



A Monthly Inhouse Bulletin

NML NEWS

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Research Council's Meet

The 22nd Research Council's Meet has been organised on Wednesday, the 23rd February, 1994, to review and monitor the R&D progress achieved by the Laboratory during August- November, 1993. The day-long meeting was attended by the Council's Chairman, Dr. J. J. Irani, along with Prof. B. K. Dhindaw, Dr. S. K. Gupta, Shri R. N. Parbat, Dr. V. Ramaswamy, Prof. P. K. Rao

Laboratory's Director, Prof. P. Ramachandra Rao, Head-Information and Research Management, Dr. K. K. Mishra and scientists of the Laboratory. Three special invitees - Dr. S.L. Malhotra, INSST, New Delhi; Shri U.K. Jha and Shri F. Vandrevalla from TISCO also participated in the meeting.

While welcoming the gathering, Prof. P. Ramachandra Rao, presented the significant achievements of the Laboratory during the period of review. Prof. Rao informed the house that the Third World Academy of Sciences, Trieste (Italy), under the presidentship of the nobel laureate, Prof. Abdus Salam has adjudged NML as a "Centre of Excellence in the South."

With respect to manpower of the Laboratory, he apprised that about 20-25 persons were retiring every year but no fresh recruitment was made. In this, we have to guard against capability/skill gaps, Prof. Rao said.

He emphasised the need to attract middle sized companies which don't have their own R&D set up. He also stressed on the laboratory's plan to undertake annual agreements with such companies on a retainership basis. During last four months, NML has bagged five new projects, namely, (1) Nano-sized alumina sponsored by TISCO, (2) Mitigation of environmental problems caused by metallurgical industries in Howrah sponsored by Central Pollution Control Board, (3) Extraction of gold and silver from copper concentrate sponsored by Hutti Gold Mines Co.Ltd., (4) Deoxidation of low carbon micro-alloyed steels (in collaboration with IIT, Kharagpur) sponsored by CSIR and (5) Inspection/Registration of diagnostic X-ray and other related equipment for the state of Bihar, sponsored by Atomic Energy Regulation Board.

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Wonder Seed aids gold concentration

A group of scientists working under the guidance of Prof. P. Ramachandra Rao, Director, NML have found that around 95% of the gold is retained by the seeds of the tree, *Strychnos potatorum*, thus providing an alternative route for the recovery of gold from ore samples. This may result in an entirely eco-friendly method for the pre-concentration of gold from ore sample because of its non-toxic and bio-degradable nature. The seeds have been traditionally used for clearing muddy water by the villagers for centuries in Andhra Pradesh.

Recently, Dr. Y. Durga Prasad, a Hyderabad based bio-chemist reported that these seeds can bind toxic metals like uranium and thorium. The seeds are reported to be very effective as coagulant aids.

The analysis of finely powered seeds shows : moisture, 8.26%; nitrogen, 1.33%; total alkaloids, 0.17%; and ash, 1.34%. Work is in progress at NML to isolate the protein from the seeds which is responsible for binding metal ions. Other applications of these seeds in mineral processing and pollution studies are also being explored.



Prof. P. Ramachandra Rao (left) with Dr. J. J. Irani while reviewing the Laboratory's progress



Research Council Members (from left : Prof. P.K.Rao, Dr. B.K. Dhindaw, Shri R.N.Parbat, Dr.K.K.Mishra Prof. P.Ramachandra Rao, Dr. J.J.Irani, Dr. S.K.Gupta and Dr.V.Ramaswamy

Prof. Rao mentioned that in a sustained attempt to interact closely with the industries, NML has organised a refresher course on Ferro-Alloys and a workshop on modern methods of chemical analysis during the period. The Laboratory has also had the privilege of having the first "Indian Refractory Congress" at its premises. In the near future, it has a plan to conduct refresher courses on "Heat Treatment" and "Metallurgy for thermal power plant engineers". Three MoUs: (1) Annual contract for testing with M/s Alpha Standards, Madras, (2) CRISPEN software with NPL (England) and (3) General R&D with M/s Panyam Cement, Hyderabad were signed.

