From the Director's Desk

Chairman & Members of the Research Council,
Invitees and Dear Colleagues,

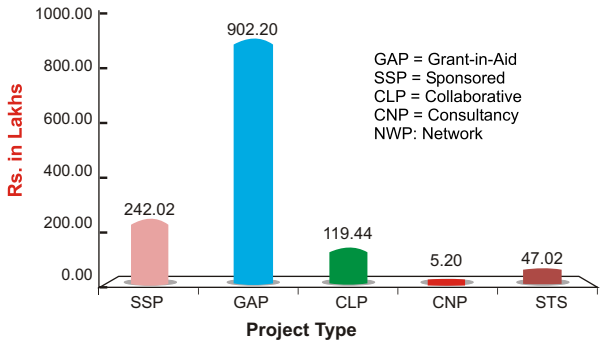
I take great pleasure in convening the 61st Research Council meeting of CSIR-NML. It is a privilege to welcome our chairman Shri H M Nerurkar and the other esteemed Research Council members for this meeting. It is for about two years now that this Research Council has been functional and I should say that we have made remarkable progress during this period and I wish to thank the Research Council especially its chairman for the unstinted support and guidance in steering this laboratory in the right direction. I will briefly showcase our performance. It would also be appropriate to bring to the attention of the august Research Council, the feedbacks received from the various Project Review Committees, the CAG audit on the performance in the various state sponsored projects and the functioning of CSIR-NML as well as the compliments and complaints received from our major clients.

In my first Research Council meeting held in August 2010, my presentation of Vision@2022 was followed up by division-wise presentation by my senior colleagues on aligning with the Vision and achieving these goals and targets consistent with and leveraging upon the core research, human resource and infrastructural strength of CSIR-NML. In a couple of months, we would be launching the 12th Five Year Plan initiatives and I would once again brief the Research Council on the national mission projects that we plan to undertake during this plan period. I would request the learned Research Council to critically assess the progress made, suggest corrective measures if any and provide advice to accelerate the pace of growth and to realize our Vision.

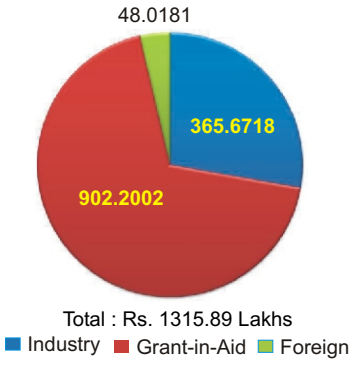
In this RC meeting, we would continue with the practice of reporting on the CSIR sponsored network and supra-institutional project, the other major flagship projects and presentation by my younger colleagues on some scientific and technological successes as well as have an extended session of the RC in the afternoon. We thought that it would also be appropriate to include some of the award winning work for discussion in the Research Council and accordingly the winners of the Nijhawan award, Altekar award and Banerjee award, will make presentations. One question that I have been asked in various forums is whether we condone scientific failures in projects and my answer has been that we encourage scientific outliers. We have therefore proposed that one such project which failed in terms of the expected outcome be dissected scientifically in this Research Council meeting. The progress made with respect to all the individual projects is included in the RC agenda compilation which has been circulated to the RC members.

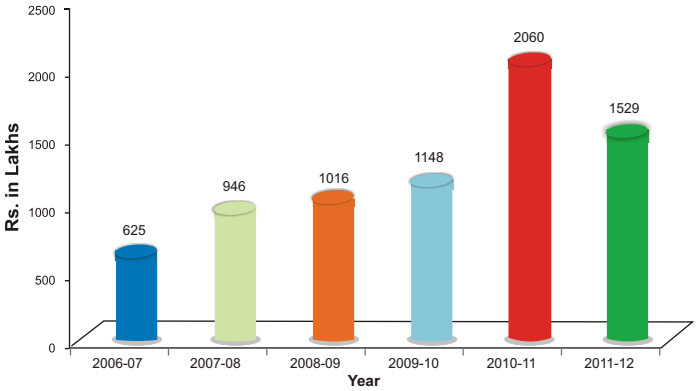
Overall Performance Parameters

The External Cash Flow of CSIR-NML during July-December, 2011, its distribution among the various categories of projects as well as the trend of the growth of ECF over the last 5 years is depicted below :



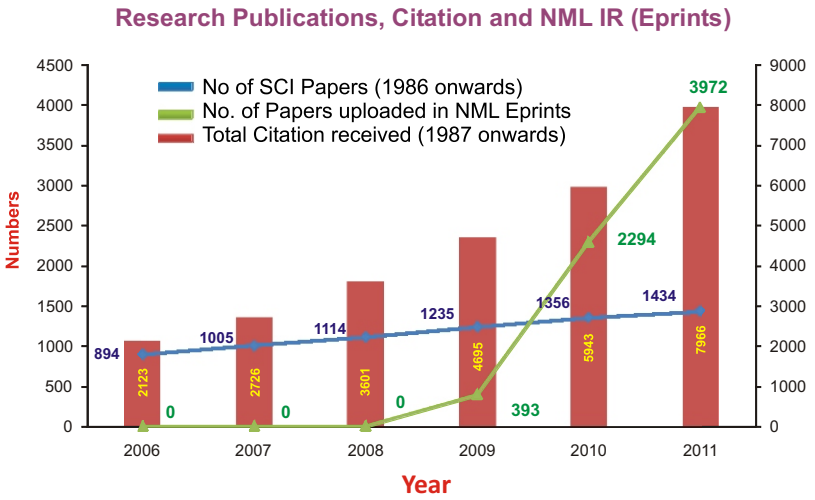
The overall external cash flow over the past six months as well as that achieved thus far in this financial year has shown a significant increase compared to the past. Although a major part of the external cash flow still comes mainly from government sponsored grant-in-aid projects, the extent of industrial funding has increased progressively.





