



# MATERIALS MATTER

A BIENNIAL E-NEWSLETTER OF IIM KALPAKKAM CHAPTER

Volume 2, Issue 1, 2010

## Greetings from Director, IGCAR

I am delighted that IIM Kalpakkam Chapter is continuing the release of E-Newsletter providing valuable information to the metallurgical community, and it has become a good resource of information on various programmes conducted by the Chapter. The idea of E-Newsletter is now percolating to other Chapters and I congratulate the editorial team for meticulously doing the layout with useful information on activities, special articles, awards and news of members etc. I also take the opportunity to request the editorial team to enhance the scope of E-Newsletter with feature articles, information on conferences, visit of eminent personalities, etc. which would further improve the usefulness of the E-Newsletter.



Dr. Baldev Raj, FNAE, FASc., FNAsc., HFICNDT, HFISNT, HFBINDT, FIIM, FUSI, FASI  
Distinguished Scientist & Director

## Chairman's Views

I would like to congratulate the editorial team for sustaining the release of E-Newsletter periodically with useful information on Chapter activities, awards, special articles, etc. It is a memorable year for us by winning the **Best Chapter Award** during NMD-ATM 2010 at Bangalore, and our Treasurer Dr. Rani P. George winning the **Certificate of Merit Award** from IIM for significant contributions to the Chapter over the years. I am sure that the E-Newsletter will further improve in its contents and quality of information that is useful to the members of IIM Kalpakkam Chapter and all other metallurgical community receiving the E-Newsletter.



Dr. U. Kamachi Mudali  
FIIM, FNAE, FECSI

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## Excerpts from 28th Annual General Body Meeting

Welcome address at the meeting was delivered by the Chairman, Dr. U. Kamachi Mudali. He shared the happy news with the gathering that Dr. Baldev Raj has been conferred with the “Materials Science Award” by the Indian Academy of Sciences and also the MRSI award for this year. He also informed the gathering that Kalpakkam Chapter has won the “Best Chapter” award in the medium chapter category and the secretary Dr. R. Sandhya has been given the certificate of honour for her effort in promoting IIM activities at the chapter level. He also informed that the chapter strength has now increased to more than 215 with more young researchers coming forward to enroll as members. Dr. R. Sandhya then presented the secretary’s report. She briefed the gathering about the various activities of the Chapter in the year 2009-10, the awards and honours received by the members of the chapter and plan for the future activities of the chapter in the year 2010-2011.

The chairman then informed that a basic as well as advanced course on metallographic practices is to be conducted in Annamalai University as per the request of Prof. Raghukandan. Dr. P. Parameswaran will be the coordinator from Kalpakkam Chapter for this course which is conducted for the benefit of both students and teachers of Annamalai University. IIM –Human Resources Development Centre had also conducted (1) 2nd training course on surface modification techniques conducted along with IIM-HRDC and (2) A course on testing and characterization of materials organized with IIT Chennai. It is also planned to organize a human resources development programme for already employed people in the metal industry along with Annamalai University and CII. Dr. P. Parameswaran will be the coordinator for this activity.

Dr. Rani P. George presented the treasurer’s report.

The Chairman requested Dr. Baldev Raj to give away the chapter awards to 3 best papers each in young researchers and general category selected by a reviewer’s panel consisting of Prof. Pathak and Prof. Seshadri of IIT Chennai. Mr. P.C. Gopi who is to retire soon was honoured by the chapter for his commendable work in various conferences and seminars organized by IIM Kalpakkam Chapter. In his special address, Dr. Baldev Raj congratulated the Chairman and his team of EC members for receiving the Best Chapter award. He thanked Dr. Bhanu Sankara Rao for accepting the invitation to attend the EC meeting. He informed that the activities of HRDC had started well. He requested the members to come with suggestions to improve the environment both in the office and in the township. He also requested the Chairman to send an invitation to all the past members of the Kalpakkam Chapter to join in the activities of the chapter. He also informed that in memory of late Dr. Placid Rodriguez who was a world renowned metallurgist “Placid Rodriguez memorial lecture series” was started in the year 2009 with the first lecture delivered by Prof. Atul Choksi of IISc, Bangalore on “Creep in Nano materials”. Dr. Baldev Raj concluded his address with a positive note that members should try to spread awareness about metallurgy in schools and colleges.

Sumantra Mandal, who had received the Young Metallurgist award at NMD 2009, received a special memento sent by Mrs. Blossom Rodriguez. It had been the late Dr. Rodriguez’s wish that the memento should be given to a young metallurgist.

Dr. Baldev Raj installed the new executive committee for the year 2010-11

### IIM-Kalpakkam Chapter EC Members

Dr.U. Kamachi Mudali	- Chairman	Shri. Hemant Kumar	- Member
Dr.B.P.C. Rao	- Vice-Chairman	Mrs.B.Sasi	- Member
Dr.R. Sandhya	- Hon. Secretary	Dr.V.S.Srinivasan	- Co-opted Member
Smt.C. Sudha	- Joint Secretary	Shri.Sunil Goyal	- Co-opted Member
Dr. Rani P.George	- Hon. Treasurer	Shri. A. Ravi shankar	- Co-opted Member
Dr. P. Parameswaran	- Member	Shri.M.Shanmugavel	- Co-opted Member
Dr.Arup Dasgupta	- Member		
Shri.V. Karthik	- Member		
Dr.R. Ramaseshan	- Member		

