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IIM
Metallurgy
Materials Engineering

The Indian Institute of Metals

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ENGINEERING

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Address by Dr. U. Kamachi Mudali, President, IIM during NMD Awards Function at Trivandrum on 14th November 2019



Honourable Union Minister of Petroleum, Natural Gas and Steel, Secretary and Jt. Secretary of Ministry of Steel, Distinguished Colleagues of IIM – on and off the dais, Former Presidents, Office bearers, Chapter Representatives, [RN Parbat, CGK Nair, B Muthuraman, Srikumar Banerjee, L Pugazhenthay, Sanak Mishra, M Narayana Rao, Kamanio Chattopadhyay, RN Patra, S S Mohanty, Anand Sen], Special Invitees from VSSC, NIIST and other Organisations from all over the nation, Industry Representatives, Sponsors, Exhibitors, Supporters, Delegates from all over the nation and Student Community, International delegates, Speakers (Keynote, Oral, Poster & Student), NMD Awardees, Press & Media, Ladies and Gentleman !

Good Morning and a Warm welcome to NMD ATM 2019 at Kovalam, Trivandrum in 'God's own country, KERALA'

The celebration and Recognition of excellence of the outstanding contributions of the Indian metallurgy and materials engineering community has been a tradition since 1962, and IIM is extremely proud in joining hands with Ministry of Steel in facilitating the same.

The National Metallurgists' Day Awards Scheme was instituted by the Ministry of Steel & Mines, Govt. of India, erstwhile 1962 beginning with 6 Awards. In the year 1989, 3 Young Metallurgists awards were added.

Currently we have 13 Awards in the categories of Lifetime; National Metallurgists [Industry and R&A]; Metallurgist of the Year [Fe;NF;MS;Env]; Young Metallurgists [Fe;NF;MS] and Certificate of Excellence, are bestowed amongst the recipients, every year.

Now it is the 57th National Metallurgists Day (NMD) year, where IIM continues to facilitate & support the pre-eminent initiative of Ministry of Steel to recognize the achievements and potential of India's prominent leaders, performers & stalwarts in the fraternity.

The NMD Awards aim to encourage continued efforts towards excellence in this challenging sector and to celebrate the recipient's outstanding & phenomenal work and contributions in respective fields.

This year recipients of NMD Awards have the privilege to get felicitated by our Hon'ble Minister of Petroleum & Natural Gas and Steel, Shri Dharmendra Pradhan Ji. His illustrious presence along with significant participation of MoS representatives adds sparkle to the 57th NMD Awards Ceremony today. Over 13 awards shall be presented to this year's awardees in various categories, instituted under the aegis of Ministry of Steel, GOI.

"Excellence deserves recognition", and I personally would like to congratulate each Awardee for your exemplary contributions to the profession, industry, research & academia and setting the highest standards for many aspirants and other members of our Institute.

India has made pioneering contributions to the metallurgical field since past, and the standing testimony are the Dancing Girl bronze idol at Delhi Museum, Rustless Delhi Iron Pillar, Damascus Sword from Wootz Steel, Time immemorial South Indian Bronzes, Konark Iron Beams, Kerala's Aranmula Metal Mirror, etc. Indian metallurgists were excellent technology masters; iron and steel making, zinc distillation, lost wax investment casting of bronzes etc. are some of the wonderful examples.

We have made significant contributions in understanding the science and technology of metals and alloys making, structure-property correlations, development of novel and innovative materials with specialized properties and functions, application in extreme conditions with high performance, etc.

IIM has broadly classified its metallurgical and materials engineering activities into three domains, namely FERROUS, NON-FERROUS and METAL SCIENCE.

Sir, as we all aware presently India is a 2.8 Trillion US \$ economy and we need to grow at 10-12% per annum to achieve the 5 trillion US \$ economy by 2024, as envisaged by our Honourable Prime Minister.

India is Third largest coal producer, Fourth in Iron ore production, Third in Crude steel production, and Third in Aluminium production.

I would like to bring to your kind attention the present status of metallurgical industries in the FERROUS and NON-FERROUS sectors, and propose a few points for consideration to the Honourable Minister of Steel to support Indian metallurgical industries and improve their performance in the years to come.

Ferrous Industry

Per capita consumption of steel is 74 kg against the world consumption of 224 kg. The National Steel Policy 2017 with nine

objectives projects an achievement of per capita consumption of steel of 160 kg by 2030-31, with crude steel capacity of 300 million tonne, generating additional employment for 36 lakh people directly or indirectly.

To achieve 300 MMT capacity and 255 MMT production of steel India needs 480 MT of iron ore while the current iron ore production is 210 MT, which will be a difficult task. This is mainly because of renewal of iron ore mines leases expiring in March 2020, less spending on exploration, inadequate infrastructural facilities, single window clearance system and lack of dedicated freight corridor for evacuation of iron ores. 90% of iron ore is concentrated in Odisha, Chhattisgarh, Jharkhand, Karnataka and Goa.

40% of steel production is from the secondary steel sector. Govt of India should encourage secondary steel sector around our integrated steel plants or demand centers in the country with a “Steel Cluster Policy”.

With enhancing domestic demand, huge spending on infrastructure and development will increase the demand of steel in the years to come. Government should encourage adequate capacity additions in the steel plants.

Also, Introduction of new environment benign technologies for CO₂ reduction and globally competitive steel manufacturing capabilities for special steel production for oil & gas, marine, chemical & petrochemical and transportation sectors. Availability of affordable iron ore, coking coal & natural gas.

Non-Ferrous Metals Industry

- Non-Ferrous metals industry constitute four major sub-sectors.
 1. Base metals (Al, Cu, Zn, Pb, Ni, Sn)
 2. Precious metals (Ag, Au, Pd, PGM)
 3. Minor metals including refractory metals (W, Mo, Ta, Nb, Cr)
 4. Specialty metals (Co, Ge, In, Te, Sb, Ga).
- Non-Ferrous Metals like Al, Cu, Zn and Pb are key metals in critical industries including infrastructure, power, automobile, defense, transport, telecom and manufacturing in general, owing to excellent thermal and electrical conductivity and high recycling, high strength to weight ratio.
- Aluminium is the fastest growing Non-Ferrous metals in India ranks third in terms of aluminum production behind China, and Russia, and during 2018-19 primary aluminum production was 3.42 million tones. India, taking the advantage of high quality Bauxite reserve, fifth in the world, should be a major Alumina and Aluminium supplier to the world.
- Copper is the second largest Non-Ferrous metals market and primary copper production in 2018 was about 2.4 million tones. It is expected that by 2020 India will become 4th largest copper market growing at 6.1% per annum.
- Lead is mainly used in storage Batteries and it is currently US\$7 billion, mostly driven by automotive sector which consumes 60% of lead acid batteries.
- Production of Zinc in India in 2018 was around 0.5 million tonnes and the consumption is about 0.7 million tonnes, about 75% of zinc is used for galvanizing in order to protect steel from corrosion. Thus with a target of 300 million tonnes of steel by 2030-31 the production of zinc should be doubled as zinc is mostly used for cathodic protection of steel and steel structures.

Expectations from Government of India:

- There are many critical challenges which are affecting the robust growth of Non-Ferrous metal industries in India, especially **China factor, under developed scrap recycling and inverted duty structure**.
- Non-Ferrous metal industry looks for government assistance in the form of infrastructure support, cheap and abundant electricity supply, relaxation in import duties of raw materials, and recycling equipment, and other taxation incentives.
- Government should include non-ferrous metals in key government reforms like Make in India, Smart cities etc.; which emphasis on Manufacturing, and Manufacturing will be directly proportional to the growth of Non-Ferrous Metal industry.
- One of the key challenges faced by Non-Ferrous metal industry is its heavy dependence on scrap metal imports and another cause of concern is reliance on imports of metals ores and concentrates especially for copper.
- Government must come with well-defined end-of-life cycle norms and strictly enforce regulations to reduce metal scrap import and close the gap between the demand and supply of metal scrap.
- Also government need to ensure that existing regulations related to import and use of metals scrap should be strictly implemented and monitored by State and Central Pollution Control Boards (S&CPCB).
- “Inverted duty structure” – select downstream products such as Copper wires, Zinc ingots and Aluminium, etc. are imported from certain countries under trade agreements at lower tariffs than imports of raw materials for producing primary metal in India.
- While dealing with international agreements such as “Regional Comprehensive Economic Partnership (RCEP)” which facilitates duty reduction or duty free import, will widen the trade imbalances and hence Aluminium should be out of RCEP purview, in future. As on date China’s Aluminium exports is higher than its imports from India. Also, if RCEP is consented, all excess zinc capacity will be exported by China to India, and this will affect the domestic zinc market.

- Government should insist that for all government procurements in defence, rural electrification, housing, make in India, smart cities etc. procurement is mandatory from domestic manufacturers. For example, galvanized rebars should be made mandatory for all high-rise buildings, bridges, structures and highways.

With the support of GoI for all the above considerations, domestic demand can be expected for non-ferrous metals to grow at a maximum of 8% per year over the next five years, contributing to the ambitious 5 trillion US\$ economy by 2024.

Concluding Remarks

- ✓ Government should find ways for increasing the use of Metals like Fe/Steel, AL, Cu, Zn in India and also exploration of Export of the same. Capacity utilization of Steel, Al and Cu industry is low due to less demand in India. This is the right time to increase Government Expenditure on Infrastructure encouraging NEW INVESTMENT in Metal Industry.
- ✓ We need to accelerate on the infrastructural front to push demand for steel & metals, create employment opportunities, and also to sustain the economic growth momentum.
- ✓ Power Generation via Solar & Nuclear Routes should be enhanced to meet increased power requirement with the industrial growth foreseen in all sectors.
- ✓ Need for Li and Co (not available in India) for Solid State Battery for Solar Cells and Electric Vehicle should be addressed urgently.
- ✓ Enhance Research in Metals, Materials and Machineries (Follow South Korean Model of Research & Development). Global Warming and CO₂ reduction should be focus of Industrial Research. Being the second largest producer and consumer we need to rethink in establishing a “Steel University” in our country in a similar line with POSTECH and University of Aachen, in addition to SRTMI (Steel Research & Technology Mission of India)
- ✓ Digitalisation of steel industry, evolving an appropriate ecosystem, and emphasizing a circular economy are need of the hour. We cannot sustain without it, and certainly Metallurgists can play a pivotal role in their applications.
- ✓ In view of the involvement of steel ministry in supporting the application of other metals beyond steel, like copper, zinc, aluminium etc and their related mining issues, why the steel Ministry cannot be rechristened as MINISTRY OF METAL or some better suitable name and bringing both Ferrous & Non-Ferrous metals together under one Ministry.
- ✓ Establish a MATERIALS RESEARCH FOUNDATION with support of Ministry of Steel at one of the existing R&D Institute of CSIR for doing material related activities relevant to industry and the government policies.
- ✓ Establish an APEX FORUM with all CSIR Labs engaged in metallurgy and materials related activities with the support of Ministry of Steel to enhance academia – research – industry interaction and networking. For this Forum, Ministry of Steel will provide necessary funding for doing industrial R&D and application oriented projects.
- ✓ A new INDIAN INSTITUTE OF MATERIALS TECHNOLOGY with the departments focussing on aluminium, copper, iron & steel, titanium & zirconium, noble metals etc. During 3rd & 4th year of B.Tech., the students will specialise in the respective metal/alloys and will do extensive studies focussing industry relevance. These students will be trained for entire eco-system from mineral exploration to environment / waste management and will be ready to take up the job from the day one, they join the metallurgical industries.
- ✓ IIM can make the base line study and submit a white paper for all the above proposals. The involvement of IIM as unofficial advisor to Ministry could also be considered, for issues involving metallurgical considerations.
- ✓ To closely monitor the National Steel Policy for implementation - a Consultative Committee consisting eminent experts from outside the Govt., drawn from the Academic & S&T institutions, Design & Engineering, Manufacturing, Economics, Trade, Information Technology, Finance, and Environmental Sustainability.

Finally, we are extremely delighted that the Honourable Minister of Steel is present for the NMD-2019 function to honour the metallurgists by presenting the awards, interacting with the metallurgical community, and also addressing all of us on this National Metallurgists’ Day. We are looking forward to have continuing interactions with the Ministry of Steel to provide valuable input to the government policies and contribution to the growth of metallurgical industries of the nation.

Thanking you Sir,

U. Kamachi Mudali
President, IIM

Min: Embrace challenge to produce high-grade steel

Union Steel Minister Dharmendra Pradhan said steel sector has a key role to play in making of a New India envisioned by Modi

EXPRESS NEWS SERVICE
@TPuram

UNION Minister for Steel Dharmendra Pradhan on Thursday urged the stakeholders in the steel sector to embrace challenge of producing high grade steel for greater self-sufficiency. He also exhorted them to work towards greater sustainability in the sector and contribute towards creation of an Indian model of green economy.