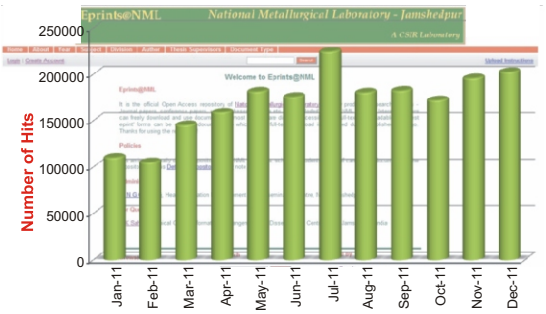
SCI Publications and Citations

The number of publications in SCI journals has remained good whereas the extent of citations of NML's publications has increased substantially indicating a greater scientific impact. All of NML's research publications are periodically uploaded to an Institutional e-Repository (http://eprints.nmlindia.org) which enables the scientific community worldwide to readily download the papers and utilize the results in their scientific research pursuits. This mechanism has enabled an exponential increase in the citations of CSIR-NML's research publications. Over one calendar year in 2011, the citations increased from 5943 to 7966 which accounted for a 34% rise indicating an increasing global visibility of NML's Research output.

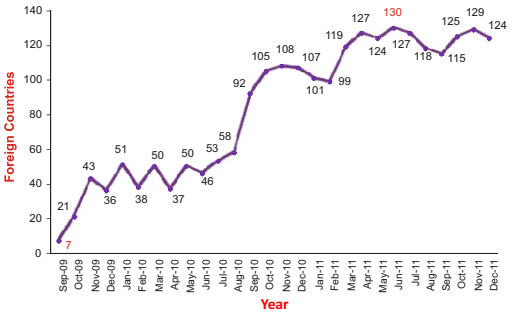


NML Institutional Repository: NML E-print

NML Institutional repository was launched in September 2009. Over the years, NML's repository has attained high global visibility and also popularity. Researchers from several foreign countries such as United States, Russia, China, UK, Hong Kong, Germany, Netherlands, Iran, Japan, France, Italy, Canada, Korea, Ukraine, Brazil, Poland, Australia, Turkey, South Africa have accessed the NML E-prints repository since its inception. By Dec 2012, the NML repository achieved a 7-fold increase in traffic, with over 200,000 hits per month and a cumulative total of over 2.92 million hits since inception. The maximum number of hits was 224,000 in July 2011. A recent review by the "Registry of Open Access Repositories", UK has shown that NML Institutional Repository ranks 4th in the country and 2nd among CSIR laboratories as on Jan 16, 2012 (Source: roar.eprints.org).



Showing Growth of NML E-prints in terms of hits



Online access of foreign countries to NML Eprints

Progress in Major Projects Pursued

Currently, CSIR-NML is pursuing a large number of projects (143 ongoing projects) in diverse areas ranging from multi-laboratory networked projects of CSIR, the supra-institutional project on steel funded by CSIR, projects on beneficiation and processing of low grade iron ores and coal funded by the Ministry of Steel, development of sodium extraction technology sponsored by the Heavy Water Board, critical projects for the strategic sector, several collaborative projects with industries especially Tata Steel, a large number of industry sponsored projects, projects sponsored by international clients, many innovative research projects funded by the grant-in-aid bodies and scientifically stimulating in-house projects.

The network project on *"Technology for assessment and refurbishment of engineering materials and components"* conceived and being coordinated by NML has been very successful in terms of the benefits accrued to the industry, new product and protocol development and synergizing the strengths of the various CSIR labs. The output has been excellent in the generic areas of sensor development and fatigue and fracture behavior of materials and components. One of the major aims of the network project was to develop capacity and expertise for industry relevant solutions and services. In this respect, about 100 instances of fruitful interactions with industries have taken place, which have resulted in spin-off sponsored projects. The cumulative value of such projects exceeds Rs 800 Lakh. Through the project assistantships enabled by the project and the support provided to numerous research fellows and research interns, more than 50 persons were facilitated towards obtaining a higher degree. The project has also yielded a generous number of research papers in SCI journals, copyrights and patents.

Under the *Supra-Institutional project on steel*, the main targets are the development of ultra-high strength steel (UTS>1800 MPa; YS>1600 MPa and Elongation > 8%), high deformability TWIP steels (UTS>1000 MPa, YS>700 MPa and uniform elongation > 50%) and steel foams. Using indigenous ESR, various compositions of Ultra High Strength Steels were developed and characterized. Thermo-mechanical treatment was carried out on these steels. In collaboration with IIT Madras, quench and partitioned steels are being developed. Characterization of these steels is in progress. I hope that at the least, the expertise and infrastructure developed under this project will pave the way for a strong steel development program for the steel industries in the immediate future.

The network project on *"Nanostructured Advanced Materials"* where NML is playing a major role as a nodal laboratory has made good progress since the last meeting. A process developed for converting nano HA to an injectable form has been demonstrated to M/s. IFGL. The mechanical property of the injectable nano-composite has been evaluated and their biocompatibilty confirmed at CSIR-CCMB. A GMI based sensing device was used to monitor the effect of microstructural variation in modified 9Cr-1Mo after high temperature ageing in M/s. BPCL. SrFe12O19 based permanent magnet has been prepared by a modified solid state method with some dopants which has resulted in a coercivity of 4600 Oe at room temperature as compared to an existing coercivity of 2000 Oe in these ferrites. The prepared powder has been sent to M/s. Mahindra Hinoday, Pune for fabrication of permanent magnet. I am hopeful that this technology of ferrite magnets would ultimately be transferred to this company for commercialization. Cu- and Ti-base bulk metallic glasses with small addition of Ni and Sn have been prepared. Cu- based BMG's exhibited compressive strength of 2000 to 2700 MPa with a ductility varying between 2 to 7%. Ti- based BMG's exhibited ~1800MPa compressive strength. Very recently, we have attained very high ductility (>20% elongation) in Cu-based BMG without compromising on the high strength as well as a very unique stress-strain behavior of high ductility BMGs in compression. It is time to explore the commercial exploitation of these BMGs.