## Technical Lectures

S.N	Title	Speaker	Affiliation	Date
1.	Synthesis and corrosion behaviour of nanocrystalline Fe-Cr alloys	Dr. Rajeev Gupta	Dept of Mechanical & Aerospace Engineering Monash University, Australia	07.01.2010
2.	Fatigue Crack Propagation of a Post-Service Gas Turbine Superalloy by Miniature Specimens	Prof. Okazaki	Nagaoka University of Technology Japan	11.01.2010
3.	Monitoring of Rail/Wheel Interaction using Acoustic Emission	Dr. Nirav Ashokkumar Thakkar	Visiting Scientist, Heriot-Watt University, Edinburgh, UK	12.01.2010
4.	Experimentation and modeling of cyclic plastic deformation behavior of piping materials	Mr. Surajit Kumar Paul	Research Scholar, NML Jamshedpur	24.02.2010
5.	Nanobiotechnology – The Ultimate in Interdisciplinary Research	Prof. Saion Sinha,	Dept. of Physics, Univ. of New Haven, Connecticut, USA	26.02.2010
6.	Numerical Simulation of Welding Process	Prof. G.G. Roy	Professor, Department of Metallurgical and Materials Engineering, IIT, Kharagpur	05-03-2010

S.N	Title	Speaker	Affiliation	Date
7.	Advanced Electron Microscopy for Materials at the nano scale	Dr.Joysurya Basu	Department of Chemical, Materials & Biomolecular Engg., Univ. of Connecticut, USA	17-03-2010
8.	Physico-Chemical Approach in Solid State Interdiffusion	Shri. Chirantan Ghosh	Dept. of Materials Engineering, IISc, Bangalore	07-04-2010
9.	Fretting fatigue mechanisms and strength prediction based on the stress distribution at the contact interface	Dr. M. Jayaprakash	Department of Materials Science & Engg., Nagaoka University of Technology, Japan	03-05-2010
10.	Kinetic Study of growth & coarsening behaviour of precipitates in steels	Dr. Sadhan Ghosh,	Graduate Inst. of Ferrous Technology (GIFT), POSTECH, Republic of Korea.	03-06-2010
11	Global overview of multiscale modelling illustrated by simulations of indentations from the atomic to the continuum level	Prof. Marc C. Fivel	CNRS, France	14-06-2010
12.	Detection of Surface Stress and Hardness In Ground Steel Components using Magnetic Barkhausen Measurements	Prof. Dr. David C. Jiles,	School of Engg, Cardiff University, UK	06-07-2010
13	Product Development at Tata Steel	Dr. T. Venugopalan	Chief Technology Officer, R&D, Tata Steels, Jamshedpur	26/08/2010
14	Basics of Fretting Fatigue and New Fretting Fatigue Design Curves	Prof. Yoshiharu Mutoh	Department of Mechanical Engineering Nagaoka University of Technology, NUT, JAPAN	14/12/2010

## Article

### *Functionally Graded Thermal Barrier Coatings- A New Generation of Engineered Materials*

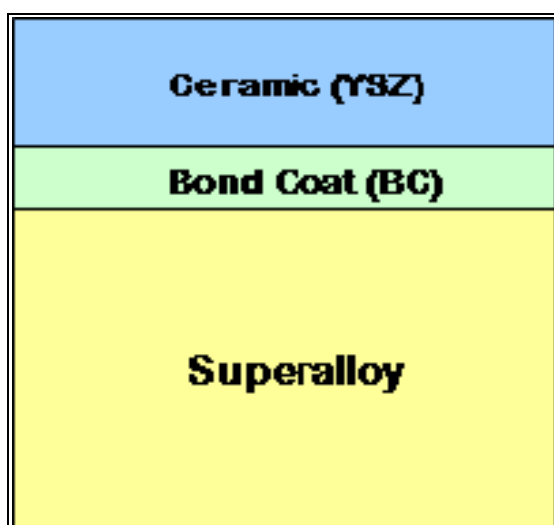
Functionally graded materials (FGM's) are a new generation of engineered materials wherein the microstructure (chemical composition, grain size, and porosity) is gradually varied to achieve a gradual change in material properties across the cross section to provide excellent performance in service. In general FGM's are composite materials with a gradual macroscopic microstructural gradient. Bamboo is a natural FGM where distribution of high strength natural fibers varies across the cross-section. The fiber content across the culm of bamboo increases from inside to outside which is a natural adaptation of the plant to withstand high stresses and flexural loads on the surface.

