downstream of the combustion. Post-combustion capture is suitable for retro-fitting to existing power plant, and also potentially to treat other industrial sources of CO_2. In outline, the typical processes under development are amine scrubbing systems broadly similar to those used in gas treatment plants.

In power plant applications the process takes the flue gas, if necessary after passing through a FGD unit. An extra cooler may be used to reduce the temperature of the saturated flue gas before it enters the absorber. For coal-fired combustion, an extra scrubber may be necessary at the front end to remove highly soluble components (such as SOx and HCl), particulates and liquid carryover from the flue gas.

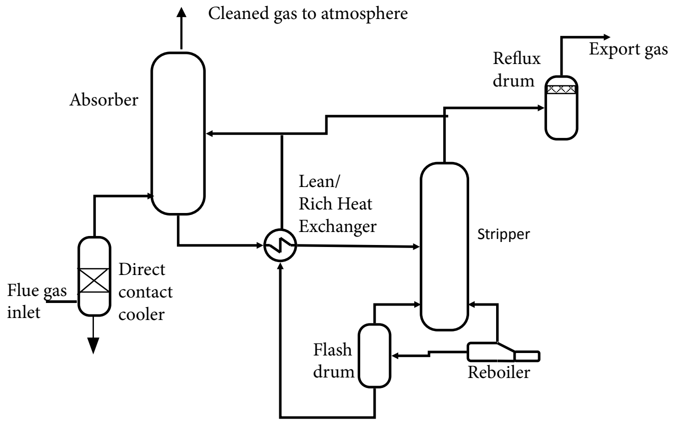


Figure 1 : Schematic diagram of carbon capture for the Post-combustion process

Oxy-fuel Combustion capture

Oxy-fuel combustion uses a high oxygen gas stream instead of air to burn the fuel. For CCS applications this has the benefit of producing a flue gas with a much higher CO_2 content than conventional combustion, typically about 60 - 70% CO_2. The carbon capture unit is located downstream of the oxy-fuel combustion process and the FGD unit (when present). SOx and NOx are removed as acids with water in successive vessels. The stream is then dried and, if necessary, mercury may be captured at this point. The other major components of the gas stream, N_2, Ar and O_2 are then removed from the CO_2 stream by cryogenic separation.

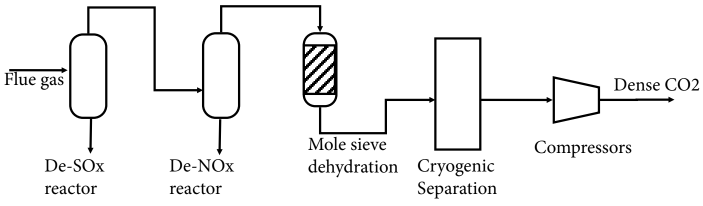


Figure 2 : Schematic diagram of carbon capture for Oxy-fuel combustion

Precombustion Capture

Also known as integrated gasification combined cycle (IGCC); this process involves production of synthetic gas (syngas), which is essentially a mixture of hydrogen, CO_2 and CO generated from natural gas or coal. The gasification reaction in the IGCC process is an established technology and not included in the scope of this study.[4] In the carbon capture version of the IGCC process, however, syngas shift reactors are added downstream of the gasification, in order to convert CO to CO_2 as shown below:

$$O + H_2O \Leftrightarrow O_2 + H_2 \qquad (1)$$

The CO_2 generated by the shift reactors can be extracted further downstream in the CO_2 absorber; any unconverted CO will eventually be converted to CO_2 in the gas turbine and will be emitted to atmosphere.

The high temperature syngas streams exiting from the shift reactors are cooled and the condensed water is removed before the dried syngas enters the capture plant proper. Typical process schemes use a physical solvent process for CO2 capture: solvent processes are more suited to the higher total pressure and CO_2 fraction in the pre-combustion situation in contrast to post-combustion, where chemical (amine) processes are the dominant technology. When using coal-firing, the syngas may contain amounts of hydrogen sulfide. Hydrogen sulfide may be captured separately from CO_2 (for example if H_2S is not desired in transport and sequestration stages), or may be captured along with the CO_2 stream. This results in two process configurations, namely "separate-capture" and "co-capture". The H_2S content in natural-gas-based syngas is minimal, so the co-capture configuration applies.

