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NML

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NML Eco-friendly Gas Melting Furnace Technology Ready for Commercialisation

National Metallurgical Laboratory (NML) in its endeavour to overcome the crisis of Agra foundries following the Hon'ble Supreme Court directives on the eco-friendly production of foundry grade iron, developed and put up environmentally benign and energy efficient eco-friendly Gas Melting Furnace popularly known as cokeless cupola for foundry grade iron. The technology intending to cater to the needs of several foundries across the country, is ready for commercial exploitation.

The cupola conventionally is a unit for melting cast iron in the foundries. It normally uses coke as fuel. Combustion of coke generates varieties of gaseous products such as oxides of carbon (CO_x), nitrogen (NO_x) and sulphur (SO_x) as well as excessive Suspended Particulate Matter (SPM). In India, the exhaust gas emission from iron foundries varies from 400 to 3000mg/ Nm^3 of SPM, more than 400 mg/ Nm^3 of SO_x and some undesirable NO_x . These figures are rather high from the pollution point of view. The permissible limits for SPM and for SO_x are 150mg/ Nm^3 and 350mg/ Nm^3 fixed respectively according to the Central

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NML Foundation Day Celebrated



Inaugural Function : Chief Guest Prof. S. G Dhande lighting the ceremonial lamp. On his left, Prof. S. P. Mehrotra Director, NML

National Metallurgical Laboratory, Jamshedpur celebrated its fifty third Foundation Day on 25th November, 2003. The function started in a traditional way with the lighting of the lamp by the Chief Guest Prof. S.G.Dhanda, Director, Indian Institute of Technology, Kanpur which was followed by NML song.

Prof. S.P. Mehrotra, Director, NML extended a very warm and hearty welcome to the Chief Guest, Prof. S. G. Dhanda, Retired employees of NML and all the distinguished guests. Prof. Mehrotra in his welcome address gave an overview of the activities and achievements of the laboratory during 2002-03. He mentioned "Over the last five years there has been a tremendous change in the economic, political

and technological environment the world over and India has been no exception. Its economy is being gradually liberalised to enable its smooth integration into the global economy. This poses a challenge to all sections of Indian Society: how to harness effectively the potential of S&T in the socio-economic sphere." Prof. Mehrotra added, NML with effective pursuance on networked initiative, focussed at a theme on Technology for Engineering Critical Assessment and proposed to CSIR/Planning Commission, Govt. of India as a Tenth Five Year Plan project. This proposal was based on one of NML's projected areas of research, and planned to be executed by a team of

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NML Eco-friendly Gas Melting Furnace Technology Ready for Commercialization

Pollution Control Board (CPCB), India. These stringent pollution specifications, as laid down by CPCB, India, have been a threat to most of the 6000 foundries operating as clusters at Agra, Batala, Ahmedabad, Rajkot, Coimbatore, Howrah and many more.

Public awareness and the pressure from the environmental activists have also forced foundry owners to look into the pollution aspects and to take corrective measures for its mitigation to the lowest permissible limits. The directives of the Honourable Supreme Court of India further strengthened the development of eco-friendly cokeless cupola in the year 1995. It prohibits the use of coke in all the foundries particularly in the Taj trapezium and in all the Indian foundries at large. NML, Jamshedpur responded to this National need and submitted a project proposal to the Technology Information Forecasting and Assessment Council (TIFAC), Department of Science of Technology (DST), Govt. of India for the development of the environment friendly cokeless cupola and initiated the technology development work in May 1996.

The use of low sulphur gaseous/liquid fuel promises extremely low level of SPM and SO_x . The studies were initiated by converting a small existing conventional coke-fired cupola of 500mm ID of NML Pilot Plant to suit initially for oil (LDO) and then for gas firing. The rated capacity of converted cupola was 1 tonne per hour. During the developmental stage many problems such as location, selection and orientation of appropriate burners, design of grates and selection of suitable permeable medium were encountered and sorted out.

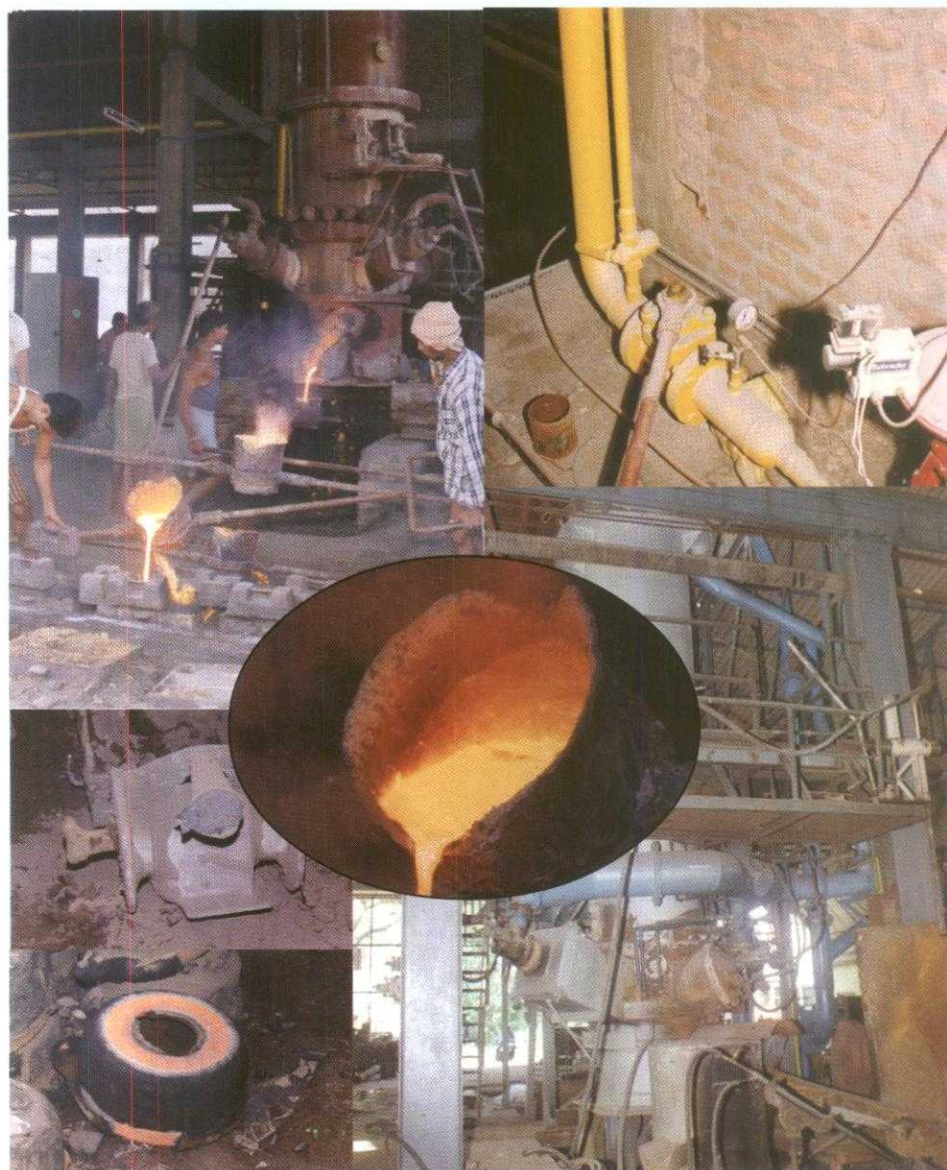
Based on success achieved by the end of 1997, M/s. Tata Korf and NML reached a Memorandum of Understanding (MoU) to commercialise the NML process and to provide technology for Pollution-free Coke less Cupolas. Subsequently, M/s. Tata Korf and the Agra Iron Founders Association (AIFA) entered into an agreement in early 1998 for the transfer of NML's developed technology involving installation, commissioning and demonstration of natural gas based cokeless cupola of 2t/hr capacity.

The first cupola of 2t/h capacity based on NML

Technology was installed in the premises of Agra Loh Udyog, Agra. The natural gas was made available to the cupola site through the pipeline of Gas Authority of India Limited (GAIL). After erection and commissioning of the cupola at Agra Loh Udyog, Agra, the first melt was taken on 11th May '98. In the subsequent 10 trials, some of the teething problems with respect to the metal temperature, slag composition and flowability of the slag, were solved. Incorporating these modifications in the above units and conducting repeated trials (from 10th to 14th), all the problems were scientifically and systematically addressed and various operational parameters were critically examined, determined

and optimised. Accordingly, after several successful demonstration trails (from 15th to 20th) resulting in the production of a total 16t to 20t of hot metal during June-August '99, the melting unit was finally handed over to AIFA.