The concept of FGM was first considered in Japan in 1980's by which thermal barriers could be capable of withstanding a surface temperature of 2000 K and a temperature gradient of 1000 K across a 10 mm section.<sup>1</sup> Thermal barrier coating (TBC) consists of a top ceramic coat with an intermediate bond coat (BC) on a superalloy substrate as shown in fig 1. Ytria stabilized zirconia (YSZ) has become the preferred top ceramic coat for gas turbine engine applications because of its low thermal conductivity, and high thermal expansion coefficient. The intermediate bond coat is typically a 50  $\mu\text{m}$  NiCrAlY layer which is oxidation and hot corrosion resistant. The bond coat also improves the adhesion of ceramic coat and reduces the thermal expansion mismatch stresses. The plasma spray process is the most attractive and widely used method of producing reproducible and durable TBC's of thickness between 300  $\mu\text{m}$  to 400  $\mu\text{m}$ . Conventional plasma sprayed TBC (duplex coating) exhibit low durability during thermal cycling, and this is attributed to poor bond strength between coating and substrate. Oxidation of bond coat and thermal expansion mismatch between the YSZ ceramic coat and metallic bond coat is another severe problem that causes failure. Functionally graded material is capable of effectively reducing the thermal expansion mismatch stresses and then improves the resistance of a TBC to thermal cycling. The concept of functionally graded thermal barrier coating is to make a composite material (YSZ + NiCrAlY) by varying the microstructure from substrate to the top surface with a specific gradient as shown in fig 2. By replacing the flat interface between bond coat and ceramic coat by graded transition layers as shown in fig 2, good adhesion of the coating to the substrate is achieved. It has been reported that the bond strength of five layer functionally graded TBC increased 1.5 to 2 times compared to conventional duplex TBC.<sup>2</sup> Functionally graded coating enables the material to have the best of both materials properties. For example thermal, or corrosion resistance or toughness, strengths of both the material may be used to avoid fatigue, fracture, corrosion, and cracking. Advanced functionally graded coatings exhibit higher level of durability and life-time (at higher service temperature and in corrosive environment). Functionally graded TBC showed extended oxidation resistance compared to duplex TBC.<sup>3</sup> Thermal cycling resistance of FGM coatings was five times better than that of duplex coating.<sup>3</sup> Therefore functionally graded thermal-barrier coatings can allow increase in operating temperature, improvement in adhesion strength with bond coat and increase in thermal-cyclic life-time.

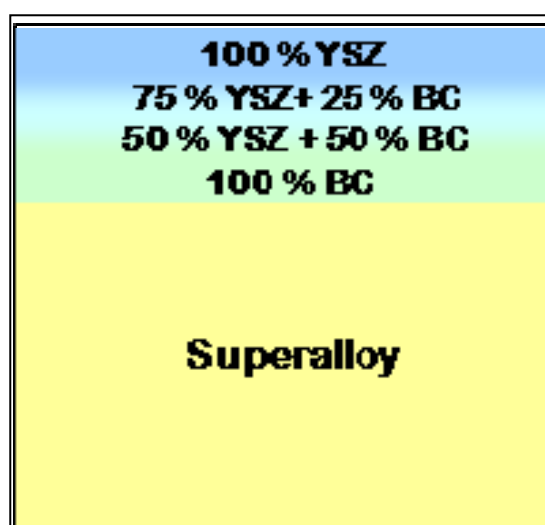
Functionally graded materials are ideal candidates for applications involving severe thermal gradients, ranging from thermal structures in advanced aircraft and aerospace engines to dental and bone implants. There is a huge demand in the global market for durable functionally graded thermal-barrier coatings for protection of many thousands of gas turbine blades and vanes. Durable FGM coatings also have potential applications in pyrochemical reprocessing plant applications where durability and corrosion resistance to molten chloride salt at high temperatures is of prime importance. There are many other potential areas of application for FGM. The other important applications include; solid oxide fuel cells, military vehicles and body armour applications, graded refractive index material in optical applications, piezo electric and thermo electric devices in electromagnetic applications and dental and bone implants in biomedical applications etc. Owing to the many variables that control the design of functionally graded microstructures, research is focused on the development of appropriate modeling strategies for the full exploitation of the FGM's potential.<sup>4</sup> Efforts are being made at corrosion science and technology division, IGCAR to develop such functionally graded thermal barrier coatings for protection against high temperature molten salt corrosion.

#### References:

- O.O. Oyekoya, D.U. Mba, A.M. El-Zafrany, *Composite Structures*, 89 (2009) 134–142.  
 A.M. Khoddami, A. Sabour, S.M.M. Hadavi, *Surface and Coatings Technology*, 201 (2007) 6019-6024.  
 K.A. Khor, Y.W. Gu, *Thin Solid Films*, 372 (2000) 104-113.  
 K. Yakubo, J.J. Xiao, K.W. Yu, *Physica B*, 394 (2007) 262–266.



**Fig 1. Schematic diagram of Duplex Thermal Barrier Coating System**



**Fig 2. Schematic diagram of Functionally Graded Thermal Barrier Coating system**

*A Ravi Shankar, CSTD  
 IGCAR, Kalpakkam*

## Two day workshop on Metallographic Practices Aug., 27-28, 2010

A workshop on Metallography was conducted at Annamalai University by IIM, Kalpakkam chapter on 27-28, Aug., 2010 in collaboration with Manufacturing Engg department of the university. It was attended by 146 participants. In the inaugural ceremony, Dr.K.Raghukandan, Prof & Head, Dept. of Manufacturing Engg., AU welcomed the gathering, Prof.B.Palaniappan, Dean, Faculty of Engg & Tech, AU quoted the importance of Metallography in his presidential address, Dr.U.Kamachi Mudali, Chairman, IIM, Kalpakkam felicitated the local organising committee and also briefed the genesis of the workshop, its aim and usefulness. Dr.T.Venugopalan, Chief Technology Officer, TATA Steel, Jamshedpur talked on latest developments in metallography and Dr.T.R.Manoharan, Associate Professor, Dept. of Manufacturing Engg., AU briefed the gathering on the deliberations of the workshop and thanked the gathering.

Followed by this, Dr.M Vijayalakshmi, Head, Physical Metallurgy Division, IGCAR addressed the participants on the importance of metallography in understanding the materials behaviour- be it the mechanical properties or the chemical properties.