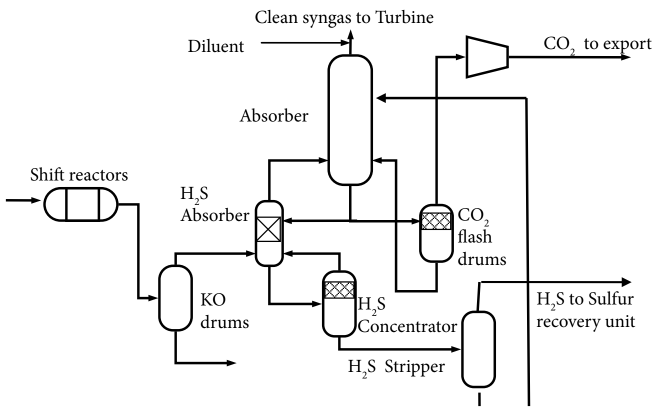


Figure 3(a) : Schematic Diagram of separate capture process for Pre-combustion

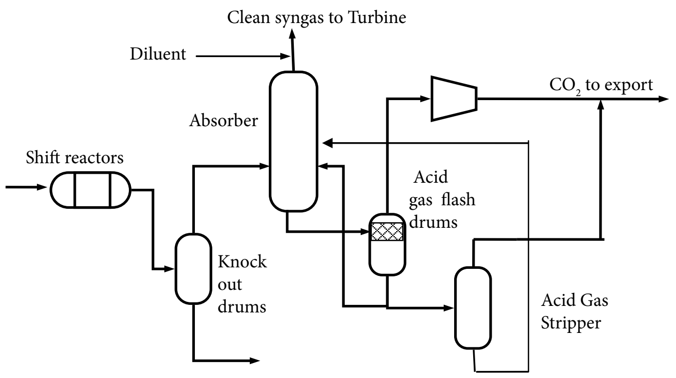


Figure 3 (b) : Schematic Diagram of the co-capture process for Pre-combustion

Environmental Conditions and Corrosion Risks

From a materials degradation and corrosion point of view, there is a wide range of environments amongst the different carbon-capture processes. In general, the high CO_2 levels mean that wet process environments tend to be acidic, resulting in high corrosion rates for unprotected carbon steel. There are acid-oxidising conditions in some process streams which present particular risks to carbon steel and also many stainless steels and corrosion resistant alloys (CRAs). Corrosion risks for metals include general and localised CO_2 corrosion; erosion–corrosion; various forms of stress-corrosion; low temperature hydrogen damage; high temperature hydrogenation, sulphidation and metal dusting; and liquid metal embrittlement.

Table 1: Example Stream Conditions at the Front End of Carbon Capture Units [5]

Component, mol%	Precombustion		Post combustion		Oxy-fuel
	Coal-fired, after shift reactors	Gas-fired after shift reactors	Coal Fired, after FGD	Gas Fired	Coal Fired, after FGD
Carbon Dioxide	25-35	16	14	13	70-80
Water	20-30	21	10	7	3-5
Oxygen	-	-	4	4	3-5
Nitrogen	0 - 6	-	72	75	15-20
Argon	0 -1	-	0.9	0.9	2-5
Carbon Monoxide	1 - 3	0.5	-	-	-
Sulfur Dioxide	-	-	0.004	-	0.01-0.5
Nitrogen Oxide	-	-	-	-	0.01-0.07
Hydrogen	35-45	63	-	-	-
Hydrogen Sulfide	0.02-0.4	-	-	-	-
Others	Hg		SOx, NOx, Hg	NOx	SOx, NOx, Hg
Temperature (°C)	330	240	45	45	30
Pressure (MPa)	3-4	3-4	circa 0.1	circa 0.1	circa 0.1

Polymers are potentially susceptible to swelling and changes in physical properties due to absorption of CO_2. The moderate operating pressures typical of capture plant are not high risk in regard to rapid gas decompression, but after compression pressures are high enough to present a risk to susceptible materials.

The minor components in the process streams can have dramatic effects on the severity of the environments, including species such as chlorides, sulfur and nitrogen oxides, oxygen, cyanides and hydrogen sulfide. The fuel type is significant here, with coal-firing producing higher levels of potentially harmful species than natural gas-firing. Although FGD plant will remove a large proportion of water soluble species, some carry-over of SOx, NOx and halides is expected.

Related Experience

Materials performance in flue gas desulphurisation (FGD) plant is very relevant to the similar acid-oxidising conditions in carbon capture plant: the inlet for the capture plants in Post Combustion and Oxy-fuel scenarios when using coal firing would be directly from an FGD unit. The distinguishing feature of the flue gas environment is the presence of the oxidising acid species NO_x and SO_x. These are absent in the oxygen-free or reducing conditions typically found in petrochemical processes. Although SO_2 is mostly removed from the flue gas in the FGD plant before reaching the CCS plant, there is still sufficient SO_2 to contribute significantly to the acidity. Where the conditions drop below the dew point there is a risk of condensation of concentrated acids, and this is the major cause of corrosion encountered in FGD systems. Dew point, acidity (pH), temperature, halide concentration (chlorides and fluorides), crevice conditions, and gas velocity all must be considered in defining the corrosivity of the environment. EPRI ([1]) have conducted a useful survey of materials usage in FGD plant.[6]

The oil & gas industry has extensive experience with materials performance in oxygen-free environments containing CO_2, including "sour" conditions with H_2S present. Service limits for stainless steels and CRAs are generally well established. [7] The ISO15156 / NACE MR0175 and NACE MR0103 standards give detailed guidance on selection of metallic materials for H_2S containing environments. [8, 9]. There is also much experience on the effect of CO_2 on polymers.[10,11]

CORROSION AND MATERIALS SELECTION ISSUES

Post -combustion Capture Process

The capture plant takes flue gases after combustion and, in the case of coal-firing, after an FGD unit. The incoming flue gas contains CO_2 with water, oxygen, some SO_x and NO_x and other contaminants and is extremely corrosive to carbon steel wherever free water is present.