The process parameters for 2t/h cokeless cupola were again examined, analysed and optimized in the scaled up cokeless cupola of 3t/h operation. A gas based cupola of 3t/hr was then engineered and installed in the premises of M/s. Goel Engineering Works, Agra in 2001 by M/s. Tata Korf Engineering based on NML's know how. Successful trial of 3t/hr cokeless cupola at M/s. Goel Engg. Works was carried out in May-June 2003. The technology is now ready for commercialization.



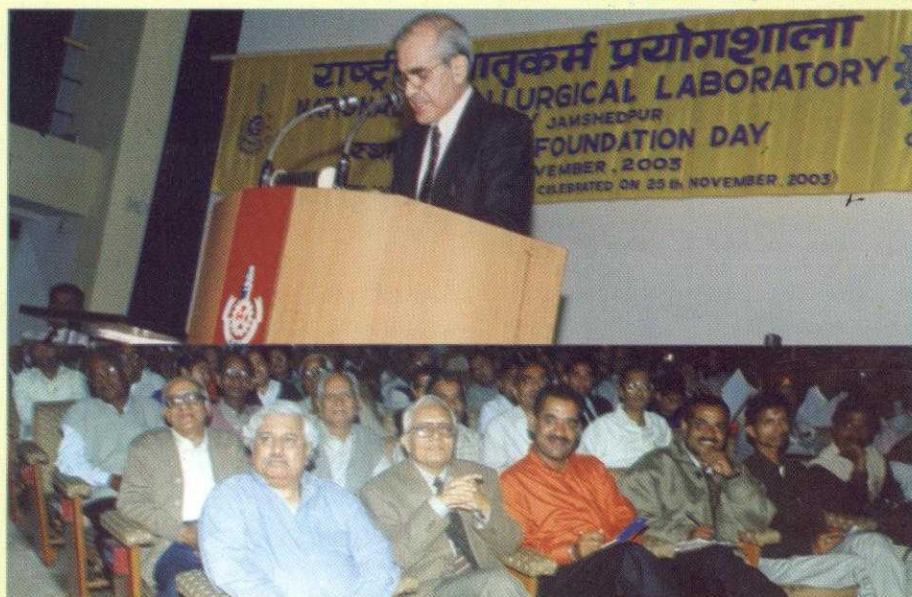
A Collage of NML Cokeless Cupola : Pilot plant, Agra demonstration plant, Gas supply connectivity, Tapping of liquid iron and Casted commercial products.

engineering laboratories of the CSIR family and other research institutions, with NML acting as the nodal co-ordinator.

Prof. Mehrotra congratulated the various prize winners of NML Foundation Awards which included the Nijhawan Award for the Best Publication in National, International Journal and Distinguished Services Award. He also felicitated the NML colleagues who won other meritorious awards.

Dr. R.N. Ghosh, Senior Scientist, introduced the Chief Guest, Prof. S.G. Dhande. In his address Prof. Dhande shared some of his thoughts among the gatherings through his lecture on "The Role of Material Design and Manufacture Technology in Digital Engineering World" which was thought provoking. Later, Shri Rameswar Dass, Controller of Administration proposed the vote of thanks.

NML Foundation Day Celebrated



Prof. S. P. Mehrotra welcoming the gathering in the NML Auditorium

LABORATORY ANNUAL REPORT RELEASED

Prof. S.G.Dhande, Director, Indian Institute of Technology, Kanpur formally released the Laboratory's Annual Report for the year 2002-03 at a function organised for celebrating NML's 53rd Foundation Day on November 25, 2003.

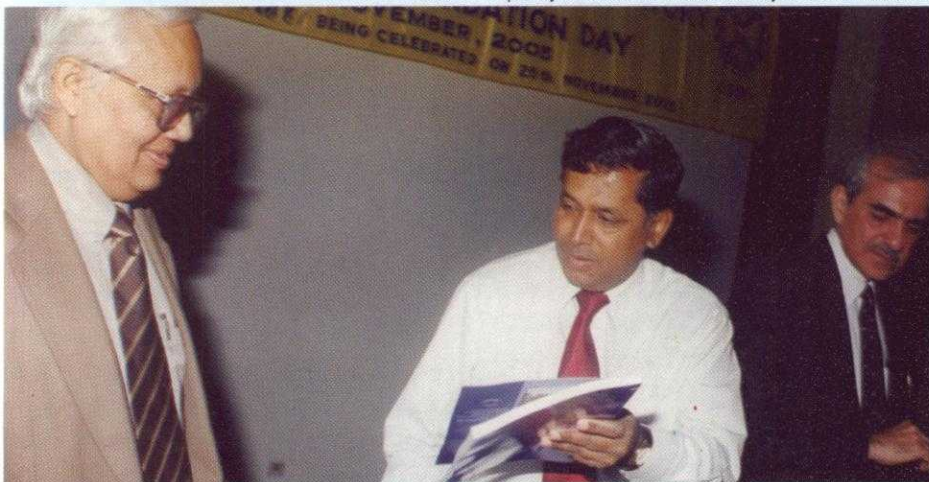
As mentioned in the report, over the past one year, NML has registered good progress in terms of formalisation of its participation in several of 57 networked projects of CSIR. In the project on Custom Tailored Special Materials, NML has four major responsibilities : (1) Development of hydroxyapatite based bioceramics through biomimetic route for biomedical application; (2) Fabrication of superhard material and castings;

(3) Fabrication of advanced high temperature - Ceramic composites by hot iso-static pressing; (4) Development and characterisation of amorphous non-crystalline soft & hard magnetic materials for sensors and high energy product magnets: The other network projects in which NML has major participation include: Developing New Building Construction Materials and Capacity Building for Coastal Placer Mineral Mining. In the latter project NML is responsible for Characterisation and bench scale studies for beneficiation of beach placer of Kerala-Karnataka coast, and conceptual flow sheet development for the production of high quality beach sand minerals by column flotation.

In the network project on advanced manufacturing processes NML is responsible for the development of Squeeze casting technology for automotive components; and production and characterisation of bulk amorphous materials.

In addition, through effective pursuance, a networked initiative on "Technology for Engineering Critical Assessment" has been proposed as a Tenth Five year plan project. This proposal is planned to be executed by a team of engineering laboratories of the CSIR family and other R&D organisations and academic institutions, with NML acting as the nodal co-ordinator.

The progress of the two NML Mega projects – (1) *Maximising blast furnace productivity with Indian iron ore* with the Financial support of Ministry of Steel, Govt. of India, under the Steel Development Fund scheme and (2) *Extraction of magnesium from indigenous raw material* sponsored by Ministry of Mines, Govt. of India has been quite encouraging. Under the BF project NML jointly with SAIL and Tata Steel is developing a knowledge base for characterising the process dynamics of the blast furnace to improve blast furnace operations and hot metal quality. Other collaborators in this project are



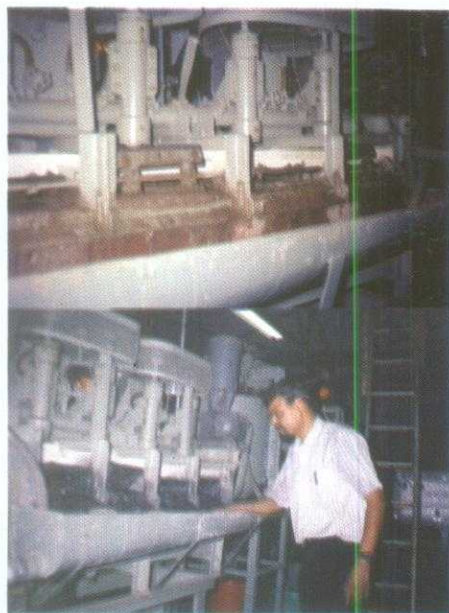
Prof. S. P. Dhande releasing the Laboratory's Annual Report 2002-03. On his left, Prof. S. P. Mehrotra and right, Dr. R. N. Ghosh

IIT, Kanpur; IIT, Bombay; IIT, Madras; IIT, Kharagpur; CDAC, Pune; MECON, Ranchi and RDCIS SAIL, Ranchi.