Progress in Major Projects Pursued

NML is also partnering several other CSIR labs in a large number of Network projects. In the network project on *"Development of processes for Iron ore resources of India"*, a flow sheet was developed for the low grade iron ore samples and dumped fines from Gua and Meghtaburu mines of SAIL to produce sinter fines product of 63% Fe with 39% yield and pellet fines of 65% Fe with 33% yield by a combination of jigging, spiralling and magnetic separation. In the network project on *"Development of cost effective mine water reclamation technology for providing safe drinking water"*, a 25000 litres/day pilot plant based on CSIR-NML's process is being commissioned in a Bharat Coking Coal mines at Dhanbad and is expected to be operational soon. In the project on *"Development of speciality inorganic materials for diverse application"*, a significant achievement has been the development of a field testing device for As(III), As(V) and F- in aqueous medium. In the network project on *"Development of advanced light weight metallic materials for engineering applications"*, a noteworthy contribution has been the development of Al-foams. Sandwich foam panels with a size of up to 20 cm x 12 cm x 25 mm were made. In the project on *"Nanomaterials and nano devices for application in health and diseases"*, a major achievement has been the establishment of bioactivity of nano-bioceramics and the transfer of this know-how to M/s. Surgiwear Ltd. In the network project on *"Engineering of structure against natural and other disasters"*, a significant accomplishment has been the correlation of cyclic tearing data on 304LN stainless steel obtained from specimen (carried out at NML, Jamshedpur) with that of component (carried out at SERC, Chennai). These results have great significance in evaluating the component properties in nuclear plants and will be used by BARC for their nuclear energy program. In the project on *"Zero emission research initiative"* aimed at technology development for the treatment of sectional wastewaters in the leather tanning industry, pilot scale electrooxidation systems (0.8 m^3/h capacity) were designed, developed, fabricated and installed at Kanpur and Erode jointly by CLRI and NML Madras Centre. The technology demonstration is under progress. In the network project on *"Advancement in metrology"* coordinated by CSIR-NPL, certified reference materials for coal have been prepared and are undergoing inter-laboratory comparisons whereas it was found that sponge iron sample was not suitable for the preparation of CRM because of its instability in ambient atmosphere. I expect that the Coal CRM's would be commercialized soon. In the project on *"Use of natural minerals for providing safe drinking water at domestic level in the state of Jharkhand"*, a comprehensive and dynamic database on naturally occurring minerals as water purifiers has been developed and launched. I understand that this database is being extensively accessed by the scientific community. I am hopeful that some of the lab-scale product development and field trial level successes achieved in these network projects will be translated to commercial exploitation in the course of time.

Four major projects sponsored by the Ministry of Steel are currently on at NML: 1) *Improvement in sinter productivity through deep beneficiation and agglomeration for rational utilization of low grade iron ore and fines*; 2) *Alternative complimentary route to direct steelmaking with reference to Indian raw materials*; 3) *Development of technology to produce clean coal from high ash and high sulphur Indian coal* and 4) *Production of low phosphorus steel using DRI through induction furnace route adopting* innovative fluxes and/or design (refractory) change. In the *1st project*, three iron ore samples viz. Waste Dump Fines, Low Grade Ore and Slimes were characterized with respect to physical, chemical and mineralogical characteristics as well as bench and pilot scale beneficiation were carried out and two alternate process flow-sheet producing 64.3% and 69.1% concentrate yields were developed. In the *2nd project*, the bulk generation of clean coal fines and optimization of micropellets preparation with iron ore and coal fines mixture was completed. Metallization studies were carried out under different conditions by varying temperature, time and ratio of ore and coal in the micropellets. In the *3rd project*, chemical beneficiation of as-received and beneficiated coal as well as processing of coarser size coal was completed. In the *4th project*, de-phosphorization studies with basic lining and different flux combinations have been completed. Major part of the experiments with acid lining and with similar flux combinations has also been accomplished. In the first review meeting by the PRC for these projects held in November, many valuable suggestions were given to reorient these projects with a view towards commercial exploitation of the research results if successful. I would exhort the PI and the team members to bear in mind that without prospects for commercialization of successful research results, they would remain an academic exercise and therefore it would be prudent to continuously reassess the relevance of some activities and take corrective measures.

The project on the *development of a technology for the production of sodium metal by fused salt electrolysis of sodium chloride* sponsored by Heavy water Board (HWB) has shown promising results. During the last six months, fabrication and operation of a 100A closed cell in which electrolyte bath was melted using internal AC heating system was carried

Progress in Major Projects Pursued

out. The 100A closed cell was operated in the presence of Heavy Water Board (HWB) Personnel and an engineering consultant firm. The cell was continuously operated for five days with controlled parameters. HWB personnel suggested the fabrication and operation of a 500A cell. They were of the view that scale up design of 500A cell is necessary as sufficient amount of sodium metal is not produced for withdrawal from the 100A electrolytic cell. However, the data generated in 100A cell was used for scaling up to 500A closed cell. The scale-up drawing of 500A closed cell was vetted by HWB and the cell has been fabricated in house. Sodium production trials in the 500 A cell is expected to commence soon.

NML had taken up the *development of silt erosion resistant material for turbines of hydro-generators* with financial support from CPRI, Bengaluru and had successfully developed a new alloy with vastly superior erosion resistant properties. Small components such as guide vanes and nozzle spear of Pelton turbine are in the process of being fabricated with the newly developed alloy and subject to field trials at Bhabha and Nathpa-Jhakri hydroelectric plants. Non-disclosure agreements with the manufacturer of nozzle spear ring and guide vane sealing rings have been signed. I am sanguine that the field trials will be successful and am excited about the prospect that years of effort gone into developing this material would finally bear fruit.

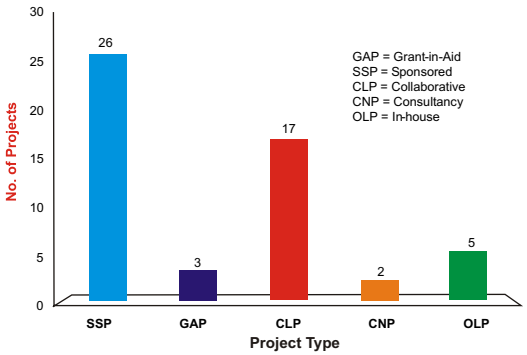
Korea Institute of Geoscience and Mineral Resources (KIGAM) has sponsored three major projects at NML. In the *1st project*, the objectives are the development of a leaching process for the separation/recovery of metals particularly Pb and Sn from the epoxy resin of PCBs obtained after the separation of metal layers from the organic swelled PCBs. The *2nd project* was undertaken to develop a metallurgical processes for the recovery of rare earth metals (REM) from Korean domestic RE concentrate/secondary materials on bench scale as well as the recovery of valuables in the form of value added products from the leach solutions of REM and feasibility studies for commercial exploitation of the process in association with KIGAM's core group. In the *3rd project* the Solvent extraction and Ion exchange studies for the separation/ recovery of rare metals from the model dilute leach liquor/solution of electronic scrap on bench scale will be conducted.