<u>Ducting</u>

Incoming flue gas is a low pressure, large volume stream and will be handled by ducting rather than piping. Conditions are similar to the outlet end of FGD plant. The outlet stream from CO2 strippers or desorbers before compression in Post-Combustion and Precombustion processes is also a low pressure and high volume stream, but with higher purity CO2 and higher temperature than the flue gases.

A wide range of CRAs have been used for FGD outlet ducting from AISI([2]) 316L (S31603), through higher alloy stainless steels, such as 317LMN (S31726) , 904L (N08904) and 6-Mo grades, to nickel-based alloys. Ducting is typically lined (wall-papered), while nozzles and connections are solid, and often in a higher grade alloy than the ducting linings. Properly applied (with a large number of slot welds to mitigate fatigue), CRA wall-papering is a low maintenance, lifetime solution; however some installations have suffered early damage and required substantial repairs and downtime. [12]

---

(1) Electric Power Research Institute, 3420 Hillview Avenue, Palo Alto, California, USA

(2) American Iron and Steel Institute, 1140 Connecticut Ave., NW Suite 705, Washington DC, USA

The option of using carbon steel with non-metallic coatings or linings has frequently been considered for reduced capital outlay in FGD plants where maintenance can be tolerated. All polymer linings and coatings allow some permeation of water vapor and other species including CO_2 and H_2S, and eventually this will lead to disbondment of the lining and corrosion of the steel substrate. For coating, only resins which are resistant to water vapor at service temperature should be considered. [13]Service experience with rubber lining has generally been poor. Flake-glass vinylester (FGV) coated steel is a standard coating option for moderate temperature use, but only has an expected service life of around 10 years to major maintenance.

An alternative approach is to use large diameter filament wound glass reinforced plastic (GRP) pipe, large diameter sections may be filament wound in-situ. It is tolerant of wide variations in flue gas composition and levels of trace contaminants. GRP pipe typically has larger capital outlay than FGV-lined ducting but is expected to last a 25 year design life without major maintenance. [14]

<u>Amine Unit</u>

Amine gas treatment units are widely used in upstream oil and gas applications and in refineries for removing CO_2, H_2S and related species such as mercaptans, from hydrocarbon gas streams. In petrochemical service, carbon steel is generally the main material of construction. Austenitic stainless steels are typically used where there are high CO_2 loadings, for higher temperature areas and locations where erosion–corrosion may be an issue. [15,16] Refinery amine systems normally aim to operate in oxygen-free conditions, and stringent measures are taken to minimise oxygen ingress. In contrast, the flue gas contains high levels of oxygen. Oxygen degrades conventional amines, forming a variety of products including organic acids and heat-stable salts, thus reducing the efficiency of operation, but also potentially increasing the corrosivity of the environment. As well as being corrosive to carbon steel, these acids can cause damage to stainless steels at the temperatures in the reboiler and stripper. Other undesirable contaminants in flue gases include sulfur-containing species (SO_2, sulfates etc), chlorides, ammonia and cyanides. Amine systems in carbon capture may also operate with higher CO_2 loadings in the lean amine than is usual for gas treatment applications, hence making the lean amine relatively more corrosive. [17] A great deal of effort has been made in developing amines suitable for carbon capture conditions. Corrosion behavior has been studied in laboratory conditions, and also in pilot and demonstration plant. So far, the indications are that conventional materials selections can be used: carbon steel for cold lean amine and 300-series stainless steels for rich amine, high temperature sections and high velocity areas. [18] Nevertheless, some caution is prudent and testing of materials with the specific amine chemistries is strongly recommended.

The Absorber Vessel in the amine system requires special consideration because of its size. For example, the absorber in the Mongstad demonstration plant (Norway) is 3.5 x 2m cross-section by 62 m height, [19] while absorbers for full-scale power plants are expected to be as much as 15 -20 m diameter. As the absorber runs at just over atmospheric pressure it is not a pressure vessel under normal design codes. Construction techniques used for similar units in FGD service include steel panel-towers with external stiffening, ring-stiffened circular steel towers or a slip-cast, reinforced concrete structure – the option used at Mongstad. It should be noted that post-weld heat treatment is necessary for coated or lined carbon steel constructions, [20] a significant issue on this scale of construction, and which therefore favors the concrete construction approach. Concrete does need protection from the acid gases. Tiling has been used in some FGD applications, while polymer lining is used at Mongstad. Polypropylene lining has shown good performance in field testing. [18]

Unlike the Absorber vessel, the CO_2 Strippers are pressure-vessels. At this stage there should be only be low levels of halides present as there are several washes and knock-out vessels before this point, so lower-cost CRAs such as S31600 stainless steel can be considered where carbon steel is not adequate. Depending on design requirements, duplex or lean duplex stainless steel may be more economic due to their higher strength. Otherwise, where chloride ions are carried over, more expensive CRA cladding materials with higher Mo content would be necessary. Stripper overheads are particularly aggressive (high CO_2 partial pressure) and higher alloy stainless steels may be necessary, especially if the stripper is run at higher temperature and pressure than usual in order to improve the efficiency of the compression stages (see below).