The second lecture of the day was by Er.K.Varadarajan, formerly of Material Science Group, IGCAR who made a lucid presentation on the preparation methods for microscopy, covering the importance of conventional polishing, grinding and etching. He introduced the methodology of sampling techniques, cutting procedures, molding methods etc.

The afternoon session involved practicals, which were carried out in three labs in parallel with three sets of three samples namely- i) plain C steel ii) stainless steel iii) brass. The practicals introduced the participants with chemical etching and electrolytic etching. It also introduced the care one has to take while polishing ferrous and nonferrous samples.

The second day of the workshop started with an introduction to Optical Microscopy and microhardness by Dr.P.Parameswaran, Scientific Officer, Nuclear Materials Microscopy Section, IGCAR. The lecture covered the physics of image formation and introduced the various components of an optical microscope. He also briefly introduced the definition of hardness and various methods of measuring it. He explained the microhardness by Vickers and Knoop methods and discussed the need for choosing the right method depending on the sample thickness.

The lecture on SEM and allied techniques was delivered by Dr S.Saroja, Head, NMMS, IGCAR. She introduced the different modes of observing in SEM and touched on the different parameters that could be handled to get a good image. She also highlighted the advances in the currently available in SEM like using environmental mode for observing biological samples.

The after noon on the second day was devoted to observing the samples prepared in Optical Microscope.

The workshop ended with a feedback session. The Convener, Dr.T.R.Manoharan, Associate Professor, Department of Manufacturing Engg, Annamalai University made a vote of thanks with appreciation at the lecturers and the people behind the demos. A CD covering the lectures, various sites and links on microscopy and standards of metallography is given to the participants.

## Prof. Brahm Prakash Memorial Materials Quiz & Elocution Contest (BPMMQ-2010), 17-18 Sep., 2010

The Prof. Brahm Prakash Memorial Materials Quiz and Elocution Contest 2010 was held at the Anupuram Convention Centre, Kalpakkam on 18th September 2010 by Indian Institute of Metals, Kalpakkam Chapter. The program was organized under the esteemed guidance of Dr. Baldev Raj, Director, IGCAR. 41 teams comprising of 82 students of class XI and XII, including teams from Srilanka participated in the programme. 21 chapters of Indian Institute of Metals from all over India supported the participation of their teams in the quiz programme. Metal Camp, a visit to the nuclear power facilities at Kalpakkam was organized on 17th September 2010 to see all the three types of reactors, PHWR, FBTR and also PFBR, which is under construction.

The Quiz and the Elocution contest were held on 18th September 2010 at the Convention Centre, Anupuram. Dr. Rani P. George, Convener, BPMMQ 2010 welcomed the gathering. Dr. T. Jayakumar, Director, MMG did the draw of lots. The preliminary rounds were held in 6 parallel sessions and the winner and the runners-up teams from each session were chosen for the semifinals. A separate semi-final was conducted for the Srilankan teams and the top team was selected for finals. Thus 2 teams from Tirunelveli, 1 team each from Bhilai, Trichy, Durgapur and Sri Lanka participated in the closely contested finals. This year the theme of essay competition was Challenging Materials and 23 essays were received on the topics Biodegradable Materials, Amorphous materials and Hydrogen Storage Materials. 4 selected participants made oral presentations for 10 minutes and were judged by a panel of three judges, Dr. G. Amarendra, Head, Metal Physics section, Shri. E. Mohandas, Head, Material Synthesis and Structural Characterization section and Dr. K. Laha, Head, Creep Studies Section of MMG.

Dr. U. Kamachi Mudali, Chairman, IIM Kalpakkam Chapter and BPMMQ 2010 in his presidential address explained the advent of the Prof. Brahm Prakash Memorial Materials Quiz and how it has served the intention of popularising Materials Science and Engineering among the young generation. Dr. Sanak Mishra CEO, Greenfield Project of ARCELOR MITTAL, delivered the Prof. Brahm Prakash Memorial Lecture. He spoke on how the metallurgy from art evolved into materials science. He detailed the transformation of wrought iron structures into high strength steel structures. According to him interdisciplinary research is forefront in the field of Metallurgy. He inspired the students by describing how biology has inspired designs and showed them an imaging device based on layout of human eye. He emphasized the importance of collaboration to innovate. He advised the students to be responsible and courageous for realizing their dreams.

Dr. Sumanth C. Raman, a renowned doctor now with TCS, Chennai and a popular quizmaster who also conducts programmes on Doordarshan, conducted the final session. Dr Sumanth had several questions for the audience too and pinned all of them to the edge of their chairs with his charismatic style in conducting the quiz. In a closely competed final, the team A from Tirunelveli comprising of Masters M. MUTHUKISHORE and ALAGAR SREENIVASAN (Sri Jayanendra Swamikal Silver Jubilee Matric HS School, Tirunelveli) won the finals and the team D from same school in Tirunelveli comprising of Ms. R. SARANYA and G. SUBBULAKSHMI emerged the runners up. Both the winners and runners were presented trophy and certificates of Merit by Dr Sanak



Mishra. The winners and runners of the quiz event were also invited to receive their awards sponsored by IOMMMS during the 48TH NATIONAL METALLURGIST DAY CELEBRATION on 14th November 2010 at Bangalore. O.P.Jindal Award for the quiz, carrying total cash prize of Rs. 25,000/- was presented to the winners and runners up by Dr. Sanak Mishra. The winner of elocution competition was Mst. Ghazi Sarwat, from Kalpakkam and Ms. Prakruti Gogia from Pune was declared as the runner. They received the award (Rs. 10,000 for winner and Rs. 5000 for runner) sponsored this year by Mailam India Limited, Puducherry along with their trophy and certificate from Dr. Sanak Mishra. Shri. Sunil Goyal, Co-Convener, BPMMQ 2010 made the vote of thanks.