During the year 2002-03 some major laboratory infrastructure has been added. NML with the help of Department of Science and Technology (DST), Govt. of India is going to launch its centre for infrastructure asset management by non-destructive evaluation techniques. The establishment of the NDT Centre is under progress. The other infrastructure components added include: a Computational Centre with a super computer 'Param-10,000', a major facility to determine melting, softening, characterisation of iron ore/sinters, Precision and analytical mass comparator for NML's calibration centre, Laser flash thermal constant measuring unit, Impact Echo System, Thermography equipment, Hindhivac Sputtering Unit, Cement testing equipment.

New Millennium Indian Technology Leadership Initiative project on 'Improved Granular Processing: Towards energy efficiency in cement manufacture' supported by CSIR has been progressing well.

NML in its endeavour to overcome crisis of Agra foundry industries following the Hon'ble Supreme Court directives on the eco-friendly production of foundry grade iron, developed and put up environmentally benign and energy efficient eco-friendly cokeless Gas fired Melting



Mineral beneficiation study at Laboratory's pilot plant.

Furnace for foundry grade iron to save Taj Mahal and neighbouring historical monuments. Trial runs were conducted in the demonstration plant of Agra Foundry Association. The technology is ready for commercial exploitation, is intended to cater to the needs of not only of Agra foundries but also of other foundries across the country.

Laboratory continued to work on its thrust area projects of Component Integrity Evaluation Programme (CIEP). The emphasis has been to solve industrial problems through failure analysis, remaining life assessment, non-destructive evaluation and stress analysis. During the last one-year, several sponsor specific projects were completed. Some of the notable beneficiaries were – Tata Steel, Jindal Steel & Power Ltd., Bharat Heavy Electrical Ltd., CESC Ltd., Hindustan Aeronautics Ltd., South Eastern Railways, Central Power Research Institute. Under CIEP, several projects are going on as per schedule. Mention may be made of: (I) Uni-axial creep rupture test for residual life assessment and Creep rupture test for RLA for M/s ALSTOM Power; (II) RLA of primary reformer tubes for National Fertilizers Ltd.; (III) Health assessment of heater tube of Indian Oil Corporation Ltd.; (IV) Creep Rupture test for M/s Thermax Babcock and Wilson Ltd.; (V) RLA-creep rupture test for Tata Power; (VI) Metallurgical failure investigation of aeroengine for Indian Air Force; and (VII) Development of silt erosion resistant materials for turbines of hydrogenerators for Central Electricity Authority.

Under the bilateral co-operations, NML continued to reinforce partnership with Indian as well as overseas organisations in the core areas of metallurgy and material science. Indian industries, Academia and Govt. Organisations, namely, Tata Steel, Jamshedpur; National Aluminium Company Ltd., Bhubaneswar; Process and Product Development Centre, Agra; GMDC Research Centre, Ahmedabad; IIT Kanpur; IIT Kharagpur; Dept. of Science & Technology; Indian Space Research Organisation, Bangalore; Dept. of Ocean Development; Ministry of Rural Development and Dept. of Biotechnology were involved. Similarly, mention may be made of Overseas institutes/organisations like Iowa State University, U.S.A.; Dept. of Materials, University



NML Scientist at Client's plant site

of Leeds, U.K.; Engineering and Physical Sciences Research Council, U.K.; (IZFP), Saarbrueckh, Germany; South Yakutia, (Russia) and Russian Academy of Sciences, Institute of Structural Macroknetics and Materials Science (ISMAN), Moscow and Russian University. Under Integrated long term Programme (ILPT), through DST, the progress of the projects on synthesis of sintering of Titanium diboride for industrial application; studies in development of flotation reagents for processing of complex ores; study on controlled adsorption of the surfactants and polymers on oxidic mineral systems for enhanced beneficiation of iron ores in their sub-sieve range were quite encouraging.

During the year, 11 numbers of Grant-in-Aid projects, 3 sponsored projects, 7 consultancy projects, 1 collaborative project and 21 technical services projects were completed. The beneficiaries were – M/s Walchandnagar Industries Pvt. Ltd., Tata Power Ltd., Tata Steel, Thapar Centre for Industrial R&D, MECON Ltd., The Orissa Mining Corporation Ltd., Sardar Sarovar Narmada Nigam Ltd., Fertiliser Corporation of India Ltd., SAIL, Dept. of Industry, Jharkhand, Power Grid Corporation of India Ltd., Jindal Steel & Power Ltd., CESC Ltd., HAL, Central Power Research Institute, South Eastern Railways, Indian Air Force and many more. Likewise, 44 Grant-in-Aid projects, 7 sponsored projects, 8 consultancy projects, 2 collaborative projects and 7 technical services projects are ongoing.

During the reporting year, three processes, namely, (1) Electrolytic Iron Powder, (2) Manufacturing of Pickling Inhibitor for descaling of steel in HCL acid solution and (3) Galvasalt-an improved production technology were transferred. 10 numbers of business MoUs were also signed.

With regard to the Intellectual Property Assets,

the performance has been quite encouraging. 7 National and 14 International patents and 2 copyrights were filed. 80 research papers in International and 63 papers in National Journals/ Proceedings were published reflecting a qualitative as well as quantitative improvement as compared to previous years. The laboratory is holding periodic get-togethers of industrialists, business people and Govt. officers to apprise the industries the products and processes developed by laboratory and the assistance that can be rendered for their commercial exploitation and to study and investigate the problems for the betterment of the products.

During the year, 14 workshops and seminars were held. Out of these, mention may be made of the mega events like the National level seminar/workshop on – Resurgence of Metallic Materials - The current scenario; Remaining life assessment and extension of aged components of thermal power plants and Petrochemical industries; Promotion of Entrepreneurial industries; Promotion of Entrepreneurial Skills for Empowerment of Women; and Intellectual Property Assets in Business Development. As part of CSIR Diamond Jubilee celebrations, a series of lectures have been planned by eminent personalities from metallurgy and material science. Three lectures were organised during this reporting period. The maiden lecture on this series was by Shri B. Muthuraman, Managing Director, Tata Steel on "Development in Steel Research." The other two lectures were delivered respectively by Dr. Placid Rodriguez, Chairman, Recruitment & Assessment Centre, DRDO, Delhi on "Non-Destructive Evaluation in Science and Technology" and by Prof. K.L. Chopra, Formerly, Director, IIT, Kharagpur on "Two Dimensional Nano-Materials-A review"

CSIR Diamond Jubilee was celebrated throughout the year with the organisations of different events in the laboratory. Several other regular events like - Hindi Diwas, CSIR Programme for Youth on Leadership in Science, NML Foundation Day, National Technology Day were also celebrated. NML participated in the Technology Fair held at Zibo City, China through TIFAC, New Delhi; Jharkhand Udyog Mela held at Ranchi; Concept 2003 held at NIT Campus, Jamshedpur and TechFest R&D Exhibition 2003

held at IIT, Mumbai with the objective of creating awareness about NML/CSIR, its achievements and supporting its business development efforts.

During the year under review, NML has achieved the ISO 9001: 2000 certification having successfully undergone upgradation audit. Unlike ISO 9000: 94 version, the revised standard lays much emphasis on Quality Management System whose bedrock is the process approach and measurability of its outputs leading to sustainable development of the organisation's business and its customer's satisfaction resulting in 'Customer Delight' which is also our commitment.

During the year, NML's effective marketing drive could mobilise an extra budgetary sources worth Rs.660 lakhs. During the year, 94 NML staff had undergone training and 104 personnel sponsored by outside agencies were imparted training at the laboratory. 12 Scientists were on foreign deputation and 4 obtained higher degree/diploma.

Several prestigious awards and recognitions have come to NML Scientists. These include CSIR Young Scientist Award; MRSI Young Scientist Award; SAIL Gold Medal-2002; Best Metallurgical and Materials Engineers Award-2002; IIME Mineral Beneficiation Award 2002; Deokaran Award for 'Glass' 2002 and Best Paper Awards.



Media coverage on NML

NML Foundation Day Awards

B. R. Nijhawan Award



Dr. S. Sivaprasad, Scientist receiving the awards from Chief Guest Prof. S. G. Dhande

B. R. Nijhawan Award for best paper, Instituted in honour of Dr. B. R. Nijhawan, who was the first Indian Director of NML during its formative years, was conferred on Dr. S. Sivaprasad, Scientist and his team comprising : Dr. S. Tarafder, Dr. V. R. Ranganath and Dr. K. K. Ray.