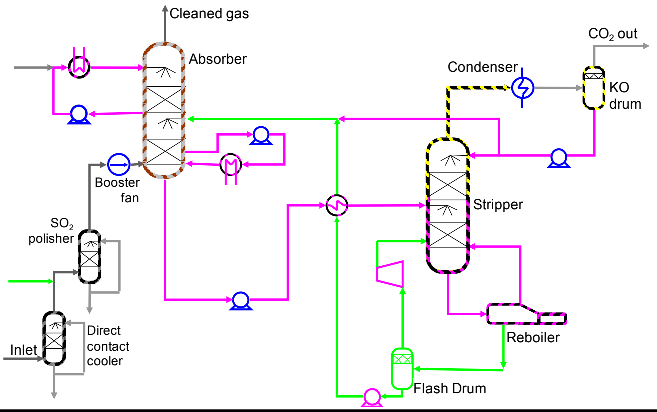
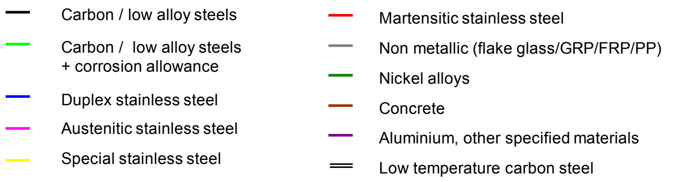


Figure 4 ` Schematic Materials Selection Diagram for Post Combustion Capture on a Coal-fired Power Plant



Oxy-fuel Capture Processes

Many projects have studied high temperature corrosion upstream of the capture plant in the oxy-fuel combustion unit. Much useful information on this topic is available through the IEAGHG (3) Oxyfuel Combustion Research Network.

The inlet to the capture plant is low pressure and acid-oxidising, similar to the Post-Combustion case and similar considerations apply for the inlet ducting. The inlet gas has to be raised to around 15-30 bar (1.5-3.0 MPa) pressure for the de-SOx / deNOx reactors in the CO_2 clean-up process. The higher pressure and temperature after compression will tend to favour use of CRA-lined ducting or piping for wet gas compared with GRP ducting. Although the average content of SO_2 is low, it is very soluble in water and there is a risk of dew-point corrosion from small volumes of acid mist or condensation in the inlet ducting and pipework. The reactions involving NO_x and SO_x are complex and so is prediction of which species are present at which points in the process, including possible upset conditions and start up / shut-down states. A conservative materials selection is therefore advisable. Compressors in the inlet gas stream similarly require higher alloy materials than those on the export gas streams after the capture plant.

(3) IEAGHG: International Energy Agency Greenhouse Gas R&D Programme, Stoke Orchard, Cheltenham, GL52 7RZ, UK

Conditions after the De-SO_x reactors are more benign and lower alloy CRAs such as AISI 300-series stainless steels can be used for wet areas. The gas is then dried to allow cryogenic separation, and carbon steel can be widely used from that point onwards. Minimum temperatures rather than the corrosion risks require stainless steel or aluminium for some items in the cryogenic separation unit, and a mercury removal unit is necessary to protect the aluminium components. [21]

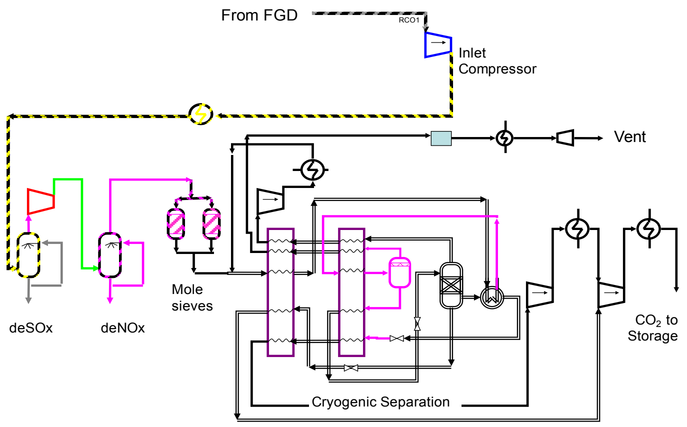


Figure 5: Schematic Materials Selection Diagram for Carbon Capture on an Oxy-Fuel Power Plant

Precombustion (IGCC) Capture Processes

Unlike the other two processes discussed, the inlet gas stream is essentially an oxygen-free, reducing environment and as such presents different corrosion and materials issues. H_2S present from coal-firing will require materials suitable for sour-service in many parts of the plant where wet conditions are possible either in normal operation or process upsets.