A Quiz digest was brought out to mark this event, which contained edited versions of selected elocution entries sent by participants of the quiz.

### A Memorable photo from BPMMQ-2010



### IIM-HRDCKC Activity:

*"Tribology – Materials, Coatings and Evaluation"*  
*6th Aug., 2010, IC&SR, IIT Madras, Chennai*

Tribology of materials and coatings is gaining momentum today as more engineering components are made with advanced materials and coatings for scientific and industrial applications. In this direction the R&D and the sophisticated analytical research tools in this area of study are very scarce. IIM HRDC Kalpakam-Chennai organised a One Day Seminar on "Tribology – Materials, Coatings and Evaluation" on 6th August 2010 to cater to the needs of the industrialists, academicians and researchers involved in tribology area. The seminar was specially planned for industries and institutions involved in these activities, and the participation is by invitation for those who are already pursuing or planning to initiate tribological studies in their respective institution. The seminar included special lectures and practical demonstrations by eminent persons from leading research institutions and industries such as IITs, IIITDM, IGCAR, CETR (USA), Anna University, etc.

### NDE for Microstructural Characterization

22<sup>nd</sup> Dec., 2010

As part of IIM activity, one day theme meeting on "Microstructural Characterisation through Nondestructive Techniques" is held on 22-12-2010 at CDO lecture hall, IGCAR. About sixty scientists and engineers attended the theme meeting from IGCAR. In the theme meeting, three eminent experts from NDE Division and Prof. Dr. Walter Arnold, *Department of Materials, Saarland University, Saarbruecken, Guest Professor, Physikalisches Institut Goettingen University, Goettingen, Germany* delivered invited lecture on material characterization using NDE. He discussed the importance of microstructure for material characterization and the role of NDE. Dr. T. Jayakumar, Director, MMG covered the aspects of material characterization using ultrasonic, micromagnetic NDE technique. He discussed the micromagnetic NDE studies carried out for determination of quenched and tempered microstructure in ferromagnetic material, case depth in carbon steel, tensile strength in Cr-Mo steels and assessment of Post Weld Heat Treatment (PWHT) in Cr-Mo steel weld joints. He also covered the role of ultrasonic NDE and effective utilisation of the parameters such as poisson's ratio, ultrasonic attenuation and velocity for microstructural characterization. He explained the results obtained from studies on solution annealing behavior of mod. 9Cr-1Mo ferritic steel and M-250 grade Maraging steel, residual stress assessment in stainless steel weldments, assessment of grain size in PWHT, forged D9 Stainless steel at 1273 K for 10-50% strain and identification of  $\beta$ -transus temperature in  $\alpha+\beta$  titanium alloy. He also discussed the application of Non-Linear Ultrasonic (NLU) technique for assessment of deformation behaviour in cold worked SS304, ageing behaviour in maraging steel and heat treatment of 0.4% carbon steel. Dr. C. K. Mukhopadhyay, Program leader, EMSI section, NDE Division, talked about the role of eddy current NDE in material characterization. He discussed the studies on characterisation of microstructures in VT-14 Ti alloy and M-250 Maraging steel to identify formation of different phases and transformations and for ensuring manufacturing quality of Zircalloy-4 rods to identify process related defects and correct the production process for defect free components. The success of EC NDE for early detection of IGC and detectability of onset of sensitisation in less than 20 hrs of ageing is explained. He also discussed the characterization of deformation and fracture behaviour through Acoustic Emission NDE. He explained the results obtained from tensile deformation of M250 grade Maraging steel, correlation AE with stress intensity factor and fatigue crack growth studies in weld CT specimen. The lecture on thermography on material characterization and deformation monitoring was delivered by Mr. Barid Baran Lahiri, Scientific officer, SMART Section, NDED. He discussed the scope of active and passive thermography in the field of corrosion monitoring, impact assessment, fatigue and tensile testing, process monitoring and thermal diffusivity measurements. Mrs. B. Sasi, Convener of the theme meeting proposed the vote of thanks.



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APPLICATION FORM FOR MEMBERSHIP			
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/ SUSTAINING MEMBER <input type="checkbox"/>	/ SUSTAINING MEMBER(SS) <input type="checkbox"/>	/ PATRON MEMBER <input type="checkbox"/>	
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Membership No.		Date of Enrolment	
Receipt No.		Date	Amount
Name of the Applicant : (In Block Letters)			
Father's Name : (In Block Letters)			
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Address for Correspondence : (In Block Letters) (Please indicate PIN Code)			
Qualifications :			
Date of Birth :			
Experience (in years) :			
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Present Occupation :			
Endorsement (by 3 IIM Members (not Student) or the Employer who know the applicant well)	<u>Name</u>	<u>Membership No.</u>	
	1. _____	_____	
	2. _____	_____	
	3. _____	_____	
Primary field of interest : (Please mark 1, 2, 3 in order of preference)	Ferrous Production	( )	Non-Ferrous Production ( )
	Mining Beneficiation	( )	Designing & Engineering ( )
	Govt./Education	( )	Research ( )
Name of the Chapter you intend to be attached :			

*I agree, if elected, to accept election, pay the prescribed fees, to abide by the Articles of Association of the Institute and to promote its aims and objects.*

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Signature of the Applicant

I undertake to appear at the Associate Membership Examination of the Institute after 3 (three) Months of election and to appear at the AMIIM Examination within 18 (eighteen) months from the date of enrolment as Student Member subject to fulfilling all the eligibility rules. (To be signed only by applicant for Student Membership aspiring for appearing at the AMIIM Examination).

