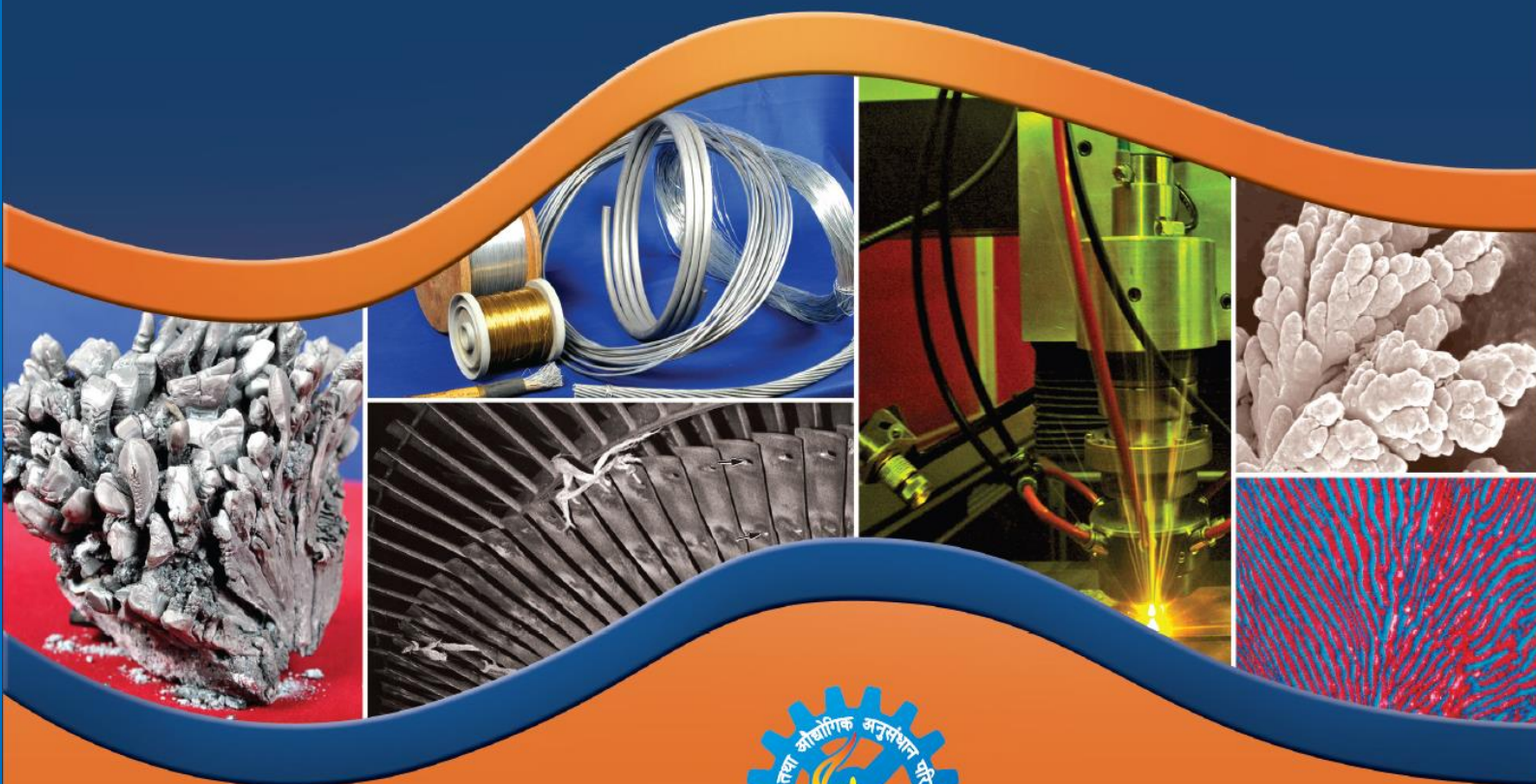


वार्षिक प्रतिवेदन 2013-14
Annual Report 2013-14



CSIR-National Metallurgical Laboratory

Jamshedpur - 831007, India



Overview of CSIR-NML

The foundation stone for CSIR- National Metallurgical Laboratory was laid by Hon'ble Sri C. Rajagopalachari on 21st November, 1946. It was formally inaugurated and dedicated to the nation on 26th November, 1950 by Pandit Jawaharlal Nehru with a mandate to marry science with industry for the progress or both. The laboratory was an element of Sir Shanti Swaroop Bhatnagar's vision of providing India with a network of research institutions for taking the country ahead in science and technology. CSIR-NML played a significant role in the industrial revolution of India starting from 1950 especially in the areas of mineral processing, iron and steel making, ferroalloys and extraction of non-ferrous metals, notably magnesium. Asia's largest creep testing facility was also set up at CSIR-NML in the early 1970s and even today it ranks as the second largest creep testing lab in Asia. CSIR-NML continues to play a vital role in the quest of the country towards scientific and technological leadership and providing scientific solutions to the industries in the areas of minerals, metals and materials.

Since inception, CSIR-NML has diversified its research areas ranging from extractive metallurgy, alloy development and import substitution, refractory material development, corrosion studies, mathematical and physical modeling of metallurgical processes, mineral research, advanced materials and materials tailoring, integrity evaluation of critical industrial components and cleaner and sustainable metals production. CSIR-NML is also carrying out major activities for creating awareness among the common masses on issues relating to health, environment, rural technology and sustainable development.

With a strong and committed staff having a wide spectrum of expertise and modern facilities, CSIR-NML has completed 64 glorious years of existence and endeavors to move ahead to meet the challenges faced by the country and global economy today and reach greater heights.

Vision

To become a global leader and an internationally benchmarked laboratory in mineral and metallurgical research and development.

To become a self-sustained technology centre in minerals, metals and materials

Goals/Targets for 2016

- 50% budget from Industrial sources
- 80% direct utilization of man-power & major equipments
- Commercialization of 5 technologies with lasting impact
- 5% of operational budget from IP licensing & technology transfer
- Paperless CSIR-NML
- One major national mission project
- Create leadership chain for tomorrow
- 150 SCI papers/Year with Avg. citation/paper of 10
- Generate 20 PhD's/year under AcSIR