He was speaking after participating in the 57th National Metallurgist's Day Function and 73rd Annual Technical Meeting of the Indian Institute of Metals at Thiruvananthapuram. Speaking about the importance of steel, he said, "Metals, including steel continue to play a vital role in building of a modern economy. There is a strong positive correlation between steel usage and a nation's economic growth. Under the leadership of Prime Minister Narendra



Metals, including steel continue to play a vital role in building of a modern economy. There is a strong positive correlation between steel usage and a nation's economic growth

Dharmendra Pradhan,
Union Minister for Steel

Modi, India is on a steady path to become a \$5 Trillion economy. This dream resolve is a collective one. We all have to work together with an IspatIrada (steely determination) to make this dream, a reality," he said. While talking about future readiness, Pradhan said, "We are in midst of Industrial Revolution 4.0 driven by digitisation, automation, big data, AI

and Internet of Things etc. It will fundamentally alter the way we live and work. Steel sector too must be future ready to embrace the change and leverage innovation for achieving this quantum leap."

He also said the decision to cut corporate tax and opt out of RCEP in its present form have been received well by stakeholders of the economy.

Speaking about making of a New India, he said, "Steel sector will have a key role to play in making of a New India envisioned by Modi. The next trajectory of growth, fuelled by Government's key focus on building infrastructure for future, creating smart cities, industrial corridors and so forth will further boost steel consumption."

He further said backed by entrepreneurial spirit of the industry and the policy measures taken by the government, Indian steel industry is becoming more competitive and environment friendly.

-The New Indian Express

PROF NP GANDHI MEMORIAL LECTURE 2019

Where Research Flourishes in Natural Atmosphere



G V S Sastry

Institute Professor,

Department of Metallurgical Engineering, IIT (BHU), Varanasi

1. Salutations to Prof N.P. Gandhi

Before I begin my Lecture I wish to thank the Indian Institute of Metals and the N P Gandhi Memorial Metallurgy Trust for choosing me for this award. With utmost humility I accepted the same as it is a unique opportunity for me, as a member of the BHUMET family, to pay tributes to that great pioneer of Metallurgical education in India at the Banaras Hindu University. The pioneering action was made possible by the visionary Mahamana Pandit Madan Mohan Malaviya ji's noble

thoughts and plans for independent industrial India. It was Mahatma Gandhi ji who suggested Professor Nagardas Purushottam Gandhi to Mahamana ji when the latter was doing talent scouting for the task. Professor N P Gandhi was given full freedom and certain privileges to establish a Geology, Mining and Metallurgy Department, which later became Min-Met College and eventually evolved as the Department of Metallurgical Engineering. Thus, the first UG programme that was relevant to the industrial needs of India, was started by Professor Gandhi

in the year 1923. The prospectus of the Banaras Hindu University of those years reveals a well thought over UG Programme in geology, mining and metallurgy which reflected the foresight of Professor Gandhi in shaping the Programme. He was fond of teaching the students through glass slides of complex diagrams even in those days. The Department grew from strength to strength owing to the eminent successors of Professor Gandhi viz. Professor Daya Swaroop and Professor T.R. Anantharaman. PG and Doctoral Programmes have been initiated in later years and the Department reached from its pioneering position to a preminent position in the country and abroad. The credit for bringing world recognition to the Department largely goes to Professor T.R. Anantharaman.

The vibrant educational atmosphere, for which foundations were laid by Professor N.P. Gandhi, can be felt at the Department even today. My salutations to that revered Pioneer.

2. My Researches

I joined the Department in August 1977, the research group of Professor T.R. Anantharaman who pioneered rapid solidification studies in India soon after its discovery at Caltech by Professor Pol Duwez, for my Ph.D. under the joint supervision of Professors C. Suryanarayana and P. Ramachandra Rao. I began my work on rapidly solidified Al-Pd and Al-Cu alloys during which time I was offered Faculty position as Lecturer. Soon after completion of my Ph.D., I started working on Quasicrystals and later on High Tc superconductors during my postdoc as Alexander von Humboldt Fellow at Universität Göttingen in the group led by Professor H C Freyhardt, which I continued in the subsequent years after return. My excursion into the new area of Carbon Nano Tubes was during a short visit to Rennselaer Polytechnic Institute to work with the research group of Professor P.M. Ajayan on Infosys Foundation Fellowship. In pursuit of the basic theme of my research on microstructural refinement and synthesis of metastable phases, I diversified and continued in the area of severe plastic deformation with an ambition to develop industrially applicable technologies.

2.1 Rapidly solidified Al-Pd and Al-Cu alloys

Metastable phases produced by rapid solidification of metallic melts (at rates exceeding about 10^5 K s^{-1}) had been hitherto characterised by optical, conventional electron microscopy, x-ray and electron diffraction techniques in the Department. I resolved some of the structures of intermediate phases in Al-Pd and Al-Cu alloys by high resolution electron microscopy, those of Al_3Pd and Al_4Pd in particular. Considerable confusion existed in literature with respect to the crystal structures of intermediate

phases in the Al-rich end of the Al-Pd phase diagram. Many metastable phases and some stable intermediate phases with structures different from those reported in the phase diagram could be identified through extensive electron diffraction experiments [01]. A modification to the existing phase diagram was suggested on the basis of these experiments. However, the real structure of Al_4Pd phase still intrigued me till the end of my thesis [02].

Another noteworthy observation of this work was the occurrence of vacancy ordered phases in rapidly solidified Al-Cu and vapor quenched Al-Pd alloys [07]. Till then, vacancy ordered τ phases were only observed in ternary Al-Cu-Ni alloys by Lu and Chang [1957]. These phases get stabilised at compositions that form a Fibonacci series (i.e. τ_3 , τ_5 ...) representing the number of vacancy layers in the structure. A special feature of observation was the predominant occurrence of τ_{13} phase which is later understood as a rational approximant to the 1-D quasicrystal. The low vacancy-solute binding energy of copper in the case of Al-Cu was contemplated to be responsible for their occurrence in melt-quenched condition, while the high binding energy in the case of Pd required quenching from vapor state in the case of Al-Pd alloys.

2.2 Quasicrystals

Following the discovery of Quasicrystals by D. Schechtman et al. in rapidly quenched Al-Mn alloys in 1984, the patterns could be reinterpreted as arising from an Al_4Pd phase that is decagonal in its structure typified by quasiperiodic order in two dimensions and periodic arrangement of these planes in the third dimension. The striated contrast, variable fringe spacing in lattice resolution images and the new ordered phase got reinterpreted as features of quasicrystals.

At the time of discovery, reasons for the occurrence of quasicrystalline phase in Al-Mn were not known, nor even regarding their stability. We proposed that Frank-Kasper phases with icosahedral symmetry packings in their structure are best candidate materials for exploration. We verified this first in the case of $\text{Mg}_{32}(\text{Al}, \text{Zn})_{49}$ [03, 04] and, our later works verified the same in many other Frank-Kasper phases by rapid solidification of the alloys [05]. Additional special feature of the $\text{Mg}_{32}(\text{Al}, \text{Zn})_{49}$ is the absence of any transition metal in its constitution. Until then it was believed that icosahedral phases get stabilized in alloy systems containing transition metals. Puzzled by the nodular appearance of the microstructure and the sectorial divisions within them, we examined the possibility of generating a Penrose tiling starting from a single rhomb [08]. Penrose tiling is considered to be a 'template' for the growth of a quasicrystal. An algorithm was developed which is capable of generating a Penrose tiling around a point at the centre.

2.3 Solid-state Amorphisation and High Tc Superconductors

Nb-Co alloys were of interest for the group at Göttingen as they were developing Nb₃Sn superconductors. When rapidly solidified onto hot substrates or annealed at 870K, the Nb-Co solid solution (with less than 25at.% Co) decomposes into cobalt-rich glassy phase and Co-lean solid solution by solid state amorphisation [09]. Interest shifted to YBaCuO superconductor soon after its discovery owing to the attractive high T_c value (above liquid nitrogen temperature) of the latter. The structure of the compound and its twin domains responsible for the superconductivity was understood by high resolution electron microscopy. There are two Cu sites in the structure: (i) in the plane (Cu(II)) and, (ii) in copper-oxygen chains (Cu(I)). To know which site is responsible for superconductivity, effect of various substituent ions for the Cu(I)-site (Fe and Ni) were studied. Once again high resolution electron microscopy of the twin domains revealed that the domain size progressively decreased with increase of Fe substituent concentration and the T_c decrease consequently. Ni-substituent in small concentrations had no effect on the domain structure [10]. The reason for such behaviour was attributed to a concomitant change in crystal structure from orthorhombic (of the superconducting compound) to tetragonal semiconducting structure. I rapidly solidified the oxide superconductor [11] that was melted by an Excimer laser using a specially designed apparatus to produce thin films of the superconductor.

2.4 Excursions into the nano world

Fullerenes and High T_c Superconductors were discovered within a gap of two years. Extended work on Fullerenes further led to carbon nanotubes and eventually to graphene. Aligned Multiwalled Carbon Nano Tubes (MWCNTs) and Single Walled Carbon Nano Tubes (SWNTs) were

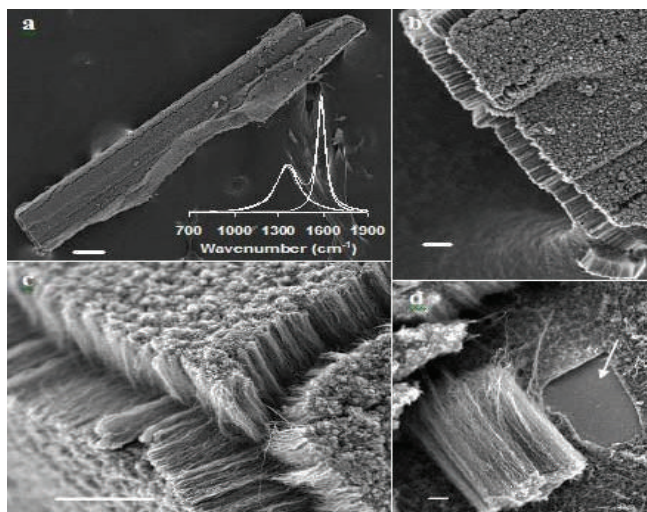


Figure 1: MWCNTs on decarods

of immense interest owing to their potential applications in electronic industry. The researchers at RPI developed several techniques for growing CNTs on oxide substrates. Iron precursors and oxide substrates were deemed to be essential at that time for their growth. With my knowledge of catalytic behaviour of Ni-containing quasicrystals, I had shown that well-aligned MWCNTs can be grown using decagonal quasicrystals (Figure 1) in 2003. Subsequently, different types of quasicrystalline substrates such as icosahedral Mg₃₂(Al, Zn)₄₉, (Al,Ga)₇₀Pd₂₀Mn₁₀ thin films were used to explore further possibilities [12].

2.5 Nano or ultrafine-grained structures in bulk materials

We studied one of the severe plastic deformation techniques, viz. Equal Channel Angular Pressing (ECAP) extensively to meet our end-goal of producing bulk materials that are strengthened by grain refinement to nano or ultra-fine size range. Process parameters and die designs had been optimised to select route Bc, die inner and outer angles ($\Psi = 60^\circ$ and $\Phi = 120^\circ$) [13] (Figure 2). ECAP is effective in refining grain size by three to four orders, but with a greater loss in ductility (Figure 3). The microstructure can though be stabilised by annealing up to 573 K (for Al), the tensile ductility remains very low [14][15].

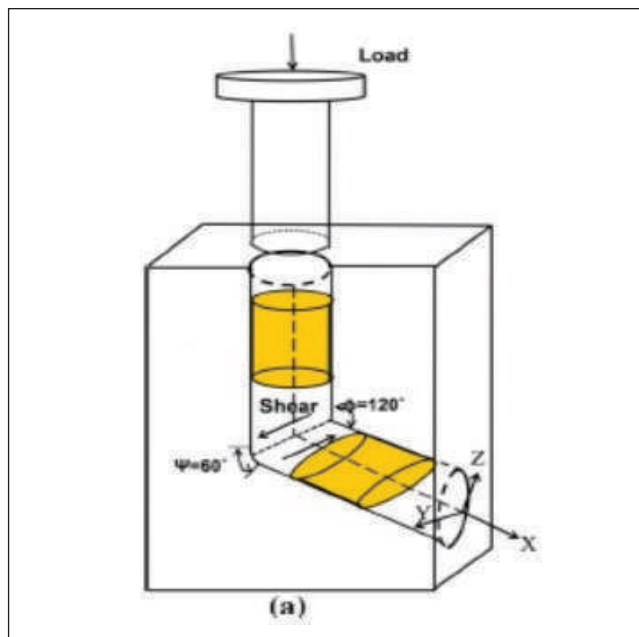


Figure 2 : ECAP Die

In another attempt, post-ECAP processing of the billets by Cryorolling was found to be effective in refining the microstructure to a few tens of nanometers. Flash annealing of the cryo-rolled samples resulted in the formation of bimodal distribution of grain sizes due to secondary recrystallization (SR) (Figure 5) (Large grains of size 4.5 μm) [16].