While interacting with the scientists, Dr.S.K.Gupta, Chairman and Managing Director, MECON, appreciated NML's R&D efforts and felt happy that NML could assist in solving the bottlenecks effectively for the

sponsors. He appreciated the idea of "Retainership" by the laboratory in light of the economic liberalisation.

Prof. B.K.Dhindaw of IIT, Kharagpur stressed on the need for maintaining records and samples of failure. Such documentation will help to save time in future endeavours and also enhancement of knowledge-base. Shri R.N.Parbat of INDAL suggested that while presenting the completion reports of a project, the sponsor may also be invited which will improve the impact of the work accomplished and on spot interaction with the user agencies for a better acceptance. Dr.V.Ramaswamy of SAIL, expressed his happiness over the new product "High energy density magnets" developed at the Laboratory. Prof. P.K.Rao of IIT, Bombay suggested that instead of one, a few more interesting results could be

presented including the interactive/collaborative programme.

Dr. J.J. Irani, Managing Director, Tata Steel, in his address, stressed the need for venture research. He said R&D scientists must be allowed at least 20% of timing for the research of their own choice. Dr Irani further pointed out that the scientist must read as much as possible and conduct considerable literature survey to avoid repetition of research work. He expressed his happiness over NML's effort on sponsored research. With respect to Tata Steel - NML interaction, he mentioned about the mutual benefits accrued upon. He indicated that while a few of the projects of TATA-NML collaborations were dropped as uneconomic but some of them were under production and had market acceptability. Dr Irani, however, said that strict adherence to time schedules is the prime concern of the sponsors. □

R & D Highlights

Beneficiation and purification of tungsten ores of India

Results so far obtained were very encouraging and concentrates analysing 20-40% were produced with combinations of magnetic, gravity and flotation techniques with recoveries ranging from 60-75%. This was considered, therefore, technically feasible and encouraging. Recovery of tungsten from preconcentrates assaying 5-20% WO_3 by chemical leaching, has already been established. NML process however involves dry-cum-wet as well as wet circuit routes. In addition to the studies on physical and chemical beneficiation, a data base on tungsten resource and its utilisation was also created. Standardisation of analytical techniques both wet as well as instrumental were completed. □

Advance high strength ferrous alloys

The details of alloy preparation through open air/vacuum induction furnace to obtain correct composition, free from inclusion etc. was done at the laboratory. Heat treatment, controlled rolling and accelerated cooling were also carried out. The final product was investigated through optical, transmission and electron diffraction routes for the study of acicular ferrite. Dilatometry in the Fast Quenching Dilatometer was carried out for samples obtained after different cooling rates to verify the phase transformation. Hardness study was made for all the samples.

Gleeble Simulator Machine recently procured by TISCO was utilised for dilatometric study and recrystallisation

behaviour of the samples during controlled cooling condition under different strain rates. These samples were investigated by optical and transmission microscopy techniques. □

Remaining life assessment of process heater tubes

Accelerated mechanical tests, microstructural examination and magnetic property measurements were carried out in the laboratory on service exposed tubes collected from 7 different units of IOC Refineries. The study revealed that carburization due to diffusion of carbon in ferrite from the inner wall of the tube as a result of prolonged high temperature exposure is the major form of damage accumulation. YS, UTS and stress rupture strength of service exposed materials were found to be still

higher than the minimum specified value. Magnetic studies indicate that saturation magnetization has a direct correlation with depth of carburization. Therefore, this could be exploited to develop a portable NDT tool to measure depth of carburization. Based on the above findings a simple procedure has been suggested for life estimation of heater tubes. To facilitate such calculations at plants by operating engineers a frame work for life estimation has been provided in the form of a menu driven computer software called RELIEF-H. The name is derived from the underlined letters of the title "Remaining Life Estimation Framework for Heater Tube".