Materials selection for the shift reactors area has to consider high temperature corrosion issues including hydrogen attack, metal dusting and, in the case of coal-firing, sulfidation. Refinery experience provides an initial guide to materials selection, for example API RP 941,[22] although the hydrogen partial pressures are relatively low compared with some refinery environments. With gas–firing, carbon steels and Cr-Mo steels are adequate for many items. In the coal-fired case, sulfidation attack demands stainless steels, and stabilised grades such as AISI 321 (S32100) or 347 (S34700) are necessary for extended service at higher temperatures. Where minimal corrosion rates are desirable for specific components, then higher chromium stainless steels or specialised Cr-Ni-Co alloys may be needed.

Carbon steel can be used for some of the streams in the solvent system. In fact with coal-firing the presence of H_2S has a generally beneficial effect in reducing the corrosion rate and allows wider use of carbon steel than in gas-firing cases. Where CRAs are necessary (eg for turbulent areas, wet syngas or rich solvent), the oxygen-free conditions and absence of chlorides mean that 300-series stainless steels are generally adequate.

With coal-firing, ingress of oxygen into the capture process creates a risk of extremely corrosive conditions for both carbon steel and CRAs due to reaction of oxygen with H_2S, producing sulfur and sulfur acids. In the separate capture scheme, one possible source of oxygen ingress is the external gas stream used to strip CO_2 from the solvent in the H_2S concentrator vessel. Only a strictly limited oxygen content will allow the use of carbon steel and low-alloy CRAs in the solvent system. There are two obvious sources of low-oxygen stripping gas for the H_2S concentrator, namely high-purity nitrogen from the air separation unit, or a side stream from the cleaned syngas. It is critical that the oxygen content is strictly controlled in operations, and continuous monitoring of the oxygen content in the stripping gas stream is suggested. Other possible sources of oxygen ingress, including make-up chemicals for example, must also be controlled.

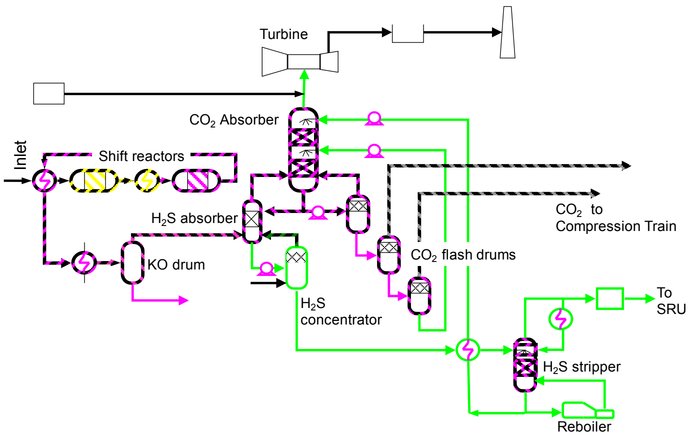


Figure 6: Schematic Materials Selection Diagram for Separate Capture on a Pre-combustion Power Plant .

COMPRESSION AND PROCESS INTEGRATION

Compression

Carbon dioxide capture plants need to have CO_2 compression facilities since the typical processes capture CO_2 at pressures well below those needed for transport and underground injection. Reciprocating compressors are used in some existing operations, but based on present studies, centrifugal compressors (either gear or in-line) are expected to be the base-line option for future power plant applications. [23 24]

In the oxy-fuel process, the CO_2 export stream is fully dried before entering the main compressor train, so carbon and low alloy steels can be used throughout.

In the other two processes, the CO_2 streams entering the compression trains are at or near dew-point and potentially corrosive. The gas streams by this point are expected to be relatively clean, with minimal levels of salts, solids or sulfur oxides. In particular, the low chloride conditions greatly reduce the risk of pitting or stress-corrosion in martensitic stainless steels. Despite the high CO_2 contents, the conditions are therefore not particularly aggressive. Operating conditions within compressors and on outlets side are normally dry due to the temperature increase on compression, but CRA materials are necessary for example to cover downtime conditions when condensation may occur. Martensitic stainless steels are often the materials of choice due to their combination of moderate cost, some corrosion resistance and the ability to achieve high strengths by heat-treatment.

At an intermediate point in the compression train, the stream is dehydrated. Usually this is at a point slightly below the critical pressure so that drying occurs in the gas phase, while the maximum amount of water has been removed by successive suction drums at the earlier compression stages. This minimises the capital and operating costs of the dehydration unit, although this is offset to some extent by the need to have corrosion resistant materials in all compression stages upstream of dehydration. Low alloy steels can be used for the final stages after the dehydrators.

Process Integration

The power required for compression represents a significant part of the parasitic energy consumption of the capture processes, perhaps as much as 50-80 MW for a full-size power plant or around 10% or more of the net power output. Optimising compression and its integration into the energy balance of the whole plant is therefore an important contribution to overall efficiency. Some of the possible strategies have implications for corrosion and materials selection.

Integration of compressor inter- and after-coolers with power generation can potentially recover some energy, e.g. by heating boiler feed water. This requires heat-exchangers at several positions along the compression train. One corrosion hazard identified here is that any leaks within the exchangers, either of CO_2 into feed water or of water into a high pressure, dry CO_2 stream have the potential for causing rapid corrosion damage. So, although the materials requirements for the exchangers may not be demanding, a high integrity construction is vital.