\_\_\_\_\_  
Signature of the Applicant

<b>MEMBER</b>	Rs. 300/- as Admission Fees & Rs. 450/- as an annual subscription.
<b>ASSOCIATE MEMBER</b>	Rs. 250/- as Admission Fees & Rs. 350/- as an annual subscription.
<b>STUDENT MEMBER</b>	Rs. 75/- as Admission Fees & Rs. 600/- towards 3 (three) years subscriptions, and Rs. 150/- towards registration fees, viz. A total of Rs. 825/-
<b>STUDENT MEMBER</b> (College Students studying Metallurgy)	Rs. 75/- as Admission Fees & Rs. 200/- as an annual subscriptions.
<b>LIFE MEMBER</b>	Rs. 300/- as Admission Fees & Rs. 6000/- as Membership Fees Or Rs. 300/- as Admission Fees & Rs. 3200/- each in two instalments as Membership Fees, within the same Financial year.
<b>LIFE ASSOCIATE MEMBER</b>	Rs. 3000/- in a single instalment or Rs. 3200/- in four instalments of Rs. 800/- each, within the same Financial Year.
<b>SUSTAINING MEMBER</b>	Rs. 10,000/- per annum.
<b>SUSTAINING MEMBER (SS)</b>	Rs. 6,000/- per annum.
<b>PATRON MEMBER</b>	Rs. 2,50,000/- in one instalment or 6 (six) annual instalments of Rs. 45,000/- each.
<b>DONOR MEMBER</b>	Rs.1,25,000/- in one instalment or 6 (six) annual instalments of Rs. 22,500/- each.
<b>AFFILAIATE MEMBER</b>	Rs. 400/- as Admission Fees & Rs. 650/- as an annual subscription.
<b>STUDENT AFFILIATE MEMBER</b>	A Student Affiliate Member shall not pay any admission fees and subscription.

- Notes:
1. Please attach attested copies of Mark Sheets/Certificates wherever necessary.
  2. Payment should be made by DD favouring 'The Indian Institute of Metals, Kolkata'.
  3. For further details, please contact the IIM Head Office at Kolkata.

## Awards & Honours for IIM-KC Members

♣ **Dr. Baldev Raj, Director, IGCAR has been**

Elected President, International Institute of Welding, which has a membership of fifty one countries.

Elected Fellow of ASM International, USA

♣ **Dr. Baldev Raj, Director, IGCAR has been awarded** the INSA Prize for Materials Science, Indian National Science Academy (2010)

♣ **Dr. Baldev Raj, Director, IGCAR has been invited to be:**

Member, DAE Science Research Council

External Expert, Peer Review Committee for the Cluster – Chemical Sciences, Group I: Chemical Materials & Energy,

Council of Scientific & Industrial Research, New Delhi (2010)

Member, R&D Advisory Council of Bharat Heavy Electricals Ltd. to enhance performance multi-fold based on science based technologies

Co-Chair, Editorial and Scientific Committee of International Journal of Nuclear Energy Science and Technology

Member, Governing Body of J&K State Council for Science & Technology

Member, Research Council, Institute of Minerals & Materials Technology, Bhubaneswar

Member, Advisory Council, Great Lakes-Bauer Energy Executive MBA Programme

Chairman, Research Advisory Board of PSG Institute of Advanced Studies, Coimbatore

Member, Editorial Advisory Board, Bulletin of Materials Science

♣ **Dr. Baldev Raj, Director, IGCAR has been invited to be** a member of the committee for selecting the Australia-India Science & Technology Research Award on “Energy Generation in a Low Carbon Future” instituted by Australian Academy of Technological Sciences and Engineering in association with Australian Government’s Australia India Council

♣ **Dr. Baldev Raj, Director, IGCAR has been nominated** as External Expert, Peer Review Committee for the Cluster – Chemical Sciences, Group I: Chemical Materials & Energy, Council of Scientific & Industrial Research, New Delhi (2010)

♣ **Dr. Baldev Raj, has been conferred** "Pandit Jawaharlal Nehru National Award" in the field of Engineering & Technological Sciences, Department of Science & Technology, Government of Madhya Pradesh for the year 2007 (Awarded in 2010)

He has been invited to be a Member, Dr. Yellapragada SubbaRow Award Committee (2010)

He has been appointed as a Member, Nuclear Fuel Cycle Board, Department of Atomic Energy