High energy density magnets

A new method using purely chemical reduction reaction has been developed for the synthesis of finely divided loose powder of $\text{Nd}_2\text{Fe}_{14}\text{B}$ alloy. Thermal stability and technology (especially for anisotropic magnets) of the powder has been studied. The process developed by NML takes entirely a different route from those developed elsewhere.

Papers published

- o Das S.K., (1993) Mathematical investigation of the flow profile sensitivity of the electromagnetic velocimeter for metallurgical fluid flow measurements. *Trans. Indian Inst. Met.* 46 :141-143.
- o Bandopadhyay D., (1993) A study on the kinetics of iron oxide reduction by solid carbon, *Steel Research* 64 (4) : 340.
- o Bhaskar Raju G., Prabhakar S. and Sankaran C. (1993) Beneficiation of iron ores by column flotation. *Trans. Inst. Mining and Metallurgy*, 102 : C135-35

Paper presented

Dr. Aruna Bahadur, scientist, participated in an International Conference on "Structural Intermetallics" held at Hyderabad during February, 1994 and presented a paper on 'Improvements in Mechanical Properties of Iron-Aluminides' Co-authored by Dr. O. N. Mohanty.

Talk organised

'Physics in ancient India' by Dr. N. G. Dongre, Director, SAH Research Institute, Varanasi (28.02.94).

NML participates

Fifth Refresher Course on Mineral Beneficiation

A refresher course on 'Mineral Beneficiation' was organised at Regional Research Laboratory, Trivandrum during 7-12 February, 1994. This was the 5th short term course in the series conducted by the institute of Mineral Engineers. The topics covered in the present one centred around "Fine particle processing". National Metallurgical Laboratory was one of the major participating agencies. Mr. N. Chakravorty, Mr. S. C. Maulik and Mr P. D. P. Rao were responsible for organising the course from NML side. The scientists deputed as participants were: Mr. B. R. Sarkhel, Dr. S. Subba Rao and Mr. Alex Thomas.

The dignitaries, who participated include Mr. M. S. Nagar, CMD, Indian Rare Earths Ltd., Dr. T. C. Rao, Director, RRL, Bhopal, Dr. V. Nair, Dy. Director, RRL, Trivandrum, Mr. K. N. Gupta and Mr. N. Chakravorty, Dy. Directors, NML, Jamshedpur, Mr V.S. Bashir, DGM, Indian Rare Earths, Quilon and Mr. L. Prasad, TRF, Jamshedpur.

Prof. T.C. Rao, delivered a talk on Gravity separation and its application to fine particles processing. The talk covered the basic aspects of plant practice and was quite thought provoking. Mr. V.S. Bashir spoke on the beach sand beneficiation practices at Indian Rare Earths. Earlier, Mr. Nagar, also highlighted various ongoing activities at IRE, Quilon.

Mr. N. Chakravorty spoke on Mineralogy and its application to mineral beneficiation. The topic was exhaustively discussed with many case studies. Various micrographs were shown for substantiating



Prof. T.C. Rao addressing the participants

and for better understanding of the subject. Dr. Lalitambika, scientist, RRL, Trivandrum gave a talk on the characterisation and exploration of clay minerals. Mr. C.P.S. Nair, Chief Technical Advisor (Retired), Ministry of Mines, spoke on the topic of Mineral resources and their exploitation in India with particular reference to South India. Mr. Nair dealt in detail with the mineral resources and production in southern states. Mr. L. Prasad spoke on the plant design aspects in fine particle processing.

Mr. K.N. Gupta spoke on Processing of Iron ore fines. The world scenario of iron ore slimes was described with some examples. The fines usage in emerging iron making technologies was also presented. Dr. B. Das, scientist, RRL, Bhubaneswar spoke on Chemical mineral processing to treat difficult ores.

An industrial visit was organised to the IRE, Beach sands processing plant at Chavara. The participants were also taken to the R&D centre of IRE at Quilon.