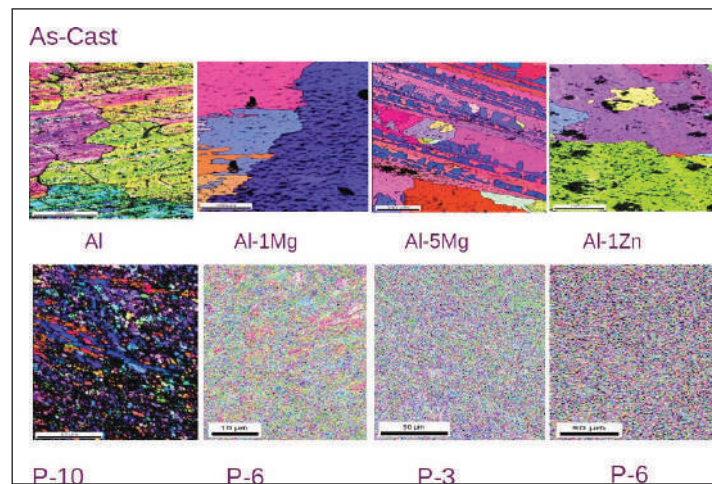


Figure 3 : ECAPed Al Alloys

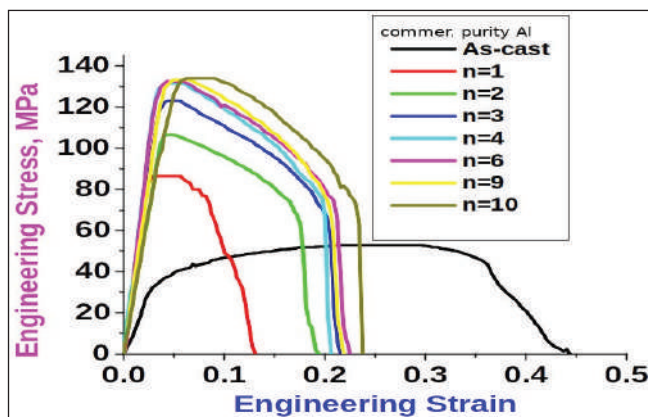


Figure 4 : The tensile curves

Electropulsing (EP), which consists of application of a high density electric current pulse on metals has recently gained importance with its promise of refining the microstructure in bulk. Prior deformation of the sample can accelerate grain modification during EP. We studied severe plastic deformation (SPD) of a low carbon steel using equal channel angular pressing (ECAP) route to generate a high dislocation density. ECAP of Low carbon steel up to $s_{vm} = 6$ was subjected to EP at ambient temperature for 1 pulse and 5 pulses. The current density



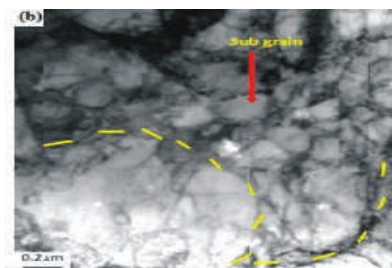
Figure 5: Secondary recrystallisation

was 14 kA/mm^2 for a time period of $358 \mu\text{s}$ (Figure 6(a)).

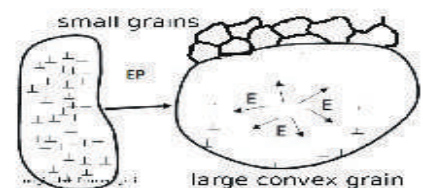
EBSD and TEM studies confirmed that some high angle grain boundaries produced during ECAP were converted into low angle grain boundaries with an increase in the average grain size. TEM results also confirm that there is a migration of grain boundaries and rearrangement of dislocations, that were produced during ECAP process, to form low angle grains. Final grain size distribution obtained was of bimodal type having ultrafine-level small grains and about $20 \mu\text{m}$ size bigger grains (Figure 6(b)).



(a) Electropulsing Unit



(b) Large grains with convex boundaries



(c) The model

Figure 6

From the profile of the (110) peak of the X-ray diffractogram, it was confirmed that as crystallite size increases, the strain and dislocation density decrease after EP treatment. The decrease in strain and dislocation density is also reflected in decrease in the measured hardness values. Electropulsing is found to be more effective, in a low carbon steel, in achieving a bimodal distribution of grain sizes required for regaining ductility (refinement to 1000nm). No secondary recrystallization is involved in this process and thus, formation of unstable boundaries of SR (owing to their negative curvature) can be eliminated. High velocity electrons (or electron wind force) exert force on certain grain boundaries through which they can't get easy free path. As a result, they bring a change in the microstructure. A mechanism is proposed (Figure 6(c)) to explain the resulting microstructure [17].

3. Concluding Remarks

Department of Metallurgical Engineering, founded by Professor N.P.Gandhi in the year 1923, became a fountainhead of many discoveries over the years, and my researches form only a small portion of them. It is like mother nature which gives the same air, water and earth to all, but the texture differs from place to place. It is, therefore, likened to Nature.

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Higher Education and Research Institutions / Universities in India : Leaders or Laggards?



M K Surappa

Vice-Chancellor, Anna University, Chennai & Honorary Professor, Indian Institute of Science, Bangalore, Former Director, Indian Institute of Technology, Ropar

Dr. Kamachi Mudali President of IIM, Member of Council of IIM, Fellow Members of my Metallurgical fraternity, distinguished invitees, budding metallurgists from various institutions, Ladies and Gentlemen, I am delighted to be here to deliver Daya Swarup Memorial Lecture. I am grateful to the Council of Indian Institute of Metals for having chosen me to deliver the lecture named after an eminent Metallurgist, Educationist and Leader in Research and Education of our nation. On an occasion like this it is perhaps appropriate to recollect some of his great contributions and attributes for the benefit of post-independence generation and also introspect on the manner in which we are shaping our future educationalist and researchers in metallurgy and materials. In addition to reading about Prof. Daya Swarup from the note I received from Prof. N.K. Mukopadhyaya, I also received inputs from Mr. Ajay Rastogi son of Dr. Daya Swarup and from my mentor and Ph.D. supervisor Prof. P.K. Rohatgi.

After receiving his Ph.D in metallurgy from Sheffield University in 1936, he returned to BHU and devoted his entire life giving shape to India's only school of mining and metallurgy in the pre-independence era. He recruited best faculty from all over India and even got experts from other countries to teach at BHU. He believed that a sound mind requires sound body. He would come to student hostels in the evening and take all students to college playground for playing sports. He himself played Tennis with students, despite his responsibilities as a Principal of the College of Mining and Metallurgy. He used to lecture students on non-ferrous metallurgy, especially on aluminum, his favourite metal. He was very disciplined and punctual person and a great host.

Metallurgy in India

It is heartening to note that India has made big strides in scaling up production of many materials including Steel, Aluminum and other materials. India is now number 2 in producing steel (106.5 million of steel) and Aluminium 3.7 million tones. However, India does not figure in Innovation in Metallurgical Technologies, despite excellent Schools for Metallurgical Education and

Research exist in Country. For example, in the Time Line of Casting Technology for the period from 500 BC to the end of 20th Century published by American Foundrymen's Society, India is credited only for one Innovation that is for producing crucible steel some time in 500 A.D. Only other Innovation listed with Indian Metallurgist is for producing cast metal matrix composites at International Nickel Co. in USA. He is Dr. Pradeep Rohatgi and happened in the year 1965. We need to accept the hard facts that with all our boasting of repository of ancient knowledge in metallurgy and metallurgical knowledge, we have not innovated novel materials / products / processes to be labelled as Indian Innovation at global level. Having talked about India's Innovation in Metallurgy, I will soon also talk about India's rank in Materials Research during last 6-7 decades.

Following the work of Dr. Rohatgi at INC, major programme on cast metal matrix composites was initiated at IISc, Bangalore by the speaker as Ph.D student of Prof. P. K. Rohatgi. As a part of Doctoral thesis stir-cast process was developed to produce cast Aluminium – Ceramic particle composites using uncoated but thermally treated ceramic particles. This process was later modified by ALCAN and patented. ALCAN graciously acknowledged author's publication based on his Ph.D Thesis as 1st reference in their patent application. First brake rotors / drums were produced from cast Aluminium Matrix Composites by stir-casting process for Lotus Elise. Several automobile companies are currently using these cast Aluminium Material Matrix Composite brake rotors.

History of Metal Casting

Metal Technologies has compiled a brief timeline of metal casting to give you an overview of the long and proud history of our industry. Since its discovery, metal casting has played a critical role in the development and advancement of human cultures and civilization. After 5000 years of technological advances, metal casting plays a greater part in our everyday lives and is more essential than it has ever been.

Origins of Metal Casting

- 3200 B.C. A copper frog, the oldest known casting in existence, is cast in Mesopotamia.
- 2000 B.C. Iron is discovered.
- 800-700 B.C. First Chinese production of cast iron.
- 645 B.C. Earliest known sand molding (Chinese).
- 233 B.C. Cast iron plowshares are poured in China.
- 500 A.D. Cast crucible steel is first produced in India, but the process is lost until 1750 when Benjamin Huntsman reinvents it in England.

Middle Ages to 1800

- 1455 Dillenburg Castle in Germany is the first to use cast iron pipe to transport water.
- 1480 Birth of Vannoccio Biringuccio (1480-1539), the "father of the foundry industry," in Italy. He is the first man to document the foundry process in writing.
- 1642 Saugus Iron Works, America's first iron foundry (and second industrial plant), is established near Lynn, Massachusetts. The first American iron casting, the Saugus pot, is poured there.
- 1709 Englishman Abraham Darby creates the first true foundry flask for sand and loam molding.
- 1720 Rene Antoine de Reaumur develops the first malleable iron, known today as "European Whiteheart."
- 1730 Abraham Darby is the first to use coke as fuel in his melting furnace in Coalbrookdale, England.
- 1750 Benjamin Huntsman reinvents the process of cast crucible steel in England. This process is the first, in which the steel is completely melted, producing a uniform composition within the melt. Since the metal is completely molten, it also allows for alloy steel production, as the additional elements in the alloy can be added to the crucible during melting. Prior steel production was accomplished by a combination of forging and tempering, and the metal never reached a molten state.
- 1776 Foundrymen Charles Carroll, James Smith, George Taylor, James Wilson, George Ross, Philip Livingston and Stephen Hopkins sign the American Declaration of Independence.
- 1794 First use of the Cupola in iron founding. Invented by John Wilkinson of England, the original had metal-cladding and utilized a steam engine to provide the air blast.

The 19th Century

- 1809 Centrifugal casting is developed by A. G. Eckhardt of Soho, England.
- 1815 The cupola is introduced in the United States in Baltimore, MD.
- 1818 First cast steel produced by the crucible process in the U.S. at the Valley Forge Foundry.
- 1825 Aluminum, the most common metal in the earth's crust, is isolated.
- 1826 Seth Boyden of Newark, NJ, is the first to develop a process for and produce "blackheart" malleable iron.
- 1831 In Cincinnati, OH, William Garrard establishes the first commercial crucible steel operation in the U.S.
- 1837 First dependable molding machine is marketed and used by the S. Jarvis Adams Company in Pittsburgh.
- 1845 The open hearth furnace is developed.
- 1851 Sir Henry Bessemer and William Kelly both invent a simple converter that uses blasts of air to burn out the impurities, silicon, manganese and excess carbon in pig iron.
- Although Kelly is the first to use a converter, Bessemer obtains the U.S. patents. Kelly proves patent priority in 1857.
- 1863 Metallography, the etching, polishing, and microscopic evaluation of metal surfaces, is developed by Henry C. Sarby of Sheffield, England. It is the first process to physically examine the surface of castings for quality analysis.
- 1867 James Nasmyth develops a gear-tilted foundry ladle, increasing worker safety and operational economy.
- 1870 Sandblasting is first used to clean large castings by R. E. Tilghman of Philadelphia.
- 1880-1887 The Sly tumbling mill is developed. It is the first cleaning machine for small castings. This mill greatly reduced the time needed for hand-cleaning operations and produced a finer finished product.
- 1896 American Foundrymen's Association (renamed American Foundrymen's Society in 1948 and now called the American Foundry Society) is formed.