One of the outstanding successes in recent times has been the strong collaboration between Tata Steel and CSIR-NML through a large number of projects. Nineteen collaborative research projects were initiated during the year 2010-11 of which 15 projects have been completed and the remaining four are expected to be completed very soon. Some of the significant scientific & technological outcomes from these collaborative projects are:

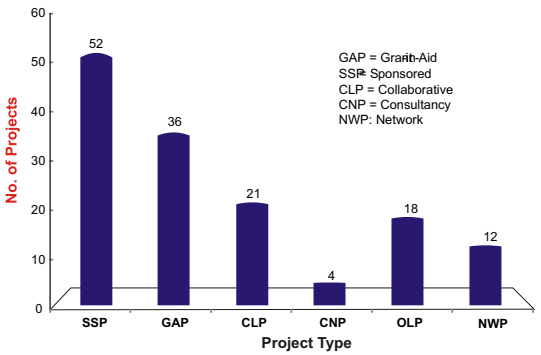
- Establishment of the precipitation behavior at the core and at the rim of 32 & 16mm TMT rebars.
- Understanding the inelastic cyclic deformation in high UTS/YS ratio rebars.
- Development of a process at pilot scale for making paving blocks using steel slag as main component. This process is being commercialized.
- Development of a single reagent system for the flotation of fine coal with high yield and low ash and their trials in the commercial plant.
- Detailed characterization of cementite dissolution (and precipitation) and its correlation with the wire drawing parameters and the tensile properties of cold drawn and annealed wires.
- Development of a plasma technique for deposition of WC-Co coatings on sink roll.
- Development of an iron ore pelletizing process for Blast Furnace iron making.
- Development of an ultrasonic technique for crack detection in rolls

The outcomes from these projects are at various stages of implementation and have been found to be very rewarding for team members from both sides. During 2011-12, another 15 projects in diverse areas have been initiated in collaboration with Tata Steel. In addition, a large number of industry sponsored projects, collaborative projects with industries, consultancy projects and scientifically stimulating in-house projects have been taken up in the past six months. These include projects with Korea Institute of Geosciences and Mineral Resources, Boeing International, General Electric and other multinational agencies. The major technology oriented projects being pursued for international clients are the *"Development of process flow sheet for beneficiation of Iron Ores from Atasu underground mines, Kazakhstan"* for Orken LLP, Arcelor Mittal and *"Development of coatings for replacement of Cd on Al-base alloys"* for Boeing and *"Studies on beneficiation of low grade iron ore sample from Morocco"* for Earthstone Iron ore resources, UAE.

It is hoped that some of these will eventually find its way to commercial exploitation. The number of projects taken up under various categories is shown below:



Projects Undertaken: July-December, 2011



On-going Projects (as on December, 2011)

Project Outcomes

Some significant outcomes from some of the sponsored projects in the past six months are:

(i) Commercial installation of a 3 metre diameter Column for the beneficiation of Barites for M/s. Indian Barytes & Chemicals Ltd., Mangampet, AP in collaboration with M/s. McNally Bharat Ltd.

(ii) Commissioning of a 25000 litres/day potable water pilot plant based on CSIR-NML's process in a coal mines at Dhanbad.

(iii) Successful development of a lacquer for Brass based on a new molecule and its field testing.

(iv) Successful operations of a 100 Ampere closed cell for sodium production and the installation of a 500 A closed cell.

(v) Development of a rare-earth free SrFe12O19 based permanent magnet with high coercivity.

(vi) Development of process for an injectable form of nanoHA and demonstration to M/s. IFGL.

(vii) Establishment of bioactivity of nano-bioceramics and the transfer of this know-how to M/S Surgiwear Ltd.

(viii) Correlation of cyclic tearing data on 304LN stainless steel at specimen (carried out at NML, Jamshedpur) and component (carried out at SERC, Chennai) levels.

(Ix) Design, development and fabrication of pilot scale electro-oxidation systems (0.8 m^3/h capacity) and its installation at Kanpur and Erode jointly by CLRI and NML Madras Centre.

(x) Development of process flowsheet for beneficiation of Iron Ores from Atasu underground mines, Kazakhstan.

(xi) Development of coatings for replacement of Cd on Al-base alloys for Boeing.

(xii) Establishment of precipitation behavior at the core and at the rim of 32 & 16mm TMT rebars.

(xiii) Understanding the inelastic cyclic deformation in high UTS/YS ratio rebars.

(xi v) Development of a process at pilot scale for making paving blocks using steel slag as main component. This process is being commercialized.

(xv) Development of a single reagent system for the flotation of fine coal with high yield and low ash and their trials in the commercial plant.

(xvi) Detailed characterization of cementite dissolution (and precipitation) and its correlation with the wire drawing parameters and the tensile properties of cold drawn and annealed wires.

(xvii) Development of a plasma technique for deposition of WC-Co coatings on sink roll.

(xviii) Development of an iron ore pelletizing process for Blast Furnace iron making.

(xix) Development of an ultrasonic technique for crack detection in rolls.

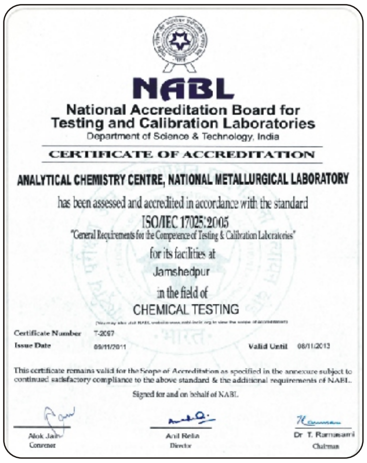
Some of the more promising developments in the immediate future are:

– CEA has authorized the field testing of guide vanes and guide vane sealing rings in their hydel power plant units, made using NML developed alloy. The field trials are scheduled for March.