Distinguished Services Award

This prestigious awards is given to an NML employees for rendering outstanding services to the organization. This year this award is shared by Smt. Savitri Iyer of NML Madras Centre, Chennai and Sri. H. C. Gope of NML health centre, Jamshedpur.



Smt. Savitri Iyer receiving the award from Prof. S. G. Dhande



Shri H. C. Gope receiving the award from the Chief Guest

Prof. S. G. Dhande, Director, Indian Institute of Technology, Kanpur delivered the 53rd NML Foundation Day Lecture on 25th November 2003 on the topic "The role of Material Design and Manufacture Technology in Digital Engineering World". The excerpts of lecture is given below :

Good Morning Everybody. I must pay my respects to the city of Jamshedpur as I always as a student of Engineering, as an engineer, an engineering educator, I always feel that there are cities in the world which are really exhibiting characteristics of the profession. You go to Haridwar and it is all religious, you go to Panaji, Goa, there is nothing but carnivals and you come to Jamshedpur there is nothing but engineering over the years. So, right in 1982 when I visited this city for the first time, I felt very happy, very proud, a city which exhibits very proudly. Indeed when I saw the history of this laboratory, the foundation day is very humbly recalled wherein it shows the honourable Prime Minister of the country and others have really contributed a lot in building of this laboratory. With such an impressive foundation, it is a day, we would like to do introspection as to how the world of engineering and research needs to be really introspected as the decades roll along. When we say Happy Birthday, for an institution, it is indeed a difficult task. I hope the future of this laboratory is really glorious stage of CSIR. I would like to share some of my thoughts. These are generally the opportunity for us to exchange some of the views and try to tell things, which we feel about, and see how you react to it or absolve about it and my background in Design and Manufacturing, I thought I would share some of my views on the title "The Role of Material Design and Manufacture Technology in Digital Engineering World." The reason I am saying is that you will find that over the years, earlier we were only dealing with atoms. If you look at the entire physical world at the base level we were dealing with atoms to some extent and we can say that the engineers, the physicists, chemists etc.

What I am trying to say is right from small objects to aircrafts all are becoming digital. If you look around you will find microwaves, whether it is washing machines, whether it is your sewing machine, whether it is manufacturing, whether it is inspection, a digital component due to the actuation mechanism is there in every engineering system. So, to some extent you will find several examples of the engineering world becoming digital. The basic components which you would like to understand and some of the major fundamental issues that need to be understood, when we can say that the world is becoming digital. The first one is the ability to convert an analog signal on analog information to digital information. So, you will find an enormous amount of development taking place in what we call analog to digital conversion. When you see a picture, graphics, you'll find that it is the conversion of the digital pictures that you see. When you hear a musical tone, it is merely a signal, which is a



Prof. S. G. Dhande delivering the lecture

continuous signal, which is again sampled, which is then converted into an MP3 sort of a file. You will find that analog to digital as well as digital to analog version is one of the key components of entering into the digital world. When you look at the different chips of the PC, a computer, then there is one chip, which is called the DSP chip. You will find the entire technology of digital signal processing now in the form of a chip can do a variety of things. So, the basic task is how to convert analog information to digital information and vice-versa. This becomes one of the cornerstones of the modern digital engineering world. The second aspect is control technology, which has direct control, and then we have good open loop control and several other aspects of control. The real crucial difference is the digital control. You will also find the control logic, control laws, the control methodology has now become digital form and the logic that is required for designing and developing the controller is really the fundamental change. Another cornerstone of the digital engineering world. The third aspect is still evolving. Today, you will find the most fascinating thing that is happening for the last 3-4 years is the rapid growing in wireless communication. Nobody ever thought that you can carry a small, the gadget called mobile phone and then communicate with anybody in the world. Engineers do not realise that energy is a very important resource fossil fuel is a very important resource. You have other fundamental resources of energy. But if you ask me what is the critical resource, then it will now be a

very important issue coming in this decade in the spectrum. You will be finding in newspapers and elsewhere, there is a whole lot of debate about taking a piece of a spectrum and trying to send your information over the wireless communication channel. For doing this kind of communication in the wireless environment you need frequencies to be allocated and the allocation of the spectrum is going to be a very very crucial resource and in our country there are many aspects of this spectrum, spectrum allocation and spectrum as a resource is one of the major component of the wireless communication. You have seen two human beings communicating but here you have two machines communicating. You have one machine communicating with the other. One can be stationary machine and the other can be a mobile machine. So, you will find over the years, you may see a factory where only the managers communicate with the machines but the machine communicating with the other machine. You can imagine what is the difference, what change it is going to bring to the engineering world. When machine are going to communicate directly amongst themselves and as well as along with the humans. How do humans communicate with the machines that we will take in a short while but the next important part is when the engineering world is going to change and how it recalls the availability in the wireless communication technology is a different form than it used to be before. Another aspect of the digital engineering world is the concept of embedded systems, the

sensors, the device is being embedded into the system. You will find in many ways that sensors, devices are embedded into different aspects. Very important example of embedded system is what you call the Wearable Computing. It has got wires and sensor signals of temperature, blood pressure of the human being and take the data and communicate with the base machine.

You will find how developed and how we can call Variable Computing Devices that can be used by the defence personnel or it can be used by people working in hazardous environment. Today you will find fashion shows are held in the different parts of the world where the smart computing clothes or the variable computing clothes. So, embedding a certain electronic or sensing element into a physical device and communicating it in a wireless mode is going to be the different equipments that the engineers will design in the years to come. Lastly, the most important cornerstone of the digital engineering world is the material silicon, which is placed in the entire gamut of development. We all know, in all due respects iron ores has been the most important element in the economy but even today you will find the Silicon Valley as it is called has changed the economy very drastically because of the element silicon. So, you'll find that new elements, new metals, new materials are going to come up on the scene which will drive the economy to the digital engineering world. We would like to see some of them today. Before I go further, I just would like to propose a basic paradigm and that is what I call it as the relationship between man, machine and information. See, when I say bits and atoms then I mean the machine is really the atom part, the information is the bits part and the human element is the man. Now, we are controlling the machines directly and controlling the information and the information controls the machine. So, you will find that in order to control the machine, what you have to do is manipulate, represent and then change information which itself controls the machine. So, man, machine and information is really the basic concept or the basic system as I may call it for the Modern Engineering World. We call the Engineering Informatics, which is information given engineering to some extent. It is direct, earlier it used to be indirect. Now, it is more of a direct support. You will find that in the engineering education, first we had practice oriented engineering education of the Second World War. After the Second World War the space programme, nuclear programme became a domineering aspect of the engineering world. It was very soon realised that the knowledge of mechanics, the knowledge of engineering sciences is very crucial and therefore the engineering science based education came on the scene and even today even all the large scale is available at a very computational form and therefore information science based education which I am explaining a few aspects of it is really becoming important even in the aspects of technical education. So, coming to the basic model of man, information and machine,

we are in the role of materials and therefore you'll find that basically if you look at the input-output model, the inputs are essentially the intellect of the human being which I am representing as man and the resources which are available I am representing as materials. So, man and material are really the inputs but these inputs have to be channelized through information. We need to represent all other intellects, all other aspects through information and what is the connection between materials and Information. I would like to explain very quickly but the man and material, which are converging into information forms the input aspect. The basic process of engineering are Design and Manufacturing and what is output? The common person sees, he is really the machine. These are all generic terms and to be understood in a very generic manner. When you look at the information and the machine there are many many aspects. I don't know if you've seen but the ladies who do knitting of the sweaters, there are some knitting machines available, there are plastic cards which you load and in these cards, there are punched holes on it and depending on the pattern type of the punched holes, you'll find that the knitting pattern will be generated and the ladies have to settle the sweater in form. So, you find that the information is stored in the form of holes in the plastic part. Similarly, if you go to churches, you'll find the organs are not played by the human operators but in a big wooden sheet where there are holes and the pins will engage in these holes and in the organ. So, these wooden sheets with the hole is nothing but information. So, you will see that the machines which were given through information and information given in the form of punched holes was really the basic interface, a relationship between information and machines. This gives rise to the numerical control and then subsequently the computer numerical control and direct numerical control which led to the numerical manufacturing systems including the device of resource planning. So, these are some of the developments in the field of Computer Aided Manufacturing. The most exciting thing that has happened in the last decade are the remaining three areas wherein you will find that not only the large scale manufacturing is important but also you need to develop your technologies by which the products can be brought to the market when exhaust. Earlier it used take 4 years 5 years for designing and developing a new automotive vehicle and bringing it into the market. Obviously, today the market conditions are such that you need to compress a design and if I have got a design, you can bring the prototype very fast, then it will help in developing the product in a rapid manner and there are now technologies which is rapid prototyping where you take the solid metal of a part, you slice it layer by layer and you have a machine which will automatically from your Computer Aided solid model will deposit layer by layer the material and then create the part very quickly. So, within a day you can see the part, whether it is a bonnet of a car or