- ♣ Dr. P. Chellapandi, Director, SG, has received Distinguished Alumnus Award of IIT-Madras, 2010.
- ♣ IIM Kalpakkam Chapter got Best Chapter award in Medium Category, at the IIM Awards Function on 14<sup>th</sup> November 2010 during the 48<sup>th</sup> National Metallurgist Day Celebrations at J.N. Tata Auditorium, Indian Institute of Science, Bangalore.
- ♣ Dr.S.Raju, .PMD has been awarded DAE “Science and Technology Excellence Award for 2009”.
- ♣ Dr.S.K.Albert, DAE Science and Technology Award – 2009
- ♣ Dr.A.K.Bhaduri, Sir LP Mishra Memorial Lecture Award – 2010 from Indian Institute of Welding.
- ♣ Dr. U. Kamachi Mudali has been elected as Fellow of Tamilnadu Academy of Sciences from 2010.
- ♣ A.K.Bhaduri (Group Leader), S.K.Albert, C.R.Das, H.C.Dey, Hemant Kumar, V.Ramasubbu (& 13 more persons from IGCAR), DAE Group Achievement Award – 2009 for “Selection and Development of Hardfacing Technology for PFBR”.
- ♣ Utpal Borah, R. Nagarajan (& 39 more persons from IGCAR), DAE Group Achievement Award – 2009 for “Design & Development of Small & Large Rotatable Plugs”
- ♣ Dr. Rani George, NIGIS Corrosion Awareness Award for Excellence in Corrosion Science and Technology for the Year 2009–10, during “CORCON-2010” East Asia & Pacific Area: Corrosion Conference & Expo during 23<sup>rd</sup> – 26<sup>th</sup> Sept 2010 at Goa.
- ♣ Dr. Rani George, IIM CERTIFICATE OF HONOUR at the IIM Awards Function on 14<sup>th</sup> November 2010 during the 48<sup>th</sup> National Metallurgist Day Celebrations at J.N. Tata Auditorium, Indian Institute of Science, Bangalore.
- ♣ D.Bhuvaneshwari, NIGIS Best M Tech Award for the Year 2009–10 on 24<sup>th</sup> Sept 2010. The NIGIS Awards was presented during “CORCON-2010” East Asia & Pacific Area: Corrosion Conference & Expo during 23<sup>rd</sup> – 26<sup>th</sup> Sept 2010 at Intercontinental The Lalit Goa Resort,Goa.

## Best paper awards for IIM-KC Members

- ◆ T.N. Prasanthi, C.Sudha, V. Thomas Paul, S. Murugesan, S. Saroja and M. Vijayalakshmi, Strain induced structural changes in 304L austenitic stainless steel and Ti-5Ta-2Nb alloy, STEM 2010, November 25-26, 2010, Anupuram, Tamilnadu, India Best Paper award.
- ◆ C. Sudha, T.N. Prasanthi, S. Saroja and M. Vijayalakshmi, I.T Mirchandani Memorial Research Award-2010, for first best research paper, Proc. National Welding Seminar, Dec 10-12, 2009, Kolkata, "Effect of heat treatment on the microstructure and microchemistry of explosive welded joints of Ti-5Ta-1.8Nb and 304L SS".
- ◆ Chanchal Ghosh, G.Balakrishnan, R.Divakar, P.Kuppusami, E.Mohandas, D.Sastikumar, Best Poster Presentation Paper Award, 21st AGM of MRSI, Gujarat, February 9-11 (2010). "HRTEM Characterization of Ceria-Zirconia Multilayers Prepared by Pulsed Laser Deposition".
- ◆ Madhusmita Behera, R.Mythili, S.Raju and S.Saroja, Best Oral Presentation Award, National Symposium for Materials Research Scholars and Workshop on Advanced Characterisation Techniques (MR10), 6th - 8th May-2010 at IIT Bombay, "Study of beta to alpha phase transformation on continuous cooling from the beta phase field in a Ti- 5%Ta-1.8%Nb alloy".
- ◆ R.Mythili, SO/E, PMD, Awarded Doctoral Degree by University of Madras after successful performance in the Public Defence VIVA VOCE on 13<sup>th</sup> September 2010. The title of the Ph.D. thesis is "Study of a Ti-5% Ta-1.8% Nb Alloy: Microstructure and its Influence on Corrosion and Mechanical Properties".
- ◆ R.Mythili, S. Saroja and M. Vijayalakshmi, 2010 IIM-SAIL Gold Medal" for the paper titled: "Study of Strain Induced Martensite formation in a Ti Modified 316 Stainless Steel Bellow by Transmission Electron Microscopy" in Transactions of the Indian Institute of Metals, 62 (6) (2009) 573-579, during 48<sup>th</sup> National Metallurgist Day (NMD) and the 64<sup>th</sup> Annual Technical Meeting (ATM) of IIM, Nov.14-16, 2010 at IISc, Bangalore.
- ◆ A Vincent Paulraj, FM/B was awarded a Distinction Certificate for his participation and presentation of a case study as a member of the MMG team, at the 9th Quality Circle Annual Meet 2010 organised by IGCAR and GSO at Kalpakkam during 16 - 17 August, 2010.
- ◆ Manmath Kumar Dash, T. Karthikeyan, S. Saroja and M. Vijayalakshmi, Best Poster Presentation, STEM 2010, November 25-26, 2010, Anupuram, Tamilnadu, India, "Crystallographic characterization of tempered martensite produced in slower kinetics of displacive transformation in 9Cr-1Mo ferritic steel".
- ◆ Chanchal Ghosh, Divakar Ramachandran, G. Balakrishnan, P. Kuppusami, E. Mohandas, D. Sastikumar, BEST POSTER AWARD, Structure & Thermodynamics of Emerging Materials (STEM-2010), Workshop on Advanced Methods in Characterisation of Texture and Microtexture of Metals, November 25-26, 2010, Anupuram (2010) , "A Study of Phase Stability in Oxide Multi-layers".
- ◆ Chanchal Ghosh, Divakar Ramachandran, G.Balakrishnan, P.Kuppusami, E.Mohandas, D.Sastikumar, BEST ORAL PRESENTATION AWARD, 48th National Metallurgist Day (NMD) and the 64th Annual Technical Meeting (ATM) Nov, 14-16,2010, National Science Seminar Com-

plex, Indian Institute of Science, Bangalore (2010), "HRTEM Characterisation of the Interfaces in Oxide multilayers".