The overall compression range in post-combustion and pre-combustion processes is from near-atmospheric pressure to the pipeline inlet pressure of 100-150 bar (10-15 MPa). Depending on the power plant size, using a single axial compressor for the lowest pressure part of the compression could avoid the need for multiple compressor trains and achieve a small reduction in the overall power consumption. However, the axial compressor would have to be fully in corrosion resistant materials, which is relatively more expensive for that design than for centrifugal designs, making this an expensive option in CAPEX terms.

Raising the inlet pressure to the compressor train would of course reduce the energy requirement for compression. For amine gas treatment, this translates to a higher pressure and hence higher temperature in the CO_2 stripper. Increased temperature in the stripper will risk faster degradation of amine (depending on the particular chemical), but also more severe conditions as regards corrosion. Corrosion of 300-series stainless steels in existing amine units is known associated with both unusually high levels of thermal degradation products and with temperature excursions above the usual operating maximum of about 110-120°C in the stripper (reboiler temperature is slightly greater). The first corrosion mitigation measure is usually to control the temperature. Deliberate use of higher operating temperatures may demand more corrosion resistant grades of stainless steel. So far, most studies of amine performance and corrosion for carbon capture have focused on normal operating temperature ranges; the implications of increased temperature operation is an area for possible future study.

SUMMARY

There is a range of environments in the different CO_2 capture processes. In general, the high CO_2 levels mean that wet process environments tend to be aggressive and unprotected carbon steel cannot be used. Post combustion and oxy-fuel processes have predominately acid-oxidising conditions which present particular risks to stainless steels and corrosion resistant alloys, while reducing conditions are characteristic of the pre-combustion process.

The minor components in the process streams have a great influence on the corrosivity. In some situations, high-performance, expensive, materials may have to be used if trace components cannot be controlled within suitable limits.

For the moderate pressures and temperatures in the majority of capture plant process streams there is much useful materials performance experience from other industries. There is a relative lack of data (especially long-term data) on a few specific issues, such as corrosion risks in amine and other gas treatment systems with oxygen present or at operating temperatures beyond conventional limits. However, in general, the materials and corrosion knowledge exists to select cost-effective and reliable materials of construction for carbon capture plants.

There are several competing technical solutions and materials selections for some major capital items such as ducting, the compression trains and large, low-pressure vessels. Each solution has a different balance of initial cost, service life, expected down-time and maintenance intervals. Detailed studies are required to determine the optimum solution for each specific project.

ACKNOWLEDGMENTS

Thanks to IEAGHG R&D Programme and to E.ON New Build & Technology Ltd

REFERENCES

1. Working Group III of the Intergovernmental Panel on Climate Change, "IPCC Special Report on Carbon Dioxide Capture and Storage", IPCC 2005
2. Finkenrath M. "Cost and Performance of Carbon Dioxide Capture from Power Generation" IEA Working Paper, OECD/IEA 2010
3. Evangelos, T. "The Cost of Carbon Capture and Storage Projects in Europe", Institute for Energy JRC Scientifc and Technical Report, European Commission, Luxembourg 2009
4. Maurstad O., "An Overview of Coal based Integrated Gasification Combined Cycle (IGCC) Technology" MIT publication LFEE 2005-002WP, September 2005
5. Intetech Consultancy Ltd & E.ON New Build & Technology Ltd "Corrosion and Selection of Materials for Carbon Capture and Storage", IEAGHG R&D Programme Technical Report 2010/03
6. Mathay WL, Gandy, D., Avery RA, "Material Performance in FGD Systems", NACE Airpol 2007
7. Craig B. D. Smith L.M "Corrosion Resistant Alloys in the Oil and Gas Industry" NiDI Technical Series Publication 10073 rev 3, 2011.
8. NACE MR0175 / ISO15156:2009 "Petroleum and natural gas industries - Materials for use in H2S-containing Environments in oil and gas production", NACE International 1440 South Creek Drive Houston USA, 2009.
9. NACE MR0103-2005, "Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments", NACE International 1440 South Creek Drive Houston USA, 2005.
10. UK Health & Safety Executive "Elastomers for fluid containment in offshore oil and gas production" Research Report 320, 2005
11. Thon, H. and Morgan, G, "Rapid Gas Decompression of Elastomers and the Effect of Service Environment". Oilfield Engineering with Polymers, RAPRA Shawbury, 2003.
12. Schwarz G. and Mueller S. "20 Jahre REA-Betrieb in Braunkohlekraftwerken." VGB PowerTech Magazine, Issue 6, 2008.
13. Adams D. et. al., "SOx - Emissions and Control", IEA Clean Coal Centre, 2006
14. A. van Buren, "Long term experience of FRP-liners in power plant chimneys" Eurocorr Conference, Stockholm, 2011
15. Harston JD, Ropital F; "Amine unit corrosion in refineries", EFC Publication nr 46, IOM, 2007
16. M. Nouri D. Clarida "Interactions of process design, operating conditions and corrosion in amine systems", NACE Corrosion 2007, Paper 07396
17. J. Kittel et al, "Corrosion in MEA units for CO_2 capture: pilot plant studies", GHGT-9, 2009
18. P. Moser et al, "Material Testing for Future Commercial Post-