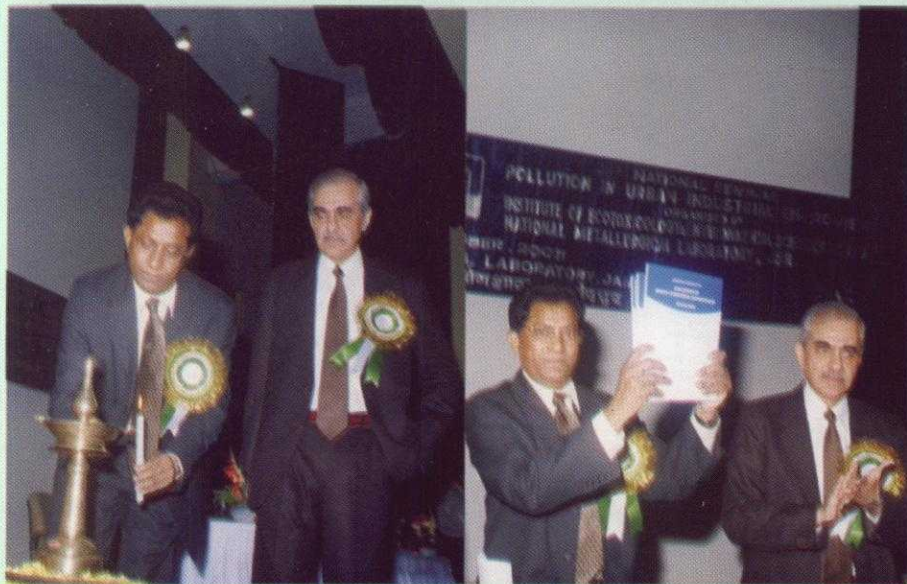
whether it is the handle of the scooter or whether it is a very complicated shape of a consumer product. You can make these parts very quickly, you can use them for checking of form, checking of function and this technology of prototyping requires enormous knowledge of materials engineering and therefore I would like to infact pose this as a challenge to the Scientists in the Materials World that newer and newer materials and newer and newer concepts of rapid prototyping is required so as to develop the process of bringing concept to the market very well. Similarly, when you look at the moulds. Today, traditionally you'll find the sign casting mould or if you look at the metal injection mould are basically for large-scale manufacture. But if I want to do prototyping or if I want to make only a few parts, I need a soft mould. You'll find silicon moulds, low melting alloy moulds. These are some of the new technologies that come up at the tooling areas and once again it is a challenge to the genius people to develop innovative material which will then generate new processes, new techniques of rapid tooling. The last in this series is the reverse engineering part where you have a part and you want to create a point cloud from that part. So, you can scan using a laser, you can scan using a photogrammetry, you can scan using a touch probe or you can scan using an MRI or CT scan but essentially to go from the part to the model or part to the drawing is really the role of reverse engineering. In all these cases you'll find there is an interplay between the information and machine. So, basically what you can see here is that information and machine are intermingling in this manner. There is of course a man-information relationship, the concept of mathematical modelling where you try to develop the information through your ability or by power of your intellect, the knowledge of your science and mechanics and try to go through these steps. I will not go into details. I am sure all of you are practitioners of this namely: creating mathematical model to engineering analysis and optimisation, probably using Computing and Computer Aided Design. Also, nowadays to verify your knowledge, you can even do simulation in a very effective way using virtual reality. We have opened a centre to work to reality and this is probably the ultimate between the man, information interaction wherein you can immerse the user in a virtual manner and then try to see whether the environment is proper or not. This is now being used in a variety of applications such as training of people, training of applications such as training of people, training of aircraft pilots, training of submarine pilots, training of operators. So, virtual training can be a very good tool for the blast furnace operator training for instance. Similarly, nowadays due to the internet and the web, you'll find that the web enabled processes are becoming really important. This is really an era, which we are entering at the moment. Then of course the communication part which I mentioned to you earlier. Looking at the materials evolution you will find that I have attempted to put in as a

very quick review starting from the stone age materials. We went through starting from the stone age materials. We went through an era where the concept of iron as the main material for engineering was a whole lot of history of 200-300 years can be seen wherein you'll find human ways were engaged in practising the iron technology and obviously slowly and slowly we found out the drawbacks where the non-ferrous materials and subsequently a shiny material which was the stainless steel. All this is really a part. One can say almost till the Second World War, the last fifty years, all of a sudden a variety of other materials came into the scene including plastics. An enormous development in different forms of polymers and plastics and also the idea of compounds probably which has something which has also thrown a challenge to the materials people in terms of how we can synthesize new materials. For a long time we felt we have to live, we have to make it do with whatever materials are available and try to adjust with them. Now slowly and slowly people are realising that we can even synthesize a material and have it as per our requirements, therefore these world of composites definitely provides an impetus for these activities and last but not the least important thing/part is the role of silicon and the subsequent digital revolution that I mentioned earlier. Now what is the relationship between materials and information? And again if you ask yourself a question. Is there information in materials and you will find an enormous amount of information is held by the materials. When you look at the basic structure you will find that there are immense possibilities of extracting, representing, manipulating, processing that information which in turn is going to process the material. So, the same thing that I mentioned about machine really holds good for the materials as well as the new process, the information which in turn will process the material. So, you'll find a variety of things such as the microstructure information. Today, you'll find the world of nanoscience and nano-materials is an attempt to manipulate the information at the nano-scale level. Fortunately, now we have abilities, then we can take material and manipulate its properties at the nano-scale though it is at the laboratory level but very soon machines will be available for manipulating the properties of the nano-scale level. Which in turn will be in a way a designing, emphasising or processing of the materials. The gross properties of the materials which we are used to. I think we all are used to only looking at the gross properties which are gross information. Whether it is mechanical information or whether it is thermal information or whether it is related to other characteristics. But you will find that we have a huge number of characterization machines which characterize different aspects of materials but most of them are at the macro level and that also constitutes the information. Unfortunate part of the information is, we cannot use it to process or manipulate the characteristics of the materials but

it is a very important and a valid information. The next part is a very important part where I want to emphasize how to synthesize materials using information is really the challenge. Today, if you ask me what is the challenge for the material scientist in the Digital Engineering World the real question is: Can I synthesize material using material information? Whether it is at the macro level or whether it is at the molecular level, whether it is at the gross level, can I use it or manipulating the information, which in turn will give me the desired properties of the material. Last part you will notice that there is a world of quantum computing using the spin of electrons or different atomic particles. You can store information and you can retreat information at a five different scale. Then what do you do with the present storage of information. So, look at the quantum-computing world, it is really the role of the material scientist which are really the basic contributors to the world of quantum computing. The computing part of it is the secondary part. The question that you can really manipulate, you can really control the macro or the nano level properties of the material allows you to design a new paradigm of computers. Now, I will give you a couple of examples though I have mentioned them already but just to say rapid prototyping and rapid tooling, we have a laboratory, we have the two processes namely: the Fusion Deposition Modelling. Just to give you very quickly what is FDM, if you look at the jilebi making machine it is an example of rapid prototyping. What we have basically is a nozzle and that nozzle we have got a wire which is ABS plastic wire which is drawn into the nozzle as it is passing through the nozzle it is heated and a paste is created and the paste is laid on a platform in a linear fashion. Now, how it will be controlled? That will be decided by the geometry of the part you would make. So, by taking a slice of the geometry, we build a layer, then we change the direction of the rasterscan of the nozzle and then create a layer, then we create another layer. In four hours-five hours a part is made. Whether it is a hip joint or a arthritic device, whether it is a part of an aircraft or a car we can make them from the CAD model very quickly. So, you will find many type of prototyping methods and this is one method. Another method is you have equal layer of polymeric material and you expose it to light or you expose it to laser and wherever this energy will impinge, the liquid polymer will turn into a solid. So, you have found that we can expose to UV lights and all this is what we call photo polymeric materials. So you will find how to make a liquid into a solid using some extra photonic energy is really rapid prototyping. One way of making solid parts. We have variety of RP processes. Every year you'll find new patents are filed and new processes are created but the challenge remains a challenge for the materials world. What type of material should I make by which I can make a product very rapidly is my question. If this can be answered. People want to make metallic RPM. Same is with the different kinds of moulds such as the silicon mould. We have