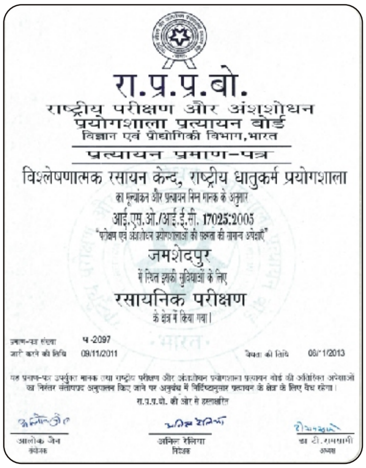
- An MoU has been signed with ITCOL which can lead to the eventual transfer of six NML technologies in diverse areas of beneficiation, waste utilization and value addition.
- Exploratory projects funded by GTRE to standardize the creep rupture test methodology, and to standardize LCF test methodology under salt environment, were successfully completed at NML as a precursor to a major program on superalloys evaluation.
- NML, Tata Steel and Polybond have agreed on pilot trials of a low-shaft iron making process using iron ore slimes and Jhama coal.
- Several activities have been initiated in collaboration with Tata Steel for use of Jhama Coal, Banded Hematite Quartz (BHQ) and Banded Hematite Jasper (BHJ).
- Commercial production of paving blocks using steel slag and their laying at various locations.
- Implementation of the novel lacquer developed for copper alloys in the artisan brass clusters in India (Moradabad and Bankura)

NABL Accreditation

Analytical Chemistry (ANC) Division of CSIR-NML has received NABL accreditation in accordance with ISO 17025:2005 in the field of chemical testing of Iron ore, Steel, and Coal samples in November 2011. This is a formal recognition of the competence of the laboratory in chemical testing and will ensure better credibility and global acceptability of the chemical testing results produced by ANC division.



NABL
National Accreditation Board for Testing and Calibration Laboratories
Department of Science & Technology, India
CERTIFICATE OF ACCREDITATION
ANALYTICAL CHEMISTRY CENTRE, NATIONAL METALLURGICAL LABORATORY
has been assessed and accredited in accordance with the standard
ISO/IEC 17025:2005
"General Requirements for the Competence of Testing & Calibration Laboratories"
for its facilities at
Jamshedpur
in the field of
CHEMICAL TESTING



रा.प्र.प्र.बो.
राष्ट्रीय परीक्षण और अंशशोधन प्रयोगशाला प्रत्यायन बोर्ड
विज्ञान एवं प्रौद्योगिकी विभाग, भारत
प्रत्यायन प्रमाण-पत्र
विश्लेषणात्मक रसायन केन्द, राष्ट्रीय धातुकर्म प्रयोगशाला
जमशेदपुर
रसायनिक परीक्षण

MoUs/ Agreements Signed

Since the last Research Council meeting, a large number of MoUs were signed with various clients including several international organizations. These are: (1) *Column flotation for the production of sillimanite (Secrecy and Knowhow Agreements)* - M/s. V.V. Minerals, Tirunelveli, (2) *Rare earth separation and recovery from Korean Monazite/REOs* - M/s. KIGAM, Korea, (3) *Achievement of technological excellence through contract research and consultancy project, Licensing technologies and Know-How transfers* - M/s. Indian Technomac Co. Ltd., (4) *General agreement on research collaboration* - M/s. Essar Steel Limited, (5) *Scientific Collaboration to study creep behaviour of zirconium alloy components over a range of temperature and stress by carrying out uniaxial creep tests.*- M/s. Bhabha Atomic Research Centre (BARC), (6) *Biomimetic Hydroxyapatite (Secrecy and Licensing Agreements)* - M/s. G. Surgiwear Ltd. Shahjahanpur, (7) *Beneficiation and Agglomeration of Chromite Ore from Oman* - M/s. Bahar Oman Holding LLC, (8) *Recovery of rare metals from effluent and leach liquor of WEEE using SX-IX* - M/s. KIGAM, Korea, (9) *Licensing, Secrecy and Sponsorship Agreements for:* (i) *Development of process for recovery of ilmenite from beach sand at pilot scale,* (ii) *Treatment of Electronic Waste for recovery of Gold and Silver,* (iii) *Development of process for producing high purity molly sulphide concentrates,* (iv) *Flow sheet Development and Pilot scale Beneficiation of Chromite Ore,* (v) *Studies on development of process for beneficiation of low grade manganese ore,* (vi) *Rare earth metal Oxide - Separation of individual oxides / metals by hydrometallurgical treatment* - M/s. Indian Technomac Co. Ltd., (10) *Co-operative program of research and development towards resources utilization and recycling technology* - M/s. Korea Maritime University(KMU), (11) *Information Disclosure Agreement* - M/s. Guru Nanak Engineering Works and (12) *Sparging System for flotation column*- M/s Diva Envitec Pvt Ltd.

Foreign Deputations

The following colleagues went on deputation abroad:

Dr. Vinay Kumar, under collaborative project with KIGAM, South Korea; *Dr. Sandip Ghosh Chowdhury*, AVH Fellowship, RWTH Aachen, Germany; *Dr. Sanchita Chakraborty*, Bilateral Exchange Program, Germany; *Ms. Rupa Das Biswas*, Bilateral Exchange Program, Germany; *Shri Abhilash*, ILTP Program with Russia, Krasnoyarsk, Siberia in Russia; *Dr. S.K. Pal*, Raman Research Fellowship, Instituto de Ciencia de Materiales, CSIC, Campus, Universitario, Canfoblanco, Spain; *Dr. A. Mitra*, JSPS Invitation Fellowship, Iwate University Japan; *Dr. Mamta Sharma*, Annual meeting of the ICCP at Porto in Portugal; *Dr. V.C. Srivastava*, The International conference on porous Metals and Metallic foams (MetFoam2011), Bhusan in South Korea; *Shri Biswaranjan Dhal*, The International Bio-hydrometallurgy Symposium-2011 at Changsha in China; *Dr. S. Prakash*, The WAITRO-ISESCO-LIPI regional Seminar - 2011, Tangerang-Banten in Indonesia; *Dr. A. Sinha* and *Dr. A. K. Pramanick*, Cambridge University, Indo-UK project in UK; *Dr. R. K. Sahu,* Expert Group Meeting, Bangkok, Thailand; and *Dr. DDN Singh*, Consultancy Assignment, King Saud University, Riyadh in Saudi Arabia