- ◆ W. Sharatchandra Singh, S. Thirunavukkarasu, S. Mahadevan, B.P.C. Rao, C. K. Mukhopadhyay and T. Jayakumar. Best paper award at the Indian Society for Nondestructive Testing (ISNT) held at Kolkata during December 9-11, 2010, for the paper "Three-dimensional finite element modeling of magnetic leakage flux from inclined and interacting defects".
- ◆ W. Sharatchandra Singh, S. Thirunavukkarasu, S. Mahadevan, B.P.C. Rao, C. K. Mukhopadhyay and T. Jayakumar. "Three-dimensional finite element modeling of magnetic flux leakage technique for detection of defects in carbon steel plates" COMSOL held at Bangalore during October 29-30, 2010
- ◆ Prof. S.M. Mayanna, Dr. Rani George, 7<sup>th</sup> Endowment Lecture during 16 & 17 July 2010 in NSEST-2010 Conference at IISc, Bangalore.
- ◆ A. Poonguzhali, T. Anita, Zahida Begum, H. Shaikh and R.K. Dayal, SCC behaviour of AISI Type 316LN Austenitic Stainless Steel with different nitrogen contents, Proceedings of the 20<sup>th</sup> Annual Conference of Indian Nuclear Society (INSAC-2009), during 04-06 January, 2010, Chennai, India Paper No. P-56, Best Paper Award.
- ◆ N. Sivai Bharasi, H. Shaikh and R.K. Dayal, presented at National Weld Meet (NWM) on 6<sup>th</sup> August 2010 at Puduchery received Best Paper Award for the paper, "Effect of Applied Potential on the Stress Corrosion Cracking Behaviour of Weldments of AISI Type 316 Stainless Steel".
- ◆ Sumantra Mandal, Dipti Samantaray, C.Phaniraj, A.K.Bhaduri, 2nd Best Oral Presentation Award (Material Processing) at 64<sup>th</sup> Annual Technical Meeting of Indian Institute of Metals, Bangalore, 14-17 Nov 2010; for paper "A study on flow behaviour and microstructural evolution in 316LN austenitic stainless steel during hot forging".
- ◆ Dipti Samantaray, INAE Innovative Student Project Award (M.Tech) – 2009; for thesis "Thermo-viscoplastic constitutive modelling of high temperature flow behaviour of an austenitic stainless steel and a ferritic steel".
- ◆ G.Nivashini, S.Raju, B.Jeya Ganesh, S.K.Albert, A.K.Bhaduri, Best Presentation Award at Int. Symposium for Research Scholars on Metallurgy, Materials Science and Engineering, IIT Madras (20-22 Dec 2010); for the paper "Phase stability and phase transformation studies on grade 92 steel using differential scanning calorimetry".
- ◆ M. Divya, C.R. Das, S.K. Albert, V. Ramasubbu, A.K. Bhaduri and P. Sivaraman, presented in National Welding Seminar of 2009 at Kolkata. Received ESAB Award of the Indian Institute of Welding for the best paper in all categories for the paper, "In-situ weld repair of cracked shrouds of turbine and characterization of the weld joint".
- ◆ A. L Skandhaprasaad, Subhranshu Sekhar Samal & S Sathyamurthy, Proceedings of International Conference on Emerging Trends in Robotics & Communication Technologies (INTERACT-2010), 3rd to 5th December, 2010, pp. 283-286, ISBN: 978-1-4244-9006-6 IEEE-2010, Best Paper Award for the paper "Selection of Materials for the Design and Development of Electromechanical Rotary Joints".



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*Please write to us with your valuable suggestions and enquiries about the activities of the IIM Kalpakkam Chapter. We would be most happy to reply to you.*



**IIM-KC**

## Editorial

Wish all the readers a very happy, productive and successful New Year in 2011. The e-newsletter of the IIM Kalpakkam Chapter, "Materials Matter", has now completed its 1st anniversary. I hope the readers and the contributors have enjoyed the contents. With your wishful patronage we hope to raise the standard of this bi-annual periodical to greater heights in the years to come. We invite you to even send articles which may seem fictions for now but could form the basis of your or other's future research. You will agree with me that there will possibly be no dearth of Government funding in the R&D sector in the near future. You can buy equipment, you can design and build infrastructure, but you cannot buy or borrow ideas. As India is emerging as one of the major economic power-

houses of the world, let us make a serious endeavour to transform our country into a land of ideas. This will make us innovative and ready to take upon likely competitions from other developed and developing countries. So we take this opportunity to appeal to all readers to use this forum to float new and path breaking ideas. For example, the year 2011 has been declared the Year of Chemistry. With so much interest now on synthetic chemistry, we hope to receive some articles depicting exciting new ideas in this field. Wish you all the very best.



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