a machine called the low melting alloy machine. So, we make a mould using a low melting alloy machine using a broad array of melting alloy which are required to develop these moulds and is used for footwear industries, many shoe makers in Kanpur require these low melting alloy moulds when you have to make the typical moulds very fast for a very short patch size whether it is jewellery, whether it is footwear many many industries will require low melting alloy moulds. Again a very important application. Another area of interest is the display technology. Today you will find that these devices with a LRT with phosphor coating is very soon going to be replaced by many alternate solutions. We have plasma based screens we now also have what we call organic polymeric material. So, if you take this polymeric material and you impinge on it with photonic material, it will glow. So, this particular search for development of very effective organic polymers is what we call the organic LED areas, Light Emitting Diodes and there are many Companies in the world, we have a Centre in IIT, Kanpur called the sample Centre for display technology and they are doing extremely good work in terms of developing the devices, developing screens today you'll find the mobile screens today contains the organic LED's. Another application and very important is one that, where instead of impinging light and then blowing the molecule, what you do is use it in a solar cell. So, you can have the solar energy impinging on the molecule and it will generate the electric current. So, you'll find a new array of solar cell being developed in organic Light Emitting Diodes. There recently was a show of American Scientist had a big article on how the organic LED revolution is going to be more promising than the present state of affairs in solar planets. So, it may herald a new era for the solar energy people. One more method is used flexible surface as a display surface. In MIT they have developed a surface where they deposited molecules, two types of molecules and by applying electrostatic voltage in a selective manner you can bring one set of molecules above and that gives you as if that is the information printed and then by changing the voltage or electrostatic potential, you can change it and again it will be like a clean slate. So, it is like a slate where you can write and clean and then write and clean in a selective manner by using two sets of molecules and the interesting part is that it is printed on a flexible plastic sheet. So, one can have a display device. So, that is another important area in the display technology. The world of smart materials is another aspect where materials and information is going to get intertwined in a very effective manner. We have ethanol with which we started smart structures and materials as I told you people are instrumenting bridges, instrumenting the rail tracks, people are instrumenting wheels, people are instrumenting tyres in a automotive vehicle. Whole lot of sensors have gone up on the screen or gone up on the world wherein you can use these sensors in an embedded manner. □

National seminar on 'Pollution in Urban Industrial Environment'



(L) : Dr. P. C. Mandal, DG-GSI inaugurating the seminar. On his left, Prof. S. P. Mehrotra Director, NML
(R) : Dr. Mandal is seen releasing the Souvenir

National Metallurgical Laboratory (NML) in association with Institute of Ecotoxicology & Environmental Sciences (IEES) organised a two day long National Seminar on "Pollution in Urban Industrial Environment" at NML during December 4-5, 2003. The seminar was held under the chairmanship of Prof. S.P. Mehrotra, Director, N.M.L., Jamshedpur. The objective of the seminar was basically to develop programmes on environmental awareness, education and management with the aim to promote sustainable development.

The seminar was inaugurated by Dr. P.C. Mandal, Director General, Geological Survey of India (GSI), Kolkata. In his inaugural address Dr. Mandal emphasised the need of striking a balance between the industrial growth and environmental pollution. He also released a souvenir containing popular articles and abstract of the papers on this occasion. Prof. S.P. Mehrotra, Director, NML delivered the presidential address. He expressed his concern over air borne diseases and of increasing air pollution. Shri S.C. Maulik, Sr. Dy. Director, NML welcomed the delegates and introduced the chief guest, Dr. P.C. Mandal, Director General, GSI while Dr. B. Bhattacharyya, President, IEES detailed about the seminar.

The inaugural function was followed by four technical sessions and the panel discussion covering the following themes: (i) Air Pollution, (ii) Water Pollution, (iii) Impact of Pollution on Riverine Environment, (iv) Environment

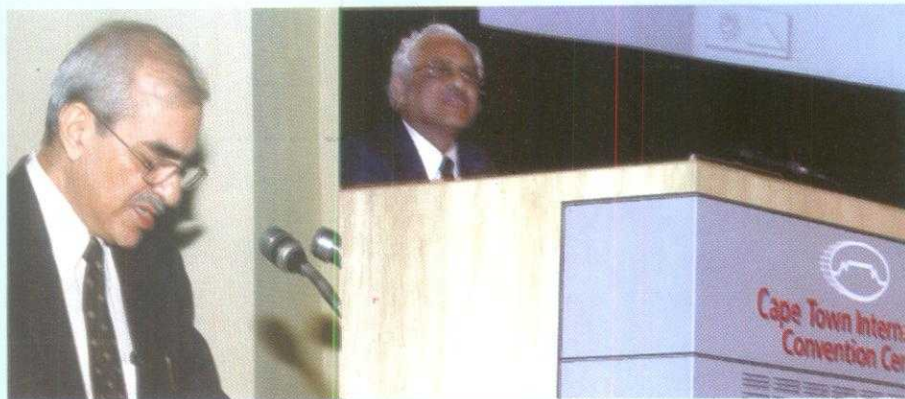
Awareness, Monitoring, Control and Management and (v) Industrial Pollution and Waste Management. Over sixty-five delegates from R&D organisation, academic institutions and industry participated in the seminar. The participants represented major organisations like I.I.T., Kharagpur, Jadavpur University, Vishwa Bharati University, Osmania University, Ranchi University, Burdwan University, IEES, NML, CFRI, IICB, DAE, Usha Martin Ltd, Tata Steel, M.N. Dastur & Co., MECON and many more.

The concluding session was chaired by Prof. S.P. Mehrotra, Director, NML with Dr. B. Bhattacharyya, Dr.S.A. Pandit, Dr.S. Bhattacharyya, Dr. P.Krishnamurthy and Mr. Premchand as the members. The Session Chairman summed up the proceedings and gave suggestions towards formulating strategies for tackling the pollution with a particular reference to urban industrial environment. The following major points emerged from the discussion: (i) Need for interaction among laboratory, academic institution and industry and sharing the facilities, considering the multi-disciplinary nature of the problem, (ii) Measures to reduce stress conditions like reducing CO₂ level, use of CNG are to be undertaken, (iii) Clustering of small industries for treatment of effluents and safe disposal of wastes, (iv) Processing and utilisation of solid waste need to be encouraged and (v) Bringing awareness among people particularly children and introducing the subject in the course curriculum in school and colleges.

Papers Published

- **Bahadur Aruna.** 2003. Enhancement of high temperature strength and room temperature ductility of iron aluminides by alloying. *Materials Science and Technology*, 19, pp.1627.
- **Biswas D. K., Asthana S. R. and Ravi V. G.,** 2003. Some studies on energy savings in sponge iron plants. *Jour. of Energy Resources Technology*, 125(1), pp. 1-10.
- **Chakraborty Jui, Kumar Swapan Das, Rao V. and Sinha Arvind.** 2003. Behaviour of iron ore in the morphosynthesis of magnetite particles. *Materials Transactions*, 44(6), pp.1124-1127.
- **Das Goutam, Ghosh Chowdhury Sandip, Ray Ashok Kumar, Das Swapan Kumar and Bhattacharya Deepak Kumar.** 2003. Turbine blade failure in a thermal power plant. *Engineering Failure Analysis*, 10, pp.85-91.
- **Singh D.D.N. and Kumar A.** 2003. A fresh look at ASTM G 1-90 solution recommended for cleaning of corrosion products formed on iron and steels. *Corrosion*, Nace International, 59(11), pp.1029.
- **Srikanth S., Gopalakrishna K., Das S. K. and Ravikumar B.** 2003. Phosphate induced stress corrosion cracking in a water wall tube from a coal fired boiler. *Engineering Failure Analysis*, 10, pp. 491-501
- **Ray A.K., Sahay S.K. and Goswami B.** 2003. Assessment of service exposed boiler tubes. *Engineering Failure Analysis*, 10, pp.645-654
- **Das Swapan Kumar, Bhattacharya Dipak Kumar.** 2003. Corrosion failure of Zn-Al detonator housing. *Engineering Failure Analysis*, 10, pp.639-643.
- **Parida N., Tarafder S., Das S.K., Kumar P., Das G., Ranganath V.R. and Bhattacharya D.K.** 2002. Failure analysis of coal pulverizer mill shaft. *Engineering Failure Analysis*, 10, pp.733-744
- **Das Gautam, Ray A.K., Ghosh Sabita, Das Swapan Kumar, Bhattacharya Dipak Kumar.** 2003. Fatigue failure of a boiler feed pump rotor shaft. *Engineering Failure Analysis*, 10, pp.725-732.
- **Maity S., Chakravarty S., Thakur P., Gupta K.K., Bhattacharjee S. and Roy B.C.** 2004. Evaluation and standardisation of a simple HG-AAS method for rapid specialisation of As (III) and As (V) in some contaminated groundwater samples of West Bengal, India. *Chemosphere*, 54, pp. 1199-1206.