Awards / Distinctions/ Fellowships Received

I am glad to report that in the ensuing period, many of our colleagues received various recognitions:

- *Dr. Arvind Sinha,* Sr. Principal Scientist, MST Division has been elected 'Fellow of the National Academy of Sciences' India 2011
- *Dr. Indranil Chattoraj,* Sr. Principal Scientist was presented the "METALLURGIST' OF THE YEAR 2011" Award (Metal Sciences Group) at the NMD-ATM 2011 held at Hyderabad.
- *Shri K.K. Bhattacharyya,* Chief Scientist has been awarded the RP Bhatnagar Award for the year 2010-2011 for his outstanding contribution in Mineral Beneficiation by the Mining, Geological and Metallurgical Institute of India.
- *Dr. Amitava Mitra,* Chief Scientist has been selected IIM Fellow for the year 2011. The Fellowship was conferred during the NMD ATM 2011 held at Hyderabad.
- *Dr. N.G. Goswami,* Chief Scientist and the IMDC Team received Special Appreciation Award (Gold Category) in October, 2011 for contribution to the CSIR Open Access Movement.
- *Dr. MM Humane,* Principal Scientist and Shri R.K. Minz, Sr. Principal Scientist have been awarded the 2011 IIM-SAIL Gold Medal for their Technical Paper titled "Effect of cold rolling and mode of annealing on textures, mechanical properties and formability limit diagrams in interstitial free steel sheets", published in the December 2010 issue of IIM Transaction.
- *Shri Avijit Metya and Dr. Gautam Das* have been awarded National NDT Awards; ISNT-Technofour National NDT and ISNT-SIEVERT National NDT awards respectively for Innovation in System Development.
- *Dr. Mita Tarafder,* Senior Principal Scientist has received the Lady Engineer Award of the Institution of Engineers India, Jamshedpur Chapter.
- *Dr. N. Parida,* Chief Scientist has received "Engineering Achievements Award" of the Institution of Engineers India, Jamshedpur Local Centre.
- *Shri Abhilash, Dr. K.D. Mehta and Dr. B.D. Pandey,* Scientists won the Misra Award for the best technical paper by the Indian Institute of Mineral Engineers (IIME) for their paper entitled, "Biomineral processing of zinc tailings and synthesis of value added nanomaterials".
- *Md. Noor Aman, Dr. T.Mishra, Dr. R.K. Sahu and Shri J.P. Tiwari* received the Dr. B.R. Nijhawan Award on CSIR-NML foundation day for the Best Technical Paper published in 2010.
- *Dr. Vinay Kumar, Dr. Manoj Kumar, Shri Lal Maharaj, Shri D. Bagchi, Dr. M.K. Jha and Ms. Rupa Das Biswas* received the Prof. V A Altekar Award on CSIR-NML foundation day for the Best Technology/ Technological Service during 2010
- *Shri V. Rajinikanth, Shri P. Munda, Dr. D. Mandal, Shri R.K. Minj, Dr. S.K. Das., Dr. S. Ghosh Chowdhury and Dr. S.R. Singh* received the Prof. Shilowbhadra Banerjee Award on CSIR-NML foundation day for the Best In-house Project in 2009.
- *Shri Parmarth Suman and Shri Anirban Shit* (Administrative / Non-Technical) and Shri Brahma Singh and Shri Deo Prakash Singh (Technical) received the Prof. P. Ramachandra Rao Awards of 2011 on CSIR-NML foundation day for the Best Employees of NML.

- *Shri Rajesh Kumar Singh Roushan,* Section Officer has been Awarded Third prize for his Article during the observance of CSIR-Vigilance Awareness Period - 2010.
- *Ms. Dibyani,* D/o Shri Santosh Kumar Mukhi, NML Dispensary won two "Silver Medals" in 100 mtr & 200 mtr race in 6th Jharkhand Junior Athletic Championship, organised by Ramgarh District Athletic Association.

I heartily congratulate all of them and hope that these recognitions will spur them to greater pursuits of individual excellence and organizational returns.

Distinguished Visitors

Several nationally and internationally renowned personalities visited NML during this period. They were *Prof. Rajiv Kumar Mandal,* Banaras Hindu University; *Dr. Nawshad Haque,* Research Scientist, CSIRO Process Science & Engineering, Australia; *Dr. N. K Das,* Cardiologist of Brahmanand Hospital, Tamolia; *Shri. S. K. Sinha* Joint Director of Petroleum Conservation Research Association (PCRA); *Dr. Alexander M. Kalinkin,* Lead Researcher, IRETCM, Kola Science Centre, Russia; *Shri Asit K. Ray,* Sibley School of Mechanical and Aerospace Engineering, Cornell University, USA; *Shri Laura Martin and Shri Robert J. Friederichs,* Ph. D Students from Cambridge University, UK; *Prof S Ranganathan,* Homi Bhabha Visiting Professor, National Institute of Advanced Studies Bengaluru; *Dr. A. K. Shukla,* Department of Metallurgy, IIT, Kanpur; *Prof. Paulo Assis,* UFOP, Brazil and *Prof. Niloy Nath,* JSPM'S Rajarshi Shahu College of Engineering Pune; *Prof. Osamu Umezawa,* Professor of Physical Metallurgy Yokohama National University, Japan; *Prof. Ahindra Ghosh,* Former Professor, Department of Metallurgy, IIT Kanpur; *Prof. Martin Strangwood,* School of metallurgy Na Materials, The University of Birmingham, UK; *Prof. T.C. Rao,* Former Director RRL, Bhopal; *Prof. R Gupta,* Alberta University, Canada; *Shri Dibakar Datta,* PhD student, School of Engineering, Brown University, Providence, USA

Shri Anand Sen, Vice Precident TQM & Shared Services of Tata Steel was the chief guest at the CSIR Foundation Day celebrated in CSIR-NML Auditorium on 26th September 2011. The 62nd foundation day of NML was celebrated in the NML auditorium on 26th November, 2011; *Dr. Shrikumar Banerjee,* Chairman, Atomic Energy Commission was the Chief Guest.