1897 Investment casting is rediscovered by B.F. Philbrook of Iowa. He uses it to cast dental inlays.

Early 20th Century

1906 First electric arc furnace is used in the U.S. at Holcomb Steel Co. in Syracuse, NY.

1913 First true stainless steel melted by Harry Brearley in Sheffield, England.

1913 Crucible Steel Casting Co.'s Lansdown, PA plant installs the first low-frequency electric furnace for special melting.

1923 Formation of the International Committee of Foundry Technical Associations in Zurich, Switzerland.

1924 Dr. W.H. Hatfield invents 18/8 stainless steel (18% chromium, 8% nickel).

1930s University of Michigan professors pioneer Spectrography for metal analysis.

1930 First high-frequency coreless electric induction furnace in the U.S. is installed in the Lebanon Steel Foundry in Lebanon, PA.

1940 Wood flour is introduced into foundry practice as a sand additive.

1947 The Shell Process, invented by J. Croning of Germany during WWII, is discovered by U.S. officials and made public.

1948 Development of ductile iron, a cast iron with a fully spheroidal graphite structure.

1949 U.S. patent granted to K.D. Millis, A.P. Gagnebin and N.B. Pilling of International Nickel Company for developing ductile iron.

1953 The Hotbox system of making and curing cores in one operation is developed, eliminating the need for dielectric drying ovens.

1958 H.F. Shroyer is granted a patent for the full mold process, the forerunner of the expendable pattern (lost foam) casting process.

1960s Compactibility and methylene blue clay tests are developed for green sand control. Also developed at this time are high-pressure molding processes and fast-setting no bake binders for sand.

1964 The first Disamatic molding machine is introduced.

1965 The Scanning Electron Microscope is invented by the Cambridge University Engineering Department in England.

1965 Cast metal matrix composites are first poured at International Nickel Company in Sterling Forest, NY, by Pradeep Rohatgi.

1968 The Cold Box Process is introduced by L. Toriello and J. Robins for high production core making.

Late 20th Century

Early 1970s The Semi-Solid Metalworking (SSM) process is conceived at Massachusetts Institute of Technology. It combines aspects of casting with aspects of forging.

1971 The Japanese develop V-Process molding. This method uses unbonded sand and a vacuum.

1971 Rheocasting is developed at Massachusetts Institute of Technology.

1971 U.S. Congress passes the Clean Air Act and OSHA, the Occupational Health and Safety Act.

1972 The first Austempered Ductile Iron (ADI) component is produced by Wagner Castings Company.

1974 Fiat introduces the in-mold process for ductile iron treatment.

1976 Compacted graphite iron (CGI), an iron with elongated graphite particles with rounded edges and roughened surfaces, is developed in the U.K. It has characteristics of both gray and ductile iron.

1982 The Warm Box binder system is introduced.

1993 First foundry application of a plasma ladle refiner (melting and refining in one vessel) occurs at Maynard Steel Casting Company in Milwaukee, WI.

1995 Babcock and Wilcox, Barberton, OH, patent a lost foam vacuum casting process to produce stainless steel castings with low carbon content.

1996 Cast metal matrix composites are first used in a production model automobile in the brake rotors for the Lotus Elise.

1997 Electromagnetic casting processes developed by Argonne and Inland Steel Corporation. Electromagnetic edge containment greatly reduces cost and energy expenditures in steel production.

I will now speak about the current status of our Institutes of Higher Education and Research in India with full of facts and verifiable data, to judge yourself, if we are leaders or laggards.

Several persons have been often expressing deep concerns on the fact that none of our institutions in India are figuring within 100 top ranked institutions. Our policy makers appear to think by merely infusing massive funds, few selected institutions could be catapulted into world class in next ten years. However, I am of the opinion there is imperative need for significant change in the governance of our higher Educational Institutions, change in the mind set of all our stake holders and very rigorous review processes are put in place to evaluate the outcomes of several of new programmes / initiatives of various ministries. Unless these changes are ushered without dilution or compromise, we are very unlikely to find our Institutions within one hundred ranks. I will provide facts and my analysed reasons which I consider as realistic and appeal to all of you ponder on this.

Increased access to higher education has provided opportunity to all sections of society, particularly young men and women from the under privileged sections. It is with great pride and joy we notice large number of children of poor and oppressed families could rise in the social ladder due to enhanced access to colleges and universities for talented students. Overall trained and talented educated workforce have contributed significantly to Indian economic growth. However, we also witness large number of our technical and non-technical graduates either unemployed or underemployed. Very often thought leaders attribute this to reckless expansion of higher education with less regard to quality.

I will share my insights why none of our institutions is unable to come within one hundred ranks amongst world class institutions. These insights are based on my own long experience that I have gained in my previous positions at IISc, IIT Ropar and also at Karnataka State Council for Science and Technology and in my current position as Vice Chancellor of Anna University. I will also narrate how, I overcame barriers for attaining research excellence and the measures I took for governance excellence at my previous position. My narration will be supported by incontrovertible data and published reports. I will also briefly talk on reasons inhibiting our institutions from attaining world class and not becoming sufficiently impactful despite all the resources made available to some of these institutions including bright, talented and highly motivated students / faculty. I will dwell upon required attributes for leadership and the pathway for institution to attain world class. Intensity of political and bureaucratic meddling in the affairs of institutions is an issue which in generally speakers and academicians still in service either feel shy or scared from disclosing and admitting in public for various reasons including having an attitude of nothing will change. I will share some of my experience

that I had with them and changes I brought in. I will also cite how parocholism and majoritarianism taking our institutions down despite excellent resources and talent are made available in those institutions. We have a large tendency to sweep these under the carpet, although in private we whisper and confide within our closed circle outside the meeting hall during coffee brakes / drinks. Absence of due diligence, rigorous review system and utter disregard for conflict of interest are other factors contributing to sliding of our institutions.

Blind loyalty to Ph.D supervisors and to our early mentors is another reason. Pre-arrived decisions based on perception of close friends / networks often behind closed doors rather than through examination of hard facts and data have been dominating in decision making processes.

Currently in India there are nearly 90 Universities imparting Technical Education across many disciplines. Of these 90, more than 30 are exclusively devoted to Technical Education with a label of Technical Universities. Decade earlier, 370 Universities were in existence and their numbers have swelled to nearly 850. In addition, currently there are nearly one hundred institutions of national importance wholly funded by the Government of India. All these well-meaning and positive measures in enhancing the access to higher education in the last one decade has resulted in almost doubling the GER from nearly 13% to 26% as of now.

In addition to expanding access to higher education, MHRD, Department of Science and Technology have taken slew of measures / schemes to promote quality of research publications by way of increasing both the number and value of Ph.D fellowships. Further, in the last ten years funding agencies such as DST, DBT and other departments have introduced many schemes such as INSPIRE, Swarna Jayanthi and J.C.Bose Fellowships and many other to provide monetary incentive and also attractive research grants to faculty and students. This has been done with aim to improve the quality and excellence of research. However it is to be noted that these Fellowships are being availed mostly by faculty and researchers of centrally funded institutions such as IITs/ IISc/CSIR Laboratories. In contrast State Universities' share of these attractive, competitive and prestigious fellowships are very meagre.

Further to improve the leadership capabilities of our senior academic / researchers, NIAS Bangalore has been conducting short term residential programmes with large support from DST for more than 15 years. Recently MHRD also has embarked similar program for senior administrators of our Universities by way of 2-3 week residential programme, partly in India and partly in abroad.

Now, with all the measures our Government has taken to improve access to higher education and improve the research performance of our institutions (both quantity and quality) and to enhance capabilities of leaders managing and governing our Universities, Institutions, National Laboratories, where we are now compared to where we

were previously. How all these proactive measures/ programmes have been effective in enhancing quality of higher education and research in our Institutions in India. Let us examine where are institutions which were at the same standing or far below of other current world class institutions decade earlier. Let us examine all these through the support of PPTs.

**Research performance of India, USA and China based on number of publications and citations
(Web of Science and incites) during 1980 – 2018**

Country	Total No. of Publications	Rank	Total No. of citations	Rank
India	1336888	12	12481459	15
USA	17607329	1	372992056	12
China	4120965	3	36923644	8

2016-2017

Country	Total No. of Publications	Rank
India	216755	8
USA	1424874	1
China	858294	2

**QS Ranking of selected Institutions in the subject of
Developmental Studies in the year 2019**

- University of Cape Town : 9
- University of Witwatersrand : 18
- University of Delhi : 37

Times Ranking of Institutions based on Citation data

World Ranking	Institution	No. of Publication in Engineering or in EE	Total number of citations	H-Index	Average no. of citations/ paper
1	Cal Tech, USA	4000	131925	145	32.98
4	Stanford (EE and Electronics), USA	6162	218237	190	35.42
5	MIT (EE), USA	6277	215848	193	34.39
7	University of Cambridge, UK	2854	52399	90	18.36
23	Tokyo University (EE) Japan	4138	47912	80	11.58
26	National University of Singapore (EE)	5299	65843	90	12.43
251-300	IISc. Bangalore	9976	81083	87	8.13
301-350	IIT Bombay	6286	39908	63	6.35
351-400	IIT Kanpur	7916	74145	80	9.37
351-400	IIT Kharagpur	8708	60642	73	6.96
351-400	IIT Delhi	7875	58418	75	7.42

India's ranking in Materials Research World Ranking of Universities by Times Higher Education for 2012

Institute	Papers	Rank	Institute	Citations	Rank	Institute	Impact	Rank
Chinese Academy of Sciences	14,019	1	Chinese Academy of Sciences	104,104	1	University of Washington	30.41	24
Russian Academy of Sciences	6,760	2	Max Planck Society	56,720	2	University of California Santa Barbara	27.41	35
Tohoku University	5,511	3	Tohoku University	45,135	3	University of California, Berkeley	26.58	9
Tsinghua University	5,128	4	NIMS, Japan	35,575	4	University of Groningen	25.07	80
Indian Institutes of Technology	4,522	5	MIT, USA	35,329	5	Harvard University	24.45	4
Harbin Institute of Technology	4,059	6	AIST, Japan	33,668	6	MIT, USA	21.61	5
AIST, Japan	4,052	7	University of California, Berkeley	33,450	7	University of Southern California	21.11	56
NIMS, Japan	3,952	8	National University of Singapore	31,740	8	University of California Los Angeles	19.23	13
Osaka University	3,618	9	Tsinghua University	31,098	9	Stanford University	18.34	2
Central South University	3,454	10	University of Cambridge	27,909	10	University of Minnesota	17.35	47
Shanghai Jiao Tong University	3,380	11	CSIC, Spain	27,285	11	Max Planck Society, Germany	17.31	NA
Max Planck Society	3,277	12	Georgia Institute of Technology	27,201	12	Georgia Institute of Technology	17.02	25
CSIC, Spain	3,191	13	Osaka University	26,217	13	Northwestern University, USA	16.39	19
University of Science and Technology, Beijing	3,065	14	Seoul National University	25,565	14	Cornell University	16.06	18
University of Tokyo	2,962	15	CNRS, France	25,132	15	University of Michigan	15.70	20
CNRS, France	2,953	16	University of California Santa Barbara	24,343	16	University of Massachusetts	15.62	72
Jhejuang University	2,721	17	University of Washington	24,240	17	Drexel University	15.53	226
Seoul National University	2,560	18	Pennsylvania State of University	24,066	18	Eindhoven University of Technology	15.29	114
Kyoto University	2,541	19	University of Tokyo	24,060	19	University Pierre and Marie Curie	14.96	81
Tokyo Institute of Technology	2,520	20	Indian Institutes of Technology	22,297	20	Rensselaer Polytechnic Institute	14.71	174
						Chinese Academy of Sciences	7.42	?
						Indian Institutes of Technology	4.93	?

What ails our Higher Educational Institutions

- Research Excellence
- Governance Excellence
- Political and Bureaucratic interferences
- Decisions made at Secretariat with the help of silent Academicians and without rigorous discussions.
- Tendency to perpetuate friendship at the cost of Institutions / Nation's interest in Committee deliberations.

Leadership deficits

1. Fear of not getting second term in the leadership position
2. Fear of possible removal from the membership of existing committees
3. High degree of insecurity
4. Inability to stand up to political and bureaucratic pressures and interferences.
5. Excessive personal loyalty over institutions.

Issues in Indian Universities

1. Students Admission
2. Examination System
 - (a) Question paper
 - (b) Evaluation
 - (c) Internal assessment
3. Faculty recruitment and promotion
4. Equipment Purchase
5. Abuse and misuse of project funds and tax payers' money

EDITORS

Dr Manojit Dutta
Prof J Dutta Majumdar
Dr R Sandhya
Dr R Raghavendra Bhat
Dr N Eswara Prasad
Prof Sudhanshu Shekhar Singh
Dr Mithun Palit

CORRESPONDENTS

Sri S K Basu (Kolkata)
Dr Chiradeep Ghosh (Jamshedpur)
Sri Rishabh Shukla (Pune)
Sri N K Kakkar (Delhi)
Sri M N V Viswanath (Hyderabad)

57th National Metallurgists' Day (Under the Aegis of Ministry of Steel, Government of India) and the 73rd Annual Technical Meeting of the Indian Institute of Metals was organized successfully in a grand manner by the IIM Trivandrum Chapter in association with IIM Kalpakkam, IIM Chennai, IIM Trichy and IIM Coimbatore Chapters during 13-16 November, 2019 at Hotel Samudra, Kerala Tourism Development Corporation (KTDC) & Hotel Uday Samudra, Kovalam, Thiruvananthapuram. Over 750 Registered delegates including VIPs, Guests and Keynote speakers participated in the mega event over the four days at God's own country, Kerala.