NML Scientists participate in the IMPC, South Africa



Prof. S. P. Mehrotra, Director, NML (left) and Dr. P. K. Bhattacharya, Sr. Scientist presenting the paper

Prof. S.P. Mehrotra, Director and Dr. P.K. Bhattacharya, Senior Scientist participated in the XII International Mineral Processing Congress (IMPC) held at Cape Town, South Africa during 28 September – 3 October, 2003.

Prof. Mehrotra presented a paper entitled "Mathematical modelling of jig bed stratification" jointly authored by B.K.Mishra. Dr. P.K. Bhattacharya too presented a paper entitled "Efficient elimination of stubborn slimes using a hydrocyclone" which was jointly co-authored by D.M. Chakrabarti, B. Banerjee, P. Saha, B.R. Sarkhel and J.P. Srivastava.

International Mineral Processing Congress (IMPC) meetings are held on an average every 2-3 years, usually in Europe or North America. After Sao Paulo in 1977 and Sydney in 1993, the XXII meeting is only the third time that an IMPC has been held in the Southern Hemisphere.

IMPC is the most prestigious conference series in minerals engineering. The minerals industry in South Africa has traditionally been a loyal supporter of both university research and conferences. The technical programme was conducted in four parallel sessions, consisting of 144 oral presentations and 76 short oral presentations based on posters, in addition to the 144 posters displayed adjacent to the trade exhibition. The five plenary speakers presented an overview of globalization, the future impact of fundamental research, education, sustainability and the mine of the future. Experts presented an overview of comminution, flotation, interfacial chemistry, hydrometallurgy, pyro-metallurgy, recycling and processing trends in eight keynote papers. The XXII IMPC was held in the brand new Cape Town Convention Centre, which offered world class facilities adjacent to the tourist attraction of the Cape Town Waterfront.

Talks Delivered

Speaker	Topic	Date
Prof. H.J. Christ Dean of the Mechanical University of Siegen, Germany	Cyclic stress-strain response of metals & alloys- Modelling on a microstructural basis	Oct. 10, 2003
Dr. S. K. Narang, Scientist NML	'Pandit Jawahar Lal Nehru and Bhartiya Vigyan Sansthanon Vikas' (AIR, Jamshedpur)	Nov. 13, 2003
Dr. S. K. Narang, Scientist NML	'Water-elixer of life'	Nov. 20, 2003
Dr. Stan Terras Renishaw Group, U.K.	Raman Spectroscopy	Dec. 8, 2003
Dr. Ajit K. Roy, Associate Professor Dept: Mechanical Engg. UNL V, Las Vegas	Characterisation of Corrosion & Metallurgical Behaviour of Materials for Nuclear Applications	Dec. 23, 2003
Mr. R. Prabhakaran Graduate Student Mechanical Engg. UNL V, Las Vegas	Stress Corrosion Cracking of Transmutation Target Structural Materials	Dec. 23, 2003
Mr.V.Marthadam Graduate Student Mechanical Engg. UNLV, Las Vegas	Residual Stress Measurements Using Destructive and Non-destructive Methods	Dec. 23, 2003
Prof. S. P. Mehrotra, Director NML	'Aaj Ke Mehmaan' (AIR, Jamshedpur)	Dec. 25, 2003

IIM Awards



Mr. A.K.Panda, Project Fellow received the first Prize for poster presentation in "Metals Science" category in the 57th Annual Technical Meeting held at Kolkata during 14-16 November 2003 for the paper entitled "AFM observations of surface morphology and soft magnetic properties of nano-crystalline $\text{Fe}_{71}\text{Nb}_{3.7}\text{Cu}_{1.3}\text{Mn}_{0.8}\text{Si}_{13.5}\text{B}_7$ ribbon". The paper was jointly authored by S. Basu, Materials Science Centre, Indian Institute of Technology, Kharagpur, M. Manimaran, Department of Electrical Engg., University of Notre Dame, USA and I. Chatteraj, A. Mitra from National Metallurgical Laboratory. The FeNbCuSiB based alloys are generally prepared in the form of amorphous ribbons by rapid solidification route using melt-spinning technique. On optimum heat treatment of the amorphous ribbons, a two-phase microstructure generated whereby $\alpha\text{-FeSi/Fe}_3\text{Si}$ nano particles were dispersed in the amorphous matrix. At this nano-crystalline state the materials exhibit superior soft magnetic properties. Such properties are generally addressed by structural changes taking place in the bulk of the material. In the present study besides bulk structural developments, corresponding surface morphological modification on the soft magnetic properties of $\text{Fe}_{71}\text{Nb}_{3.7}\text{Cu}_{1.3}\text{Mn}_{0.8}\text{Si}_{13.5}\text{B}_7$ alloy was investigated. Surface morphology studies by AFM showed that the material, which was predominantly amorphous in the as-cast state indicated segregates in the form of Cu atoms seated within the holes in the surface topography. With increase in annealing temperature, nucleation and subsequent growth of $\alpha\text{-Fe}$ phase indicating relatively low surface roughness and ultrasoft magnetic properties. The correlation between the surface morphology and magnetic properties were explained by nucleation and growth model. At elevated temperatures formation of strongly magneto-crystalline anisotropic crystalline phases like Fe-borides and Fe Nb deteriorated the soft magnetic properties. The occurrence of these phases in the form of multiple protrusions increased surface roughness.



Shri Ajay Kr Mandhyan, QHF was awarded first Prize for Best Oral Presentation in "Non-Ferrous, Waste

recovery & Environment Management" category in the 57th Annual Technical Meeting (NMD-ATM, 2003) held at Kolkata during 14-16 November 2003 for the paper entitled "Hydrogen Permeation Behaviour of High Strength Aluminium Alloy (AA7010)". The paper was jointly authored by B.M. Kannan, V.S. Raja, R.Raman and A.K. Mukhopadhyay. Hydrogen permeation measurements were performed on foils of high strength aluminium alloys using electrochemical double cell technique. The potentiostatic permeation technique was applied. The diffusion co-efficients of Al-alloy (AA7010) in different heat-treated conditions were obtained, which are in agreement with the similar work carried out. One interesting observation was the difference in diffusion coefficients in two tempers i.e. T6 and T73. T6 was found to have higher value of diffusion coefficient ($1.13 \times 10^{-6} \text{ cm}^2/\text{s}$), as against the value for T73 ($1.85 \times 10^{-7} \text{ cm}^2/\text{s}$), which can be attributed to extremely fine grain boundary precipitates present in T6 heat-treated alloy and coarse grain boundary precipitates (blocking the H transport). One more observation was the difference in diffusivity along different rolling directions. The short transverse direction of T73 treated alloy is found to have higher D value ($5.37 \times 10^{-7} \text{ cm}^2/\text{s}$), as compared to planar direction ($1.85 \times 10^{-7} \text{ cm}^2/\text{s}$). This can be due to the larger grain boundary area in short transverse direction than that of planar direction.

Best Paper Award



Dr. B. Nayak, Scientist, MNP Division received the Best Paper Award for the paper entitled "Hydrothermal Sulfide Mineralisations in the Mid-Ocean Ridges of the Indian Ocean" for the year 2003 published in the Bulletin of the Society of Geoscientists and Allied Technologists, Bhubaneswar on December 20, 2003.