Human Resource

The following people have joined the laboratory in the past six months:

Shri Ajay Tirkey, Asstt.; *Dr Atish Ray,* Scientist Fellow; *Dr Ajay Shukla,* Scientist Fellow; *Dr Shantanu Magde,* Scientist Fellow.

I welcome them amidst us, wish them a very successful career at NML and a pleasant stay at Jamshedpur. Several of our colleagues also superannuated during this period. They were :

Shri Kalyan Kr. Gupta, Chief Scientist; *Shri Purushottam Narayan Mishra,* Sr. Principal Scientist; *Shri Zahid Husain Khan,* Sr. T.O.; *Shri Bhushan Mishra,* CO(F&A); *Shri Mritunjai Mandal,* Lab Asstt; *Shri Lalan Ram,* Lab Asstt.

I wish them all A Very Happy & Healthy Retired Life.

AcSIR Activities

The bill on CSIR's Academy of Scientific and Innovative Research (AcSIR) to promote postgraduate education and pursue trans-disciplinary research has now been passed in both houses of the parliament and AcSIR is operational. CSIR-NML under AcSIR has started a Ph.D program through research in various areas of Materials & Metallurgical Engineering i.e. Mineral Processing, Extractive Metallurgy, Surface Engineering, Applied and Analytical Chemistry, Materials Engineering and Evaluation, Energy & Environment. Applications were invited for admission to the Ph.D programmes for the January 2012 session in Engineering. Three candidates (Shri B. Siva Kumar, Shri Yashabanta Narayan Singhbabu and Shri Ganesh Chalavadi) have been selected for the first batch of the PhD program under AcSIR from CSIR-NML. I wish them a stimulating and exciting time pursuing research. Towards the requirements of AcSIR, two core courses (4 credits each) have been initiated: (i) Thermodynamics and Kinetics of Materials & Processes and (ii) Tools and techniques of minerals & materials characterization.

La vintage metallurgie - 60 years of the marriage of science with industry

A Coffee Table book, *la vintage metallurgie* - 60 years of the marriage of science with industry, composed as part of the Diamond Jubilee year of CSIR-NML was released on the foundation day function of CSIR-NML on 26th Sept. 2011. The book was released by the Chief Guest, Dr. Srikumar Banerjee, Chairman Atomic Energy Commission. The book is a chronological compilation of the history of NML since the laying of its foundation stone in Sept. 1946. It is a tale narrated through the words of the founders, the leaders through these times, the past and the present employees and above all, the stakeholders who benefited; be it industries, the strategic establishments of the country, the government departments, academia and several of the distinguished visitors from all over the world. I am sure, the book, which is a potpourri of standalone technical achievements, snippets of innovation, pictures from time immemorial, anecdotes and extraordinary events, perceptions of people, expression of dreams, wishes and pure nostalgia will invoke interest in metallurgical and material science community in India and overseas. I thank all my colleagues from NML who made this publication possible.

Other Activities

School-NML Interactive Programme

To inspire school students to pursue a science career, CSIR-NML has launched a School-NML Interactive program (SNIP) for the Standard VIII to XII School students in and around Jamshedpur. Under this program, on the forenoon of every Friday, the students accompanied by their teachers are invited to CSIR-NML and taken around the laboratories as well as the museum and archives. Under the SNIP program, more than 2500 students from 32 schools across East & West Singhbhum districts of Jharkhand have already visited CSIR-National Metallurgical Laboratory, Jamshedpur over the last seven months. This program has drawn wide publicity and appreciation from the schools and is very well covered by the press.



Students participation in the School-NML interactive programme

The External Perspective

For any public funded organization, the inputs received on the individual expert project review committees, the audit reports of the Controller and Auditor General's office and the feedbacks received from the various stakeholders forms the basis of performance and assessment. It is therefore necessary to put these in perspective to the Research Council and seek suggestions and advise. The complete audit reports and our response to these reports as well as the minutes of the various Project Review Committee meetings for the major projects are appended as Annexures in the RC Agenda circulated. I would request the members of the RC to look into it critically and make observations. It is satisfactory to note that as on date only three minor audit paragraphs are outstanding and I am positive that these would be addressed and dropped soon. With regard to the observations in the Minutes of the various Project Review Committee meetings, the actionables have been identified and put into motion. I would request the various Project Leaders and Task Coordinators to periodically review the status of the actionables and ensure that the corrective steps have been taken and implemented. The overall Customer Satisfaction Feedback received for most of the sponsored projects are very good ($>\frac{4}{5}$) and the suggestions made by the customers have been considered and some implemented.

Restating Vision@2022

Immediately upon assuming office, I had outlined my Vision@2022 for NML. In that context, we had set the goals and targets for 2016 which would put us on the path towards Vision@2022. These were:

- Meet 50 % of NML's total budget from industrial sponsorship

- Achieve 80% direct utilization of man-power and major equipments
- Develop and commercialize five technologies that will have a lasting impact
- Realize 5% of operational budget from IP licensing and royalties
- Move towards a paperless NML
- Deliver on one national mission project

In view of the operationalisation of AcSIR, we have added one more goal for 2016 i.e.,

- Produce 20 PhDs/year from CSIR-NML through AcSIR

It is imperative that we continuously calibrate our performance with respect to these goals and targets.

Enhanced Industrial Sponsorship

The trends in the extent of industrial funding *vis-à-vis* the CSIR budget and external cash flow show (ECF) has increased in the past two years. For the period July-December 2011, industrial projects contributed to Rs 366 lakhs, which is significantly higher. As part of the roadmap towards enhanced industry sponsorship and partnership, we have reached out for collaboration with several industrial partners, evolving consortia of industries in select areas and started leasing of several facilities including pilot scale facilities. These efforts have started to bear fruits and several MoUs have been signed with major industrial clients in the recent past. Several business queries were received through the e-customer desk during this period.

Effective Manpower and Equipment Utilization

Towards effective man and machine utilization, we have put in place mechanisms where both man hour utilization in projects by scientists and equipment utilization time are properly recorded. For the period July-December 2011, the man-hour utilization of scientists stood at 66% (11549 mandays accounted through project against the total available man days of 17640). Several initiatives such as projectizing of all activities (R&D, services, systems development etc.), increased thrust on internal projects (iPSG), proportional financial incentives, inclusion of manpower and equipment utilization factors as parameters of performance in the Annual Appraisal forms, competence mapping etc. have been taken and I am hopeful that we would be able to measure and achieve the target of 80% man and machine utilization.