The International Symposium on “Advanced Materials for Industrial and Societal Applications” was organized on 13th November 2019 at Vizinjam Hall, Hotel Uday Samudra, Kovalam. **Dr. PV Venkitakrishnan, Chairman, Core Organising Committee** welcomed the gathering. **Dr. R. Divakar, Chairman, International Symposium** presented the details of the Symposium. **Dr. U. Kamachi Mudali, President, IIM** delivered the Presidential address. The symposium was inaugurated by **Dr. Srikumar Banerjee, Chancellor, Homi Bhabha National Institute, DAE and Former, Secretary, DAE**. Dr. Banerjee also delivered the **Plenary talk** on the occasion. Vote of thanks on the occasion was proposed by **Dr. P. Ramesh Narayanan, Convener, NMD ATM 2019**. 14 eminent personalities from various important fields related to the two themes of Industry and Society delivered Keynote lectures. It brought together experts from industry, R&D and academia to share their knowledge and experience, and projection for the future in the subject area.



Inauguration of International Symposium



Panel discussion chaired by Dr. Sanak Mishra, Former President, IIM

National Metallurgist's Day Awards Ceremony on 14th November was held at the Banquet Hall, Hotel Samudra, KTDC, Kovalam, Thiruvananthapuram. **Hon'ble Shri. Dharmendra Pradhan, Minister of Petroleum, Natural Gas and Steel, Govt. of India** inaugurated the NMD Awards Function as Chief Guest and distributed the NMD Awards. **Mr. Binoy Kumar, Secretary, Ministry of Steel, Govt. of India** was the Guest of Honour and offered felicitations on the occasion. **Mrs. Ruchika Chaudhry Govil, Joint Secretary, Ministry of Steel, Govt. of India** participated as Special Guest in the event. **Dr. Amol A. Gokhale, Vice President, IIM** welcomed the gathering. **Dr. U. Kamachi Mudali, President, IIM** addressed the gathering. **Dr. PV Venkitakrishnan, Chairman, Core Organising Committee, NMD 2019** proposed the vote of thanks. A souvenir containing messages from important personalities related to the event and advertisements from various companies and details of various programmes was released by the Hon. Minister during the occasion.



Hon'ble Minister Shri Dharmendra Pradhan addressing the gathering



Release of Souvenir



Mr. B Muthuraman receiving Lifetime Achievement Award



Dr. P V Venkitakrishnan receiving National Metallurgist (Industry) Award



Prof. Dipak Majumdar receiving National Metallurgist (Research & Academia) Award

Hon'ble Shri Dharmendra Pradhan, Minister of Petroleum, Natural gas and Steel, Government of India Distributed the Lifetime Achievement Award to Mr. B. Muthuraman, Former Vice Chairman, Tata Steel. He also gave away the National Metallurgist (Industry) award to Dr. P V Venkitakrishnan, Director, CBPO, ISRO HQ, Bangalore and the National Metallurgist (Research and Academia) award to Prof. Dipak Majumdar, Department of MSE, IIT Kanpur.

Prof. Debalay Chakrabarti, Dept of MME, IIT Karaghpur, Dr.Nurni Neelakanntan Viswanathan, Dept. of MMS, IIT Bombay received the Metallurgist of the Year Awards for

Ferrous Category. Dr. Rohit Kumar Gupta, Head, Foundary Technology, MME, VSSC, ISRO, Trivandrum bagged the Metallurgist of the Year Awards for Non-Ferrous Category. Dr. Phanikumar Gandham, Dept. of MME, IIT madras and Dr. Sivaprasad Seetharaman, Sr. Principal Scientist, CSIR-NML, Jamshedpur received it for the Metal Sciences category. Dr. Pinakpani Biswas, Principal Scientist, Tata Steel bagged it for the Environment category.

In the Young Metallurgist of the Year category, the award winners were Mr. Avik Mondal, Principal Researcher, Tata Steel for Ferrous, Dr. Prosenjit Das, Sr. Scientist CSIR-CMERI, Durgapur for Non-Ferrous and Prof. Chandra Sekhar Tiwary, Asst. Prof. Dept. of MME, IIT Karagpur for Metal Sciences. Certificate of Excellence was awarded to Dr. Ashok Kumar Arya, Ourstanding Scientist, Materials Group, BARC, Mumbai.



IIM-JRD Tata Award being conferred on Mr. SN Subrahmanyam, CEO and MD, L & T Ltd.



Hon'ble Minister Shri Dharmendra Pradhan inaugurating the Exhibition

IIM AWARDS Function on 14 November 2019 Evening

For the first time IIM Award functions were held in the serene environs of the Hotel Uday Samudra in the presence of all the delegates and family members in the evening. The initiative was very much appreciated by one and all. Dr. P. Ramesh Narayanan, Convener, NMD ATM 2019 welcomed the gathering on the momentous occasion. Dr. Amol A. Gokhale, Vice President, IIM addressed the gathering. Shri. Somnath Guha, Hon. Treasurer, IIM HQ read out the citations of the awards. Dr. U. Kamachi Mudali, President, IIM delivered the Presidential address and presented the IIM Awards to various winners. Mr. Kushal Saha, Secretary General, IIM HQ proposed the vote of thanks.



Dr. RN Patra receiving IIM Platinum Medal



Mr. Rajasekhar Pattanasetty receiving IIM Tata Gold Medal



Dr. G Madhusudhan Reddy receiving IIM GD Birla Gold Medal



Prof. Martin Stratmann receiving IIM Honorary Membership



Mr. Anand Sen receiving IIM Honorary Membership



Jamshedpur Chapter receiving Best Large Chapter Award



Trivandrum Chapter receiving Best Medium Chapter Award



Release of Special issue of Trans IIM



Release of the Book entitled "Light Weighting for Defence, Aerospace, and Transportation"

Annual Technical Meeting (ATM) on 15-16 November 2019



Dr.S Ramakrishnan inaugurating ATM



Prof. Liu, President ASM International

Inaugural function of the 73rd Annual Technical Meeting of the IIM was organized in Vizhinjam Hall of the Hotel Uday Samudra on 15th November morning. Dr. S Somanath, Director, VSSC and Co-Chairman, National Organising Committee welcomed the gathering. Dr. SVS Narayana Murty, Chairman, ATM Committee introduced the details of the ATM. Mr. TV Narendran, Vice President, IIM addressed the gathering. Dr. Amol A. Gokhale, Vice President, IIM introduced the Chief Guest, Dr.S.Ramakrishnan, Former Director, VSSC, who inaugurated the ATM and delivered a talk on overall materials development for launch vehicles of ISRO. Dr. P. Ramesh Narayanan, Convener, NMD ATM 2019 proposed the vote of thanks on the occasion.

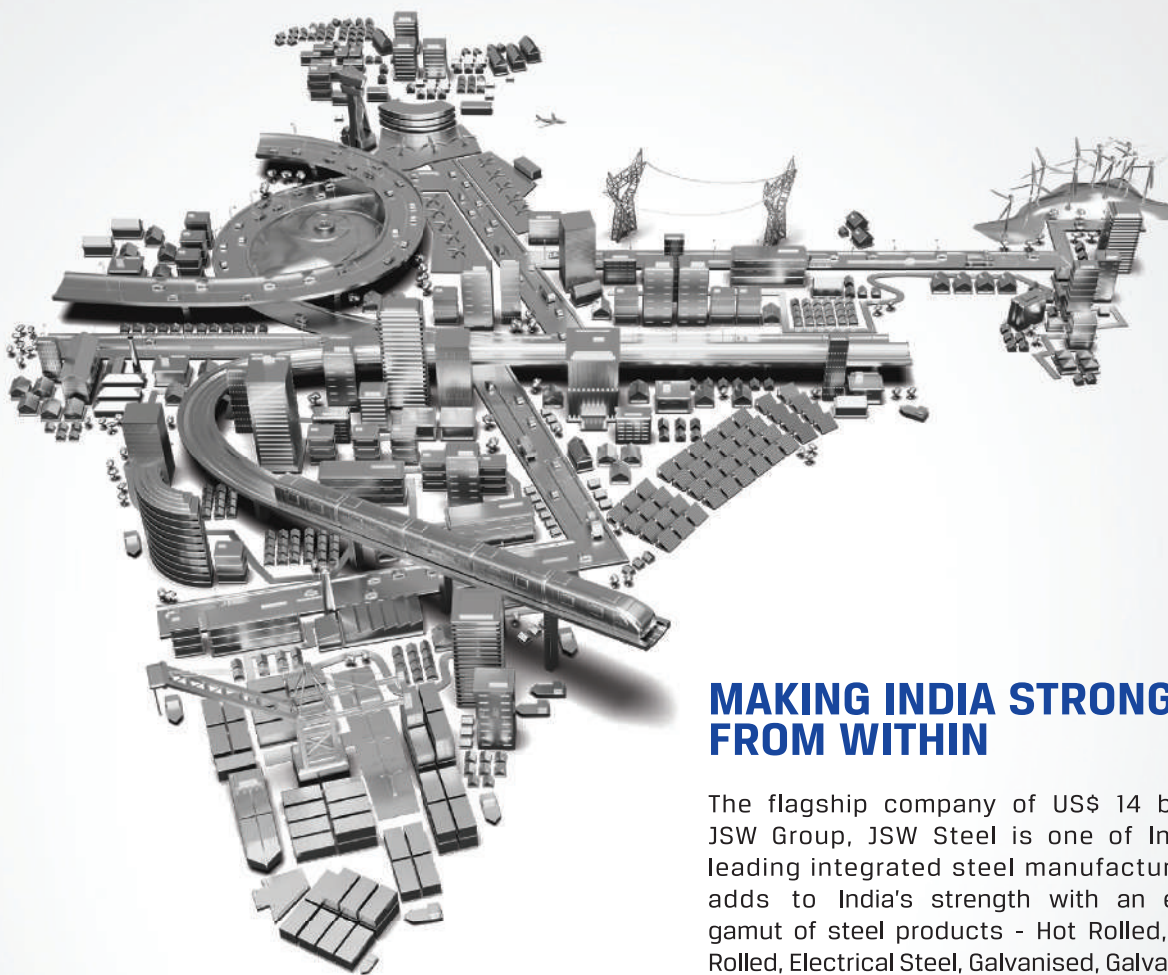
The ATM 2019 was structured around the following six broad themes, namely, Advances in Ferrous Metallurgy, Advances in Non-Ferrous Metallurgy, Advances in Materials Science and Engineering, Energy, Environment and Safety, Testing and Characterisation of Materials and Advanced Materials Processing and Manufacturing Techniques. 711 abstracts had been submitted online overall which includes 216 oral and 495 posters presented during the two days. 36 keynote speakers, both from abroad and India, have delivered in the six themes. A special session for students of Metallurgy and Materials Science from different Institutes across the country was arranged for the first time on 16th November wherein eminent professionals from the Metallurgical community like Dr. U. Kamachi Mudali, President, IIM, Prof.

Kamanio Chttopadhyay, Former President, IIM, Prof. Zi-Kui Liu of The Pennsylvania State University & President, ASM International and Dr. Amol Gokhale, Vice President, IIM motivated the students with inspiring address.

Poster Session and Metallography Contest were inaugurated by Prof. Kamanio Chttopadhyay, Former President, IIM on 15th November, 2019 at Hotel Samudra, Kovalam. Exclusive poster session with a lot of interaction between the presenters and the judges was the highlight of the technical events of the day. This was followed by a scintillating Gazal performance by Shri. Manu Thampy and theme based dinner to add to the atmosphere surrounding the pools at Hotel Uday Samudra in the evening.

Valedictory Function and ATM Awards Distribution on 16 November

The valedictory function and the ATM awards distribution function for the winners of the various categories of Poster, Oral and the Metallography Contest was held at the Vizhinjam Hall of Hotel Uday Samudra on 16th November 2019. Dr. P.V. Venkitakrishnan welcomed the gathering. Dr. P. Ramesh Narayanan, Convener, NMD ATM 2019 presented the overall summary of the NMD event. He highlighted the contributions of each and every committee which includes Technical, Printing, Transport and Accommodation, Catering, Hall Arrangement, Registration, Website and Publicity, Exhibition and Cultural etc. Dr. Amol A. Gokhale, Vice President, IIM and Dr. U. Kamachi Mudali, President, IIM addressed the gathering and gave away the certificates and prizes to the winners of the various categories of Poster, Oral and the Metallography Contest. The prestigious GS Tendulkar Prize for the overall best oral paper was bagged by Ms. Revathi Gorle, IIT Madras. Das Gupta Prize for Ferrous Category was won by Mr. Naveen kumar, JSQW Works, Salem and for the Non-Ferrous category by Mr. Ujjval Bansal, IISc, Bangalore. Dr.SVS Narayana Murty, Chairman, ATM Committee proposed the vote of thanks. The grand gala events of Technical and Cultural extravaganza came to an end with the National Anthem.



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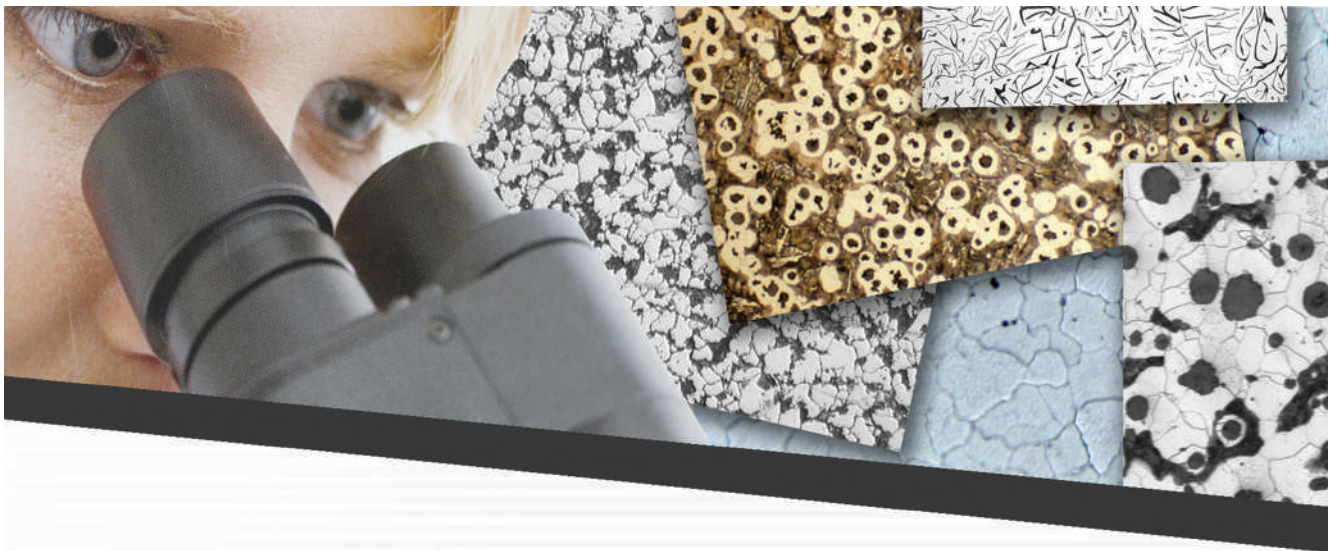
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NMD AWARDS 2019

LIFETIME ACHIEVEMENT



Mr. Muthuraman Balasubramanian, Former Vice Chairman and Managing Director, Tata Steel Limited and Former President, The Indian Institute of Metals, is awarded the **2019 “Lifetime Achievement” Award**.

Mr. Muthuraman had his early college education at the Madras Christian College, holds degrees in Bachelor of Technology in Metallurgical Engineering from IIT, Madras and a Masters of Business Administration from XLRI, Jamshedpur. He has also pursued the Advanced Management Programme at European Centre for Executive Development (CEDEP), France and has undergone the “Challenge of Leadership” Programme at INSEAD, France.

Mr. Muthuraman joined Tata Steel in 1966 and held various positions, including Vice President (Marketing & Sales) & Vice President (Cold Rolling Mill Projects). He was appointed as an Executive Director in 2000, Managing Director in 2001 and Non-Executive Vice Chairman in 2009. He held board positions in a large number of organisations. He was on the Board of International Iron & Steel Institute for several years and in its Executive Committee for 4 years. He served on the Board of Global Compact of the United Nations for 4 Years; on the Board of Bosch India Ltd. for 6 years; on the Boards of Tata Industries Ltd. He was the Chairman of the Board of Governors of IIT, Kharagpur; NIT, Jamshedpur and XLRI, Jamshedpur. He was Chairman of multiple Tata Steel Group entities like Nat Steel, Singapore; Tata Steel, Thailand; Tinplate Company of India Ltd; Dhamra Port Company Ltd.; Tata Sponge Ltd. and Tata Martrade International Logistics Ltd.

Mr. Muthuraman demonstrated innovative & visionary leadership throughout his career. He has been honoured with innumerable number of awards & accolades including the illustrious “Padma Bhushan” award in 2012. Amongst his diverse feathers in cap, an Honorary Degree of Doctor of Humane Letters, Honoris Causa from Loyola University, Chicago is worth mentioning. He has also been bestowed an Honorary Degree of Doctor of Science (Honoris Causa) from Indian Institute of Technology, Kharagpur.

NATIONAL METALLURGIST



Dr. Pazhayanoor Venkitachalam Venkitakrishnan, Former Director, LPRC, ISRO & presently Director, Capacity Building Program Office, ISRO Head Quarters, ISRO

is awarded the **2019 National Metallurgist Award for Industry**.

Dr. Venkitakrishnan has made astounding contributions for Indian space programme by way of indigenous development, realisation and application of super alloys, special alloys like Cu-Cr-Ti-Zr for cryogenic applications, National Capacity Building for indigenisation of spacegrade Aluminium alloys and Titanium alloys, complex-shaped investment castings in ferrous/non-ferrous alloys for cryogenic/semi-cryogenic engines and powder metallurgy products for performance-critical systems. His contributions have significant impact on National Space scenario and are fully carried out in India using existing infrastructure/ creating new ones.

NATIONAL METALLURGIST



Prof. Dipak Mazumdar, Professor, Dept. of Materials Science & Engineering, IIT Kanpur, is awarded the **2019 National Metallurgist Award for Research and Academia**.

Prof. Mazumdar has an illustrious teaching and research career in Metallurgical Engineering at IIT, Kanpur, spanning more than three decades (1987-2019). An outstanding Teacher (INAE, 2015) and a distinguished educator (IIM, 2014), he has made numerous original contributions to the science and technology of Steelmaking.

Over the past three decades, the Ministry of Steel (Govt. of India), the Indian National Academy of Engineering (INAE) and The Indian Institute of Metals (IIM) have recognised his outstanding contributions to steelmaking education and research, and bestowed collectively upon him several large research grants, numerous awards and two prestigious, Chair Professorship.

METALLURGIST OF THE YEAR



Prof. Debalay Chakrabarti, Professor, Department of Metallurgical & Materials Engineering, IIT Kharagpur has been selected to receive one of the **2019 ‘Metallurgist of the Year’ Award in Ferrous Category**.

Prof. Chakrabarti’s research at IIT Kharagpur has involved processing of different grades of steels, characterisation of microstructures, precipitates and crystallographic texture and establishing structure property relations. He has been supporting DMRL for developing naval grade steels with high strength ($YS \geq 790$ MPa) and sub-zero impact toughness (minimum 78J at -400C) and IGCAR, Kalpakkam for evolving a new grade of boron added

9Cr-Mo steel (for power plant) with high toughness and creep resistance.

METALLURGIST OF THE YEAR



Prof. Nurni Neelakantan Viswanathan, Professor, Department of Metallurgical Engineering and Materials Science, IIT, Bombay, has been selected to receive one of the **2019 ‘Metallurgist of the Year’ Award in**

Ferrous Category.

Dr. Viswanathan’s research contributions can be referred in the areas of modelling of metallurgical processes: specifically, modelling of blast furnace, pellet induration, BOF, ladle operations, and continuous casting among others. These have resulted in a large number of quality publications and a large number of PhD theses.

METALLURGIST OF THE YEAR



Dr. Rohit Kumar Gupta, Head, Foundry Technology Division, Materials and Mechanical Entity, Vikram Sarabhai Space Centre, ISRO, Thiruvananthapuram is recipient of one of the **2019 ‘Metallurgist of**

the Year’ Award in Non-Ferrous Category.

Dr. Gupta has made significant contributions in indigenous development, processing and characterization of various non-ferrous strategic alloys (Ti, Al, Co, Nb etc.) and components for space programme. Some of his significant innovative accomplishments include Titanium alloy Ti6Al-4V rolled rings for INSAT/GSAT satellite tanks and for PSLV propellant tanks; Ti6Al-4V hemispherical forgings for composite overwrapped pressure vessel (COPV) for INSAT/GSAT satellites; Titanium sponge processing into alloy products ; Cobalt based superalloy KC20WN for Liquid propellant engines.

METALLURGIST OF THE YEAR



Prof. Phanikumar Gandham, Professor, Department of Metallurgical and Materials Engineering, IIT, Madras has been selected to receive one of the **2019 ‘Metallurgist of the Year’ Award in Metal Science Category.**

Dr. Gandham has contributed to the understanding of microstructure evolution during materials processing, particularly involving solidification of under cooled melts. He has developed computer simulation codes for phase field simulations and used GPU computing to make large scale realistic 3D simulations possible. A combination of high-performance computation, analytical models and challenging experimentation has been used to bring integrated computational materials engineering approach to maturity and to design new alloys.

METALLURGIST OF THE YEAR



Dr. Sivaprasad Seetharaman, Senior Principal Scientist, Materials Evaluation Division, CSIR-National Metallurgical Laboratory, Jamshedpur has been selected

to receive one of the **2019 ‘Metallurgist of the Year’ Award in Metal Science Category.**

Dr. Seetharaman has made notable contributions in the area of Fatigue, Fracture and Structural Integrity, which include the development of a fast decreasing FCGR method to alleviate the time and specimen size constraints; development of a cyclic fracture procedure ; developing the concept of true strain controlled ratchetting fatigue methodology and cyclic plasticity models ; initiating multiaxial fatigue research and generation of extensive material information in this area. His performance in the areas of cross creep fracture, creep fatigue interaction in high temperature alloys have been recognised.

METALLURGIST OF THE YEAR



Dr. Pinakpani Biswas, Principal Scientist, Environment Research Group, Tata Steel Jamshedpur has been selected to receive one of the **2019 ‘Metallurgist of the Year’ Award in the Environment Category.**

Dr. Biswas has developed an innovative process for removal of total cyanide and other pollutants from coke plant wastewater. This is first of its kind and has been implemented at multiple locations in Tata Steel, as a pilot project. Currently it has been absorbed by Tata Steel BSL, and the full phased plant shall come up latest by 2020. His contributions on Environmental & Energy research, involving several computational techniques and continuous innovation with state-of-the-art technology are noteworthy.

YOUNG METALLURGIST OF THE YEAR



Mr. Avik Mondal, Principal Researcher, Research & Development, Tata Steel Ltd, Jamshedpur received the **2019 ‘Young Metallurgist of the Year’ Award in Ferrous Category.**

Mr. Mondal significantly contributed in improvement of galvanising process and product by developing galvanised coating having potential to reduce zinc consumption and suppressing selective oxidation of high strength steel. His endeavour in root cause analysis and elimination of severe surface defects on galvanized coating is praiseworthy.

YOUNG METALLURGIST OF THE YEAR



Dr. Prosenjit Das, Senior Scientist, CSIR-Central Mechanical Engineering Research Institute, Durgapur, received the **2019 ‘Young Metallurgist of the Year’ Awards in Non-Ferrous Category.**

Dr. Das contributed remarkably in the development of process technology of Rheo Pressure die casting (RPDC) and Rheo gravity die casting (RGDC) of Al alloys and Al matrix composites. He is associated with development of an automotive Knuckle housing (Mahindra, SUV) out of A356 Al alloy, as a prototype component. RGDC technique is used to develop prototype automobile brake

disc (Tata Indica) and connecting rod (two-wheeler) out of in-house developed novel Al-15Mg2Si-4.5Si composite.

YOUNG METALLURGIST OF THE YEAR



Prof. Chandra Sekhar Tiwary, Asst. Professor, Dept of Metallurgical and Materials Engineering, Indian Institute of Technology, Kharagpur, is the recipient of the **2019 'Young Metallurgist of the Year' Award in Metal**

Science Category.

Dr. Tiwary has developed steady stream of novel new metal (two dimensional gallium), alloys and different advanced materials (Hematene, rhenium disulfied alloy 2D TMD, etc.). His research include development of a new class of intermetallic Ni-Zr-Al alloy; (US-Patent no: 9,816,159). He also designed and developed a new cryomill (IP: 3091/CHE/2012) which can make free-standing nanoparticles

CERTIFICATE OF EXCELLENCE



Dr. Ashok Kumar Arya, Outstanding Scientist, Material processing & Corrosion Engineering Division, BARC, received **2019 'Certificate of Excellence'**.

Dr. Arya has made some rewarding contributions towards modelling and simulations of alloy phase stability & phase transformation behaviour and related thermodynamic and mechanical properties of several important alloy materials relevant to nuclear energy programme.

IIM AWARDS 2019

IIM-JRD TATA AWARD



IIM-JRD Tata Award for 'Excellence in Corporate Leadership in Metallurgical Industries' was presented to **Mr. S N Subrahmanyam**, Chief Executive Officer and Managing Director of L&T.

SNS, as he is popularly known in industry circles, took over the reins in July, 2017 having previously, in his capacity as Deputy Managing Director and President, L&T, headed the construction business of the group. He is on the Boards of LTI and L&T Technology Services, Non-Executive Chairman of L&T Metro Rail (Hyderabad) Limited and Vice Chairman of the recently acquired company, Mindtree.

IIM NATIONAL SUSTAINABILITY AWARDS : IRON & STEEL

The Ferrous Division of the Indian Institute of Metals has been organising the National Quality Competition since 1991 to encourage and recognize Quality Control aspects in the Steel Sector. The award has been re-named as National Sustainability Award from 2007.

The Awards for the year 2019 are presented to:

Category I : Integrated Steel Plants:

1st Prize : **Tata Steel Ltd., Jamshedpur**

2nd Prize : **JSW Steel Ltd., Bellary**

Category II : Secondary Steel/Alloy Steel Plants:

Winner : **JSW Steel Ltd, Salem Works, Salem**

IIM NON-FERROUS BEST PERFORMANCE AWARD

The Non-Ferrous Division of the Indian Institute of Metals has been organizing the National Quality Competition since 2002 to encourage and recognize Quality Control aspects in the Non-ferrous sector. The Awards for the year 2019 are presented to :

Category I: Large Integrated Production Organizations :

1st Prize : **HINDALCO Industries, Mahan Aluminium**

2nd Prize : **NALCO, Angul**

Category II : Secondary Processing / Fabrication Plants of Non-Ferrous Products

Winner : **HINDALCO Industries, Hirakud, FRP**

Category III : Units engaged in Casting and Forging of Non- Ferrous Metals & Alloys :

Winner : **Ordinance Factory, Ambarnath**

IIM HONORARY MEMBERSHIP



The **Honorary Membership** of IIM is conferred on **Mr. Anand Sen**, Former President (TQM & Steel Business), Tata Steel & Former President, The Indian Institute of Metals.

Mr. Anand Sen graduated from Indian Institute of Technology Kharagpur (BTech, Hons) as a Metallurgical Engineer. Subsequently, he completed his Post Graduation in Marketing from Indian Institute of Management, Kolkata and also has an Executive MBA from CEDEP at INSEAD, France.

Mr. Sen joined Tata Steel as a graduate trainee in 1981 and held the posts of Chief of Strategic Planning and Corporation Marketing and Chief Marketing. He was elevated as the Vice-President (Flat Products) of the company in 2004. In 2008 Mr. Sen was made Vice-President (TQM and Flat Products). In 2013 Mr. Sen picked up the baton as President, TQM & Steel Business. Mr. Sen is the Former President of The Indian Institute of Metals. Mr. Sen led from the front, understood broader strategic objectives, making each process aligned toward that objective. Under his guidance and mentorship, the Institute sailed through many adversities at ease.

IIM HONORARY MEMBERSHIP



The **Honorary Membership** of IIM is conferred on **Dr. K Sivan**, Chairman, ISRO and Secretary, DOS, Govt. of India.

Dr. Sivan graduated from Madras Institute of Technology in Aeronautical engineering in 1980. He took his ME in Aerospace engineering from IISc, Bangalore in 1982. Subsequently, he completed his PhD in Aerospace engineering from IIT, Bombay in 2006. He joined ISRO in 1982 in PSLV Project and has contributed immensely towards end to end mission planning, mission design, mission integration and analysis. The mission design process and innovative mission design strategies perfected for PSLV has become the foundation for ISRO

launch vehicles like GSLV, GSLV-MK3 and RLV-TD. He is the chief architect of 6D trajectory simulation software, SITARA which is the back-bone of the real-time and non-real-time trajectory simulations of all ISRO launch vehicles. During his career at ISRO, he has held many responsibilities like Group Director, MSSG, Project Director, RLV-TD, Deputy Director, Aeronautics Entity, Deputy Director, Structures Entity, Project Director, GSLV, Chief controller, VSSC, Director LPSC and presently Director, VSSC from June 2015.

IIM HONORARY MEMBERSHIP



The **Honorary Membership** of IIM is conferred on **Prof. Martin Stratmann**, President of the Max Planck Society, Munchen. Prof. Stratmann grew up in Traben-Trarbach. After completing his Abitur in 1974, he studied chemistry at Ruhr-Universität Bochum with a grant from the German National Academic Foundation, completing his chemistry degree in 1979. He then commenced his doctoral studies at the Max-Planck-Institut für Eisenforschung GmbH (MPIE) in Düsseldorf on “Electrochemical investigations of phase transitions in rust layers”, which he completed in 1982. This was followed by a two-year postdoctoral grant at Case Western Reserve University in Cleveland (USA).

Prof. Stratmann’s research team at the MPIE, which studies the corrosion process, has contributed greatly to the understanding of how conductive polymers (which can be used as synthetic protective coatings) prevent rust, and when and why they fail. He served as Vice President of the Max Planck Society from 2008 to 2014, adding to his considerable experience in research policy and skill of building bridges between knowledge-driven and needs oriented research. As the current President of MPIE, Prof. Stratman is an initiator of innovation and have succeeded in transferring the Institute’s exploratory vision to industry.

IIM HONORARY MEMBERSHIP



The **Honorary Membership** of IIM is conferred on **Mr. K L Mehrotra**, Former Chairman, IIM Delhi Chapter.

Mr. Mehrotra’s ingenious & articulate approach transcended through various prestigious positions in his forty years of career. During the tenure as CMD of MOIL, Mr. Mehrotra’s significant contributions to Indian and World Manganese Ore and Ferro Alloy Industries were exhibited through conducting International Bench-marking studies, boosting production & sales, implementation of Integrity Pact with Transparency International India as per the CVC guidelines, establishment of an integrated training centre and introduction of e-sale of manganese ore. He was associated with Wean United, Pittsburgh, USA for facilitating transfer of technology and equipment for finishing line of Bokaro Steel Plant.

IIM PLATINUM MEDAL



The **IIM Platinum Medal** for the year 2019 is awarded to **Dr. R N Patra**, Consultant & Former Chairman & Managing Director, Indian Rare Earths Limited.

Dr. Patra, a graduate in Chemical Engineering from IIT Kharagpur, started his career at BARC as Scientific Officer. Subsequently he obtained his PhD in Chemical Engineering (Reverse Osmosis/hyper filtration) from IIT, Mumbai. He joined IREL in 1989. During his tenure Dr. Patra traversed through diversified experiences & important responsibilities, such as Chief General Manager (Marketing) in the Corporate Office at Mumbai & Director (Technical) in 2006. He took over the reins of IREL as the CMD in 2009. He is able to combine the state of the art scientific and technological knowledge with engineering aspects, keeping commercial feasibility in mind.

IIM TATA GOLD MEDAL



The **Tata Gold Medal** for the year 2019 is awarded to **Mr. Rajashekhar Pattanasetty**, President, JSW Steel Ltd., Vijayanagar Works, Karnataka.

As President of JSW Steel Ltd, Mr. Pattanasetty led JSW Steel to greater heights, with strategic thrust on cost optimization, value-chain strengthening, automation, expanding product portfolio through value added products, adopting new technology & best practices, and digitalization. He is a dynamic and visionary leader in all possible endeavour. He has been instrumental in making JSW Steel, Vijayanagar Works the largest integrated steel plant (12 MTPA capacity) in India and is driving its current expansion plans to build 18 MTPA capacity.

IIM G D BIRLA GOLD MEDAL



The **G D Birla Gold Medal** for the year 2019 is awarded to **Dr. G Madhusudhan Reddy**, Outstanding Scientist & Associate Director, DMRL, Hyderabad.

Dr. Reddy started his carrier as a Scientist in 1987 at the Combat Vehicles R&D Establishment (CVRDE), Chennai. His career spanning nearly 30 years is marked by significant R&D contributions in the field of materials joining and surfacing and have been direct applications in defence and aerospace technologies. He is very well known internationally for his excellence in the field of friction-stir welding of very large components required by aerospace programs in India. He has made a significant breakthrough by establishing ballistic capabilities in welds, comparable to those of parent armour. On fundamental research front, niobium segregation, causing Laves phase formation, is a major problem in fusion welding of superalloys.

IIM HINDUSTAN ZINC GOLD MEDAL



The **Hindustan Zinc Gold Medal** for the year 2019 is awarded to **Dr. Dhruva Kumar Singh**, Scientific Officer 'G', Bhabha Atomic Research Centre.

Dr. Singh joined BARC in 1991. He has worked extensively to develop process flow sheets for production of highly pure heavy rare earths namely yttrium, dysprosium, gadolinium and terbium oxides from different sources. He was actively involved in the development and timely delivery of materials using novel solvent extraction-based techniques for important projects of IREL (India) Limited, Heavy Water Board (HWB) and Nuclear Power corporation of India (NPCIL).

IIM TSL NEW MILLENNIUM IRON AWARD



The **IIM TSL New Millennium Award** for the year 2019 is awarded to **Mr. Somnath Mitra**, Deputy General Manager, RDCIS, SAIL, Ranchi.

Mr. Mitra has made remarkable and outstanding contribution in spearheading various innovative R&D projects especially in Iron Area at different Steel Plants of SAIL. His significant contributions are in the field of technology development through Level-II based process models, Expert Systems, Artificial Intelligence, Process Optimisation, Process Control etc.

IIM ESSAR GOLD MEDAL



The **Essar Gold Medal** for 2019 is awarded to **Mr. S C Viswanath**, Sr. Vice President - Steel at JSW Steel, Vijayanagar works.

With strong analytical ability, innovative approach and meticulous planning abilities he significantly contributed to the rise of JSW Steel Ltd. He was the driving force behind the adoption of technology of hot metal pre-treatment (Desiliconisation, Dephosphorisation & Desulphurisation) and LD slag granulation, both first of its kind in the country. He led his team for achieving a significant increase in waste utilization.

IIM NALCO GOLD MEDAL



The **NALCO Gold Medal** for 2019 is awarded to **Mr. M P Mishra**, Executive Director (Smelter & Power Complex), National Aluminium Company Ltd.

Mr. Mishra has vast experience in different capacities of Operation and Maintenance in Smelter & Power plants of NALCO, especially in Potline, Carbon Area & Cast House. He had spear-headed implementation of computerised maintenance package across NALCO. He led in achieving the targeted production in FY 2018-19 which was highest in the last 10 years in the company along with record specific consumption of power & input raw materials. He was involved in Business Development (BD) initiatives of NALCO during 2008-17 to pursue new

projects for green-field growth, diversification, backward and forward integration, mineral resource acquisition etc.

IIM MECON AWARD



The **MECON Award** for 2019 is awarded to **Mr. Subhash Kumar Sinha**, Chief Blast Furnace II Project, Tata Steel.

Mr. Sinha's crucial contributions include installation, commissioning, start up and stabilisation of the largest blast furnace in India, witnessed by the Country in February 2016. Under his leadership, models are being developed with simplified or no assumptions, and all the derivatives and their use in formulation is data based. The work done so far has yielded benefits in making the process much more predictable.

IIM SAIL GOLD MEDAL



The **SAIL Gold Medal** for 2019 is awarded to **Mr. P. Ramkumar**, Brahm Prakash Professor, Materials and Mechanical Entity, VSSC, Thiruvananthapuram, as the Principal Author of the Technical Paper no.3604 on "Melting and Thermomechanical Processing of High Strength 0.3%C-CrMoV (ESR) Steel", published in the Transactions of The Indian Institute of Metals, 2018, Issue 6, Pages 1475-1485.

As coauthors of the paper, the following incumbents received certificate of Merit.

Mr. V. Anil Kumar, Engineer 'SF', VSSC, Thiruvananthapuram

Dr. R .K. Gupta, Deputy General Manager, VSSC, Thiruvananthapuram

Mr. M. K. Karthikeyan, Engineer 'SF', VSSC, Thiruvananthapuram

Mr. S. Narahari Prasad, Deputy General Manager, Mishra Dhatu Nigam Limited, Hyderabad

Mr. F. G. Prakash, Engineer 'SF', Materials and Mechanical Entity, VSSC, Thiruvananthapuram

Mr. K. V. A. Chakravarti, Retd. Engineer 'SG', VSSC, Thiruvananthapuram

Mr. Y. Maruthi Prasad, Engineer 'SF', VSSC, Thiruvananthapuram

Dr. P V Venkitakrishnan, Director, Capacity Building Programme Officer, ISRO HQ, GOI

IIM BEST PAPER on NON-FERROUS METALLURGY, TIIM Medal

The **IIM Best Paper on Non-ferrous Metallurgy** in Trans. IIM (TIIM Medal) for 2019 is awarded to **Mr. S.V. Sujith**, Research Scholar, Dept. of Mechanical & Industrial Engineering, IIT Roorkee, as the Principal Author of the Technical Paper No. 3549 on "A New Hot Tearing Assessment by using stepped Ring core Mould and the effect of Strontium on the hot tearing Resistance of Al-6 wt% Zn Alloy".

As coauthors of the referred paper, the following incumbents received certificate of Merit.

Prof. M.M. Mahapatra, Associate Professor, School of Mechanical Sciences, IIT Bhubaneswar

Prof. R.S. Mulik, Associate Professor, Dept. of Mechanical & Industrial Engineering, IIT Roorkee

IIM DISTINGUISHED EDUCATOR AWARD



The **IIM Distinguished Educator Award** is conferred on **Prof. N K Mukhopadhyay**, Professor and Head, Department of Metallurgical Engineering, IIT (BHU).

Prof. Mukhopadhyay's colossal contribution to Metallurgy & Materials Science research & education is well known. He designed a tailor-made course structure & syllabus for B.Tech & M.Tech students at IIT (BHU), befitting the placement scenario in the country. His involvement in research areas of quasicrystals, complex metallic alloys, mechanical alloying/milling, nanomaterials, high entropy alloys, severe plastic deformation and nano-indentation has been well acclaimed.

IIM DR. A. K. BOSE GOLD MEDAL



The **Dr. A. K. Bose Gold Medal**, established in 1972 to perpetuate the memory of Late Dr. A. K. Bose, is awarded to honour a student whose M E Thesis is adjudged as the best.

For the year 2019 it is awarded to **Mr. Abhilash Agnihotri**, Dept of Materials Engineering, IISc, Bangalore in recognition of his ME Thesis on “ Effect of Electric Current on Whiskering in Tin ” submitted and defended during the year 2018-19.

IIM N B SEN MEDAL



The **N. B. Sen Medal**, established in 1967 to perpetuate the memory of Late N. B. Sen, is presented to the candidate securing highest grade in aggregate marks in the Part - II AMIIM held during 2018, appearing in two consecutive attempts.

For the year 2019, it is awarded to **Mr. Shashi Prasad** for obtaining highest grade in order of merit, appearing consecutively in examinations of June & December 2018 as per the existing rules.

IIM VIDYA BHARATHI PRIZE

The **Vidya Bharathi Prize** established in 1978, is presented to a student for securing highest grade in order of merit in the final B.Tech./ B.E./ B.Sc. (Met. Engineering) Examinations held in 2016-2019 academic session among all Indian Institutes of Technology and Institutes of Technology.

The Vidya Bharathi Prize for the year 2019 is awarded to



Mr. Samarth Agarwal, Dept. of Met & Mat Engg., IIT, Roorkee

&



Mr. Swagata Roy, Dept of Met & Mat Engg., IIT, Kharagpur.

IIM STUDENTS' PRIZE

IIM Students' Prize, established in 2001, is presented to three students for securing highest marks in order of merit in the final B.Tech. / B.E. / B.Sc. (Met. Engineering) Examination during 2018-2019 academic session among all National Institutes of Technology / Indian Universities / Engineering Colleges.



Ms. Prachi Jaiswal

The **IIM Students' Prize** for the year 2019 is awarded to **Ms. Prachi Jaiswal**, NIT Jamshedpur, **Mr. Pratyush Ranjan Samantaray**, NIT Rourkela and **Ms. Deepika Kumari Sahu**, NIT Jamshedpur.

IIM BEST CHAPTER AWARD

The **Best Chapter Award** Plaque / Trophy is awarded to encourage Chapters for overall performance.

The following Chapters in various categories are felicitated with the IIM Best Chapter Award :

Large Chapter → 1st : **Jamshedpur**
→ 2nd : **Kalpakkam**

Medium Chapter → **Trivandrum**

Small Chapter → **Kharagpur**

PROF. BRAHM PRAKASH MEMORIAL QUIZ AWARD

Prof. Brahm Prakash Memorial Quiz is aimed to create an awareness among school students and to motivate them to choose their career in Materials Science and Engineering.

WINNERS :

Ashutosh M Bharadwaj & Bharath Shankar, National Public School, Rajajinagar, Bangalore, Nominated by : **IIM Bangalore Chapter**

RUNNERS UP :

Deiva Prasanna V & Harshavarthini P, Sri Jayendra Swamigal Silver Jubilee MHSS, Tirunelveli, Nominated by : **IIM Trichy Chapter**

IIM FELLOWS

The Fellowship is conferred on members in recognition of their services to the Institute and to the Metallurgy Profession.

The 2019 Fellowship is conferred on :



Prof. Sudipta Seal, Professor, Chair, Pegasus Prof, Trustee Chair, UCF's Advanced Materials Processing Analysis Center and Nanoscience Technology Center, University of Florida.



Prof. T A Abinandanan, Professor and Chairman, Department of Materials Engineering, Indian Institute of Science, Bangalore.



Dr. M Kamaraj, Professor, Indian Institute of Technology Madras, Chennai.



Mr. Sumanta Mandal, Ex-General Manager (Technology & Research), RINL, Visakhapatnam.



Mr. Debashis Das, Chief of Manufacturing - Long products, Tata Steel, Jamshe



Mr. Lokendra Raj Singh, Sr. Vice President, Iron, Energy & Environment, JSW Steel Ltd., Vijayanagar Works

CERTIFICATE OF HONOUR



The 2019 'Certificate of Honour' (introduced in 2008) is presented to **Dr. P Ramesh Narayanan**, Secretary, IIM Thiruvananthapuram Chapter, in recognition for his commendable work in overall membership development of the Chapter, interaction with

students / colleges, co-ordination with IIM Head Quarters and office bearers.

IIM DISTINGUISHED SERVICE AWARD



Mr. S K Basu, Secretary, IIM Kolkata Chapter has been awarded the **2019 IIM Distinguished Service Award** in recognition of his prolonged and dedicated services provided to The Indian Institute of Metals, Kolkata Chapter, in various capacities.

IIM SPECIAL CONTRIBUTION AWARD

A special Award has been presented to **Ms. Swati Meherishi**, Executive Editor, Applied Sciences & Engineering, Springer Nature India Pvt Ltd, in recognition of her brilliant contribution in making the Transactions of IIM one of the best Technical Journals.

IIM ASM LECTURESHIP 2019



The **IIM ASM Lectureship** for 2019 is conferred on **Prof. Manojit Ghosh**, Associate Professor & Head, Dept. of Metallurgy and Materials Engineering, Indian Institute of Engineering, Science & Technology, Shibpur.

&



Prof. Chandra Sekhar Tiwary, Assistant Professor, Dept. of Metallurgy and Materials Engineering, Indian Institute of Technology, Kharagpur.

IIM CHAPTERS' CONCLAVE

The Chapters' Conclave of the Indian Institute of Metals was held at the Agora Hall, Taj Green Cove Resort at Kovalam on 15th November, 2019 at 9:30 hrs. Dr. R. N. Patra, Chairman, Chapter Relations Committee (CRC) chaired the meeting, with former Presidents Mr. R N Parbat and Mr. L Pugazhenthay, Dr. Divakar R., Co-Chairman, CRC, Dr. D. De Sarkar, Dr. P. Parameswaran, Dr. J. Krishnamoorthi, Mr. S. K. Basu, and representatives from Chapters.

A. The Chairman, CRC welcomed all members. Dr. Divakar presented a summary of discussions of the previous meeting and action points.

1. On issue of declining membership, the recommendation in previous meeting was for engaging industry. Three approaches have been tried by Chapters – (a) engaging through other professional bodies which have better access to industries and associating with them for events and industry interactions, (b) engaging with Government departments / private bodies representing / dealing with second tier / MSME industrial establishments, and

offer assistance on technical and policy matters, and (c) engaging with nearby weak Chapters.

These approaches have been initiated by Coimbatore and Delhi Chapters, and all Chapters were advised to adopt these, with additional attempt to find gaps where IIM could play a useful role, not covered by other professional bodies in the vicinity.

2. There was a discussion on the issue of regular participation of only a few Chapters at CRC meetings, while many others not participating, as shown in the following data on attendance at last three meetings of CRC.

It has been seen only five (9%) of the fifty-six chapters had attended all three meetings while the majority, thirty-five Chapters (63%) did not attend any of the three meetings. The non-attending chapters include some that are quite active otherwise. It was also noted that CRC meetings held at NMD-ATM events had an understandably higher level of attendance, especially from the zone in which the

	07-17	11-18	07-19		07-17	11-18	07-19		07-17	11-18	07-19		07-17	11-18	07-19
Ambarnath				Baroda				Chennai				Hisar			
Angul				Bangalore				Durgapur				Hazira			
B E College				Bhopal				Delhi				Ichapur			
Burnpur				Bharuch				Dolvi				Jamshedpur			
Bokaro				Chandigarh				Ghatsila				Jaipur			
Bhubaneswar				Coimbatore				Goa				Jabalpur GIF			
Bhilai				Chittorgarh				Hyderabad				Kharagpur			
Korba				Kolkata				Ranchi				Sambalpur			
Katni				Kalinganagar				Rourkela				Trichy			
Kanpur				Mumbai				Roorkee				Trivandram			
Khetrinagar				Mathura				Raigarh				Udaipur			
Kalpakkam				Nagpur				Sunabeda				Varanasi			
Keonjhar				Poona				Surathkal				Visakhapatnam			
Kolar Gold Fields				Paloncha				Salem				Vijaynagar			

NMD-ATM was being held. Major reasons that emerged, are (i) difficulty in getting leave and funding from parent institution for attending CRC meetings, (ii) disinterest of office bearers, and (iii) communication gap. Of these, the last was advised to be rectified by Head office by correcting e-mail addresses, and having quarterly contact programmes over video conferencing, while ways and means for overcoming first two were further deliberated.

B. Deliberations and recommendations

1. Based on the recommendations arrived at the Association of Former Presidents, it was suggested that in each of the four zones, North, East, West and South, one strong, active Chapter be identified, and a Vice-President of the Institute could organise a NMD-ATM type of event, gathering all Chapters of the zone. This could generate income, improve inter-chapter relations, and give impetus for weak, inactive Chapters to take-off.

2. On financial compliance by Chapters, it was suggested by a representative from Trichy Chapter that Chapter bank accounts could be organised as child accounts linked to another account used by the Head-office and configured such that the Head-office would get all required financial account use information directly, while Chapters operate and transact the child accounts transparently. In response to this, Head-office informed that action had been taken to enable a login panel for Chapters at the IIM website where financial information could be uploaded by the Chapter Office bearers, to ensure timely and convenient submission of account information. Further, Mr.

Pugazhenty advised that each Chapter have a commercial calendar of activities that they meticulously follow up tax compliance reporting, membership advancement, etc.

3. Disinterest at Chapter level needs to be tackled by the respective Chapters by bringing in enthusiastic young members into the Chapter Executive Committee.

4. Mr. Pugazhenty recalled the founding of CRC under the guidance of Dr. Placid Rodriguez to bring together Chapters bi-annually to develop sense of fraternity, and disseminate information on the Institute's activities. He advised that Head-office visits that have been so far only to the strong Chapters, should also include those that are non-compliant and inactive. He also stressed on importance of industry engagement and promoting and guiding members of student affiliate Chapters.

5. Mr. Parbat advised that Head-office and Chapters should work out a mechanism where by Chapter representatives could be supported for attending CRC meetings. He stressed on the importance of the role of industry and academic institutions in encouraging and retaining membership of IIM, and on the need to communicate with each segment of membership in the appropriate language. He advised that Chapter participation in CRC should be monitored by displaying status of Chapters on a map of India, at each meeting.

6. Dr. De Sarkar reiterated the importance of financial compliance, and thanked the members for their active participation.

- Report by Divakar R

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developing technologies to

**reduce CO₂
emissions**
by more than 50%

Source: World Steel Association

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Maximum steel output, minimal carbon footprint, a commitment to our planet - Our Kalinganagar plant is designed to make technology serve the environment. It is our tribute to the unbounded spirit of new India. And the promise of good for tomorrow. Sure, we make steel.

But #WeAlsoMakeTomorrow.