Combustion Capture Plants – Results of the Testing Programme Conducted at the Niederaussem Pilot Plant" GHGT-10, Amsterdam 2010

19. G. de Koeijer et al., " CO_2 Technology Centre Mongstad – Design, Functionality and Emissions of the Amine Plant", GHGT-10 , Amsterdam 2010
20. API RP 945, "Avoiding Environmental Cracking in Amine Units", American Petroleum Institute, 2003.
21. T. Fout, "SO_2/SO_3/Hg and Corrosion Issue Results from DOE/NETL Existing Plants Oxy-combustion projects" IEAGHG Workshop on Corrosion in Oxyfuel Plants, London 2011
22. API RP 941, "Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants" American Petroleum Institute, 2008
23. T. Jockenhövel et al "Optimal Power Plant Integration of Post-Combustion CO2 Capture" POWER-GEN Europe 2009, Köln Germany, May 26-29 2009
24. R. W. Allen, "CO_2, its contaminants and their treatment during compression in oxyfuel applications", Workshop – IEAGHG 1st Oxyfuel Conference, Cottbus 2009

Specialty Polymers for High Temperature and High Pressure Applications in the Oil & Gas Industry

Friday 14th June 2013

Lobby Lounge of Malaysia Petroleum Club (MPC), PETRONAS Twin Towers, Tower 2 (Level 41), KLCC

coming soon

1st International Materials Symposium cum Materials Lecture Competition

Thursday 30th May 2013
Seri Pacific Hotel, Kuala Lumpur
7.00 am - 5.30pm

INTRODUCTION:

1st International Materials Symposium

The Institute of Materials, Malaysia (IMM) is pleased to announce its **1st International Materials Symposium IMS** scheduled on **30th May 2013** at the **Seri Pacific Hotel, Kuala Lumpur.** IMM invites you and your colleagues to participate in this technical symposium.

The Institute of Materials, Malaysia (IMM) Technical Publications Committee introduces the Materials Symposium series which will offer postgraduate students, university lecturers & professors, academic & industry researchers, and industry technologists the opportunity to showcase their technical research and development works. These 1-day technical symposiums will be held in Kuala Lumpur and various regions such as Langkawi, Melaka and where IMM Regional Chapters are based (Johor, Penang, Kuantan, Kuching and Kota Kinabalu).

As part of the Malaysian Materials Scientific Fraternity, you can utilize this opportunity to share your contributions to Materials research & development with others, via the International Materials Symposium dedicated to Materials Science & Engineering.

IMM is a non-profit society of professionals whose aims are to promote honourable practice and professional ethics and encourage education in Materials Science, engineering and technology. Numerous technical talks, seminars, certification programmes, conferences, short courses and Masterclasses have been organized over the years.

Organising Chairperson :

Dr. Karen Wong Mee Chu, Universiti Tunku Abdul Rahman (UTAR),Malaysia
Email :mcwong@utar.edu.my

INTRODUCTION:

Materials Lecture Competition 2013

The **Materials Lecture Competition 2013 (MLC2013)** is jointly organized by the Institute of Materials,Malaysia (IMM) and Institute of Materials Minerals and Mining, Malaysia Branch (IOM3-MB), sponsored by PETRONAS, and will be held in conjunction with the 1st International IMM Materials Symposium scheduled on **30th May 2013** at **Seri Pacific Hotel, in Kuala Lumpur**. The MLC 2013 is being held for the second time, after the 2012 edition held in conjunction with the IMTCE2012 conference received excellent feedback.

Aim of the Competition

The MLC 2013 is an initiative intended to enhance awareness among young Material Scientists and Engineers in Malaysia, on the importance of Materials Engineering, Innovations in Materials and sustainability in the advancement of Technology and humankind. The aim of the MLC 2013 is to provide an atmosphere of friendly competition for young scientists and engineers so that their presentation skill will improve whilst addressing an informed audience.

Organising Chairperson:

Prof. Dr. Esah Hamzah, Universiti Teknologi Malaysia (UTM),Malaysia
Email :esah@fkm.utm.my

Sponsored by:

PETRONAS

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 : iomm@po.jaring.com

2nd IMM International Materials Symposium cum 4th Regional Materials Conference & Exhibition

CALL FOR PAPERS

THEME: MATERIALS TECHNOLOGIES FOR ASSET SUSTAINABILITY

Many assets in oil & gas facilities, power stations, ports & harbours, water treatment plants, commercial buildings, bridges & highways, chemical plants, and defence facilities throughout the world face operations and maintenance challenges due to design and construction deficiencies. These deficiencies include improper materials design, inadequate materials selection knowledge, insufficient materials trade-skills. This symposium and conference covers research, development and applications of materials technologies to assure durability of assets.

Seize this opportunity to share your contributions on the Materials research and development with the Malaysian Materials Scientific fraternity in this International Materials Symposium and Conference which is dedicated to Materials Science and Engineering.