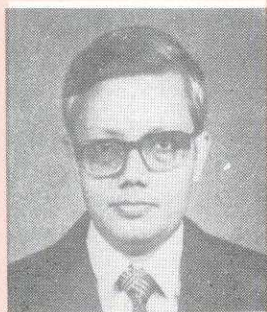


Seen on the dais from left : Shri N. Chakravorty, Dr. V. Nair, Shri C.P.S. Nair and Shri K.N. Gupta



A keepsake photograph of the Refresher Course participants

MRSI Medal to NML Scientist



Dr. R. N. Ghosh

The prestigious Materials Research Society of India (MRSI) Medal for the year 1993 has been conferred on Dr. R.N. Ghosh, Scientist in recognition of his outstanding work in the area of modelling high temperature creep behaviour of steel and superalloys. His work has led to not only a better understanding of the mechanism of creep deformation but also has significantly reduced the total testing time required for their complete characterisation.

Dr. Ghosh received his B.Tech Hons. (1969), M.Tech. (1971) and Ph.D. (1981) from the Department of Metallurgical Engineering, IIT, Kharagpur. He is the recipient of the Alumni Association Medal of IIT Kharagpur on being adjudged as the best post graduate student of the session 1969-1971.

Dr. Ghosh started his professional career as a Lecturer in Deptt. of Met. Engg., IIT, Kharagpur. He has more than 10 years of experience in teaching a wide range of subjects at both under graduate and post-graduate level. He joined the 'High

temperature Creep Testing Group' at NML in December, 1982 and since then he has been actively involved in the testing and evaluation of indigenous grades of steel for power plant application. A new division of Computer Application was established at NML under his guidance in 1987. Ever since, a wide range of user friendly computer softwares have been developed by the Division. Some of the softwares particularly those developed by him for creep life prediction of single crystal super alloy are being used by NPL, Teddington and Imperial College, London. He has been instrumental in popularising the use of numerical techniques in the analysis of creep and stress rupture data in our country.

Patent filed

- o "A process for the production of Nano-size Neodymium-Iron boron permanent magnet alloy powder" by P. Ramachandrarao, V. Rao, S. Ram and A. Sinha.

STAFF NEWS

Honours/Awards

- Dr. S.K. Narang, scientist has been elected as
 - Vice-President of Electrochemical Society of India, Bangalore.
 - Chairman, Electroplating and Metal finishing group of SAEST (India) Karaikudi
 - Member, organising Committee of INDFIN'93.
- Dr. S. Prakash, scientist has been elected as Fellow of the Institutions of Engineers.

- Shri Chheda L. Jha has been awarded M.Sc. (Engg.) in Mechanical Engineering by RIT, Jamshedpur.

Training

- o Dr. B.D. Pandey, Shri Ratnakar Singh, Shri P.V. Viswanathan, Scientists and Shri K.D. Mehta, Research Associate have attended a short-term course on Bio-hydro-metallurgy held at Indian Institute of Science, Bangalore during January 10 to 15, 1994.
- o Shri A.K. Dutta, Scientist, has attended an advanced course on 'Investigation, Assessment and Rehabilitation of distressed concrete structures' held at Structural Engineering Research Centre, Madras from January 31 to February 4, 1994.

Recognition



S.N. Ghose

Shri Sachin Ghose, a NML Staff at the Regional Liaison Centre, Calcutta has been applauded by the Nobel Laureate Mother Teresa for his active role in the societal welfare activities. Shri Ghose also holds the position of the Secretary of Calcutta Zonal Committee, a Nabadwip based Welfare Organisation for last five years.

Welcome at NML.....

Dr. George V. K. Puvvada, Dr. N. K. Mukhopadhyay, Quick Hire Fellows, Shri S. Prakash and Shri Sanjay Kumar, Junior Research Fellows, Shri B. Goswami, Project Assistant.

Wishing a happy retired life...

Shri P.K. Sinha, Scientist-C, Shri M.N. Mukhopadhyay, Admn. Officer; Shri M.C. Mondal and S.C. Ram, Tech. Assts.