Competence Mapping

A preliminary competence mapping exercise has been carried and this will be presented in this RC meeting by one of my younger colleague. This study brings out clearly the distribution of manpower, based on their academic qualification, in the different areas of competence as also their equipment handling expertise. A clear picture of the distribution of scientists in the core areas of CSIR-NML with a further distribution in the sub areas, the qualification of scientists available in each core area and sub area and in the projects executed by CSIR-NML in these core areas are shown.

Development & Commercialization of Technologies

In the recent past, the following technologies were commercialized:

• *Column Flotation for the production of illimanite;* (M/s V.V.Minerals, Tirunelvely); • *Evaluation of reagent for iron ore flotation;* (M/s Somu Organo Chem (P) Ltd, Bangalore); • *Portable stress strain measuring system using automated ball indentation technique;* M/s Ducom Instruments Pvt Ltd, Banglore; • *Paving blocks from Steel slugs;* (M/s Tata Steel, Jamshedpur)

A list of existing CSIR-NML technologies which have commercial potential have been identified for the development of Basic Engineering Packages. The following technologies that have been developed/or in the process of development have the potential for commercial exploitation if successful:

• *Erosion resistant alloy for guide vanes and spear nozzles of hydro-turbines;* • *Ferrosilicon production from BHQ/BHJ and Jhama Coal in a Submerged Arc Furnace;* • *Pig iron and slag wool production from iron ore slimes and Jhama Coal in Low Shaft Furnace;* • *New reagent for coal flotation;* • *New Lacquer for Brass Artifacts;* • *Rare earth free ferrite permanent magnet*

Creation of Transparency Portal

As part of the systemic initiatives towards greater transparency and democratization of information, a transparency portal would soon be launched. This portal will contain all information pertaining to staff (Immovable Property, Allowances drawn, Foreign and local travel undertaken, Honorarium received), project details, CAG reports and all other information of relevance to the public. This portal is expected to be operational by the end of this financial year.

Change leadership program

A two week Leadership Development Programs was conducted by Mr. Ian Dean of Groman Consulting, South Africa to develop leaders who will usher the change at CSIR-NML. The workshop addressed various aspect of leadership quality. A large number of NML personnel participated in this program.

Towards a Paperless NML

In this pursuit, CSIR has initiated a CSIR Enterprise Transformation & ICT Intervention Initiative, wherein six portals on 1) *Human Resource Management,* 2) *E-learning & Knowledge Repository,* 3) *Infrastructure/ Engineering Services,* 4) *Policy and program module*, 5) *Stores and Purchase module* and 6) *Finance & Accounts Module have been created.* The necessary hardware has been procured, installed and commissioned at NML. Data entry towards populating the employee profiler module of the ERP package with e-service book data of NML staff is in progress. Storage Area Network (SAN) has been installed and the pertinent software has also been ordered. Purchase order for the Enterprise Servers has been placed and delivery is awaited. Creation of customized infrastructure for equipment installation is also under progress. The NKN connectivity is in the process of being activated. The National Grid computing facility, GARUDA, has been made accessible for open source grid computing applications through a partnership mode with C-DAC , Bangalore, (Ministry of IT) for a limited timeframe.

12th Plan Projects

As discussed in the previous Research Council Meeting, NML will be leading three CSIR network projects under the 12th plan: 1) *Development of Zero Waste Technology for Processing and Utilization of Thermal Coal :* The project aims at developing a dry beneficiation flowsheet for washing thermal coal, utilization of combustion products (fly and bottom ash) and recovery of cenospheres and several trace metals,. 2) *Development of commercially viable magnesium metal production technologies :* The proposed project aims to develop an energy efficient, cost-competitive and eco-friendly commercially viable Mg production technology through electrothermal process exploiting indigenous raw materials including MgO by-product generated from the Sulphate of Potash (SoP) process. The goal is to enable commercial production of Mg (~97-99% purity) at a price cheaper than that of China. 3) *Development of technology for Cold rolled grain oriented (CRGO) electrical steel :* In this project, the objective is development of superior CRGO products with lower core losses, higher permeabilities or lower magnetostriction for higher energy efficiency at low manufacturing costs. A pilot plant (3-5 tonnes) is proposed to be set-up along with necessary strip casting process and hot-cold rolling facilities with annealing furnaces. This pilot plant can be used for any new steel development. In addition, CSIR-NML will be partnering various other CSIR laboratories in several network projects: 1) *Clean technology build up for rare earths material needs in energy, health care and transportation* (CSIR-RETECH); 2) *Nanobioceramic-composites for wound care;* 3) *Development of Composite Armor for protection against medium caliber threats;* and 4) *Measurement for Innovation in Science and Technology for Improvement in Quality and Economy of Life (MISTIQUE) .* NML is also expected to play a major role especially in materials evaluation, qualification and development of structural integrity and damage assessment protocols in the Mission-2017 project on the commissioning of 2X800 MW ultra-supercritical boilers being taken up by IGCAR, BHEL and NTPC in the 12th plan.

A few other major projects are also proposed to be taken up by NML under the 12th plan in partnership with the industry with partial financial support from the ministries. 1) *Technology for processing of base metals, rare metals and precious metals from secondaries and wastes;* 2) *Integrated Computational Materials Engineering for Design of New Alloys*; 3) *Turbine Materials Evaluation, Thin specimen creep testing and for LCF on coated superalloys;* 4) *Beneficiation and agglomeration of low grade iron ores, iron ore tailings and slimes;* 5) *Development of Al-alloy conductors;* 6) *Light metals extraction by fused salt electrolysis;* 7) *Column Flotation technologies for low grade iron ores/slimes and coal;* and 8) *Life-cycle integrated energy and environmental analysis for metallurgical processes and industries.* Discussions are on with the relevant industrial partners for the formulation of project proposals and seeking financial support. It is hoped that these projects will fructify in due course of time.

S. Srikanth

(S. Srikanth)
DIRECTOR

2nd February 2012