Date	: 12th Sept 2013, Thursday
Venue	: Eastwood Valley Golf & Country Club, Miri
Time	: 8.30am to 5.00pm
Subject Coverage	: Materials & Corrosion Engineering, Welding Technology and Inspection Techniques

Oral Presentation	: 20 papers
Fee per participant	: RM 200.00
Fee for Exhibitors	: RM 1,000.00

Organised by IMM Miri Chapter

Chairman	:Ir Dr Edwin Jong
	:Giridharan Anandan
	:Wong Siong Pin
Sec.	:Bernard Sim
V. Sec.	:Derick Ung
Treasurer	:Lee Chung Khiong
Committee	:Dr Aaron Goh
	Dr Beena Giridharan
	Andrew Ling
	Daniel Liau
	Liew Wei Yiew
	Liew Shann Ching
	Teng Hui Chung

Contact:

Ir Dr Edwin Jong	: edwin_jong@yahoo.co.uk
Beena Giridharan	: beena@curtin.edu.my
Azman Murad	: iomm@po.jaring.my

Advertisement Rates in Materials Mind

Standard full page (odd numbered page)
Rate: RM 1500
Size:A4 210 (w) x 297 (h) mm

Standard full page (even numbered page)
Rate: RM 1000
Size:A4 210 (w) x 297 (h) mm

Inside Cover
Rate: RM 2000*
Size:A4 210 (w) x 297 (h) mm

Back Cover
Rate: RM 2500*
Size:A4 210 (w) x 297 (h) mm

Half Page
Product/Services article without advertisement with one photograph
RM 800

Quarter Page
Product/Services article without advertisement with one photograph
RM 500

Name card size
Classified Ads
RM 200

Note* : Advertisers enjoy free half page article

Technical Requirement

- JPG / Ai / PDF Format
- Ai / Illustrator - Text must be outlined and saved together with high resolution picture embedded.
- All format must be at least - 300 dpi pictures and / or embedded pictures in Ai.
- Films are not acceptable.

For more information please contact:

Ellia bt Ab Rahim
ellia@mte.com.my

Tel: 03-58823574
Fax: 03-58823524

ABOUT IMM

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 4000.

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 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 12 materials committee, and 7 regional chapters, and supported by a secretariat with full time staff.

Membership of IMM is categorised into 7 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, corrosion and welding in support of the oil and gas industry in Malaysia. Over 600 Coating Inspectors have been trained and certified as well as 2,500 Blasters & Painters, supervisors and Corrosion technicians. Its certification programmes are recognized by PETRONAS and all oil & gas operators. Since January 2011, 42 Associate Welding Engineers, 33 Welding Engineers and 8 Senior Welding Engineers were trained and certified.

IMM has also organised 8 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 been offered occasionally. Training on materials awareness has also been conducted in public listed companies.

The courses and programmes are being organised by Materials Technology Education Sdn Bhd (MTE), a joint-venture between IMM and InterMerger Group.

Collaborations with the Asian Welding Federation, American corrosion society 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

IMM

CONTACT INFORMATION

Institute of Materials, Malaysia
No. 10-1, Jalan Bandar 3
Pusat Bandar Puchong
47160 Puchong Selangor

Email : iomm@po.jaring.my
Website: www.iomm.org.my
Tel. 03-5882 3574
Fax. 03-5882 3524

IMM MEMBERSHIP GRADES

Honorary Fellow (Hon. FIMM) - Fellow (FIMM)
Professional Member (MIMM) - Associate Member (AMIMM)
Company Member - Ordinary Member - Student Member
** Details and forms are available in IMM website*
** Term and condition apply for each grade of membership*

Category / Fee	A	B	C	D
Honorary Fellow	*EXEMPTED*			
Fellow (F.I.M.M)	-	*RM300.00*	*RM10.00*	*RM150.00*
Professional Member (M.I.M.M)	-	*RM150.00*	*RM10.00*	*RM100.00*
Company Member (CO)	*RM 50.00*	-	-	*RM200.00*
Associate Member (A.M.I.M.M)	-	*RM150.00*	*RM10.00*	*RM80.00*
Ordinary Member	*RM20.00*	-	-	*RM40.00*
Student Member	*RM10.00*	-	-	*RM10.00*
Affiliate Ordinary Member	*RM40.00*		*EXEMPTED*	
NB: Members above the age of 55 years shall pay 50% of the fees				

Note: (A) Entrance (B) Processing (C) Transfer (D) Annual Subscription
For membership details, contact the Secretariat at:
Tel: (603) 5882 3574 Fax: (603) 5882 3524 Email: iomm@po.jaring.my

1st Announcement
CALL FOR PAPERS

IMTCE2014

9th International Materials Technology Conference & Exhibition

13th – 16th May 2014

Putra World Trade Centre
Kuala Lumpur, Malaysia

Synergising Industry & Academia:
Innovations for Industrial Applications

www.imtce2014.com

Organised by

IMM

Co-organised by

IOM3
Malaysia Branch

Event Organiser

MTE