Seminars Attended / Papers Presented

- Dr.S.Subba Rao attended a "National Seminar on Clean and Sustainable Technology" organized by IICChE, Pondichery Chapter during 10-11 October, 2003.
- *Reduction leaching of manganese ore in sulphuric acid medium using bagasse An Agro-Industry Waste*, by B. R. V. Narasimhan, S. Kumar, D. Gomathi and T. S. N.Sankara Narayanan, presented at NMD-ATM 2003, IIM, held at Kolkata during 14-16 November, 2003.
- *Kinetics of dissolution of combustion synthesized cobalt doped alumina in sodium hydroxide and sodium carbonate media*, by P.Gupta and B.R.V.Narasimhan, presented at NMD-ATM, 2003 held at IIM, Kolkata during 14-16 November, 2003.
- *Studies on the utilization of fly ash and copper converter slag to produce cement concrete tiles*, by S.Tripathi, B. R. V. Narasimhan and A.Rajakumar, presented at NMD-ATM, 2003 held at IIM, Kolkata during 14-16 November, 2003.
- *Wear resistance of electro-deposited Ni-B alloy films*, by K.Krishnaveni, T. S. N. Sankara Narayanan and S.K.Seshadri, presented at NMD-ATM, 2003 held at IIM, Kolkata during 14-16 November, 2003.
- *Acid leaching of natural graphite and production of expanded graphite*, by Shukla, B. R. V. Narasimhan and A. Rajakumar, presented at NMD-ATM, 2003 held at IIM, Kolkata during 14-16 November, 2003.
- *Synthesis of ultra pure fine ferric oxide by thermal decomposition of ferrous carbonate*, by B.R.V.Narasimhan, D.S.Rao and S. Prabhakar, presented at NMD-ATM, 2003 held at IIM, Kolkata during 14-16 November, 2003.
- Dr. T. S. N.Sankara Narayanan attended an International Conference on Advances in Surface Treatment: Research & Applications (ASTRA-2003), organized by ARCI held at Hyderabad, during 3-7 November, 2003.
- *Borohydride reduced electroless nickel deposits - Their role in surface engineering*, by K.Krishnaveni, T.S.N.Sankara Narayanan and S.K.Seshadri, presented at ASTRA 2003 in the International Conference on Surface Modification Technology held at Hyderabad during 3-6 November, 2003.
- Dr. T.S.N.Sankara Narayanan and Satendra Kumar attended the NMD-ATM 2003, organised by IIM, Kolkata during 14-16 November, 2003.
- Dr. T.S.N. Sankara Narayanan and K. Gopalakrishna have attended the Satellite Conference on "Materials and Technologies for Nuclear Fuel Cycle" conducted by IGCAR, Kalpakkam at SERC held at Chennai during 15-16 December, 2003.
- *Effects of doping transition metal ions (Mn, Co and Ni) on the thermal and magnetic properties of gamma ferric oxide*, by B. R. V. Narasimhan, S. Prabhakar, A. Stephen, P.Manohar and F.D.Gnanam, presented at the 67th Annual Session of The Indian Ceramic Society held at Chennai during 9-11 January, 2004.
- Dr. G. Bhaskar Raju attended the 38th Leather Research Industry Get-together on "Paradigm Shift in Leather Product" held in Chennai during 27-30 January, 2004.
- *Development of semi-commercial flotation column and beneficiation of sillimanite*, by S. Prabhakar, G. Bhaskar Raju and S. Subba Rao, presented at the National Workshop and Seminar on Sustainable Development of Coastal Placer Minerals held at New Delhi during 1-2 February, 2004.
- *Studies on the beneficiation of barites*, by G. Bhaskar Raju, S. Prabhakar and S. Subba Rao, presented at MPT 2004 held at RRL, Bhubaneswar during February, 2004.

CII Members visit NML

On November 7th, 2003, 22 members of the Technology Upgradation Panel, Confederation of Indian Industries (CII), Jharkhand visited National Metallurgical Laboratory (NML) Jamshedpur to familiarize themselves with R&D activities of the laboratory. An overview of NML was presented by Prof. S.P. Mehrotra, Director, NML, which was followed by a visit to select facilities of NML. They visited Melting Section, Analytical Chemistry Centre, Mechanical working, Creep Lab, Transmission Electron Microscope, Scanning Electron Microscope and X-ray diffraction units of NML. At the end they had an interactive session with Director/Head of Divisions/Scientists where they discussed the technological needs of CII Members.



Prof. S. P. Mehrotra addressing the CII members. On his left, NML Scientist is seen interacting with two CII members.

19th World Mining Congress and Expo' 2003

The 19th World Mining Congress and Expo'2003 with the theme on 'Mining in the 21st Century', was inaugurated by His Excellency, Hon'ble President of Republic of India, Dr. A.P.J. Abdul Kalam on 1st November, 2003. Other dignitaries present on the occasion included Shri Kariya Munda, Minister of Coal, Govt. of Jharkhand, Shri K.C. Pant, Dy. Chairman, Planning Commission, Govt. of India. NML participated in the Expo along with few other CSIR Laboratories. On the whole the event was a grand success. Nearly 2500 visitors registered their names and showed keen interest on various NML technologies, facilities and in-house publications.

Swadeshi Mela

NML participated in the Swadeshi Mela organised by the Swadeshi Jagran Foundation during 12-17 October, 2003 at Gopal Maidan, Jamshedpur. The main objective of the Mela was to promote Bharatiya efforts in self-reliance through promotion of indigenous industry aiming to strengthen, promote and help the national economy to go within the overall framework of Bharatiya need and value system. About 5000 visitors visited NML stall over these six days. 352 visitors showed their keen interest in NML technologies products. Fly ash products, Corrosion protection and Eco-friendly cokeless cupola were the main attraction among the entrepreneurs.

Wishing a Happy Retired Life

Shri K.B. Das, Gr.I.(2); Shri A.C. Dandapat, Gr.II(4); Shri V.N. Singh, Gr.II(4); Shri Bhagwani, Gr.II(4); Dr. V.N. Choudhury, Scientist Gr.IV(5); Shri B.R. Sarkhel, Tech. Officer III(7); Shri N.Singh, Gr.II(3).



India International Trade Fair

NML participated in the India International Trade Fair which was held at Pragati Maidan, New Delhi during 14-27 November, 2003. The event was organized by the Department of Scientific & Industrial Research in collaboration with the India Trade Promotion Organisation (ITPO). This year the main focus at the CSIR pavillion was on Engineering Design capabilities in different National Laboratories. NML, being one of the establishments presented the Engineering Design relating to its three processes, namely : (1) Gas Cleaning System, (2) Cokeless Cupola and (3) Magnesium Technology. The exhibits were supported by models. NML also put up a stall at the Jharkhand State pavillion. More than 5000 visitors comprising students, teachers, R&D workers, entrepreneurs, bureaucrats and dignitaries visited the stall. Several visitors showed keen interest on various NML technologies, facilities and in-house publications.

ISO AWARENESS PROGRAMME

An Awareness-cum-Implementation Programme on ISO 9001:2000 QMS was organised at NML Premises on 15th October, 2003. Altogether twenty-one executives and staffs belonging to Administration, Finance, Stores & Purchase Divisions participated in the daylong deliberation. This was a part of continual training programme on ISO 9001:2000 at NML, the training was imparted by internal faculty members, most of them being certified ISO Lead Auditors. The Technical Session was started with the deliberation by Dr. S.P. Chaudhuri, MR on the topic "ISO-9000 Quality Management System & Eight Quality Management Principles." This was followed by in-depth Clause wise

Analysis demonstrating conformity to ISO 9001-2000. The first part was elucidated by Shri Ratnakar Singh and the remaining part by Dr. K. Chatterjee, ISO Co-ordinator. Mr. K. K. Gupta spoke on the topic "Records & Documents required by ISO 9001-2000 and their Maintenance". Mr. Vinod Kumar from Administration and Mr. A.M. Pradhan shared their experiences with the fellow participants regarding the progress achieved towards bringing their Divisions under ISO certification. The day long session concluded with a detail interaction between the participants and the faculty members.

SSBM FINAL INDOOR TOURNAMENT

In the 36th SSBM final tournament held at RRL Trivandrum on 28th and 30th November 2003. Sri Manjit Singh and Sri Naeem Ansari has won the Runners up trophy for the first time in carrom.



Sri Manjit Singh receiving the trophy from Mrs. V. Mashekar, Dr. R. A. Mashelkar, DG CSIR is seen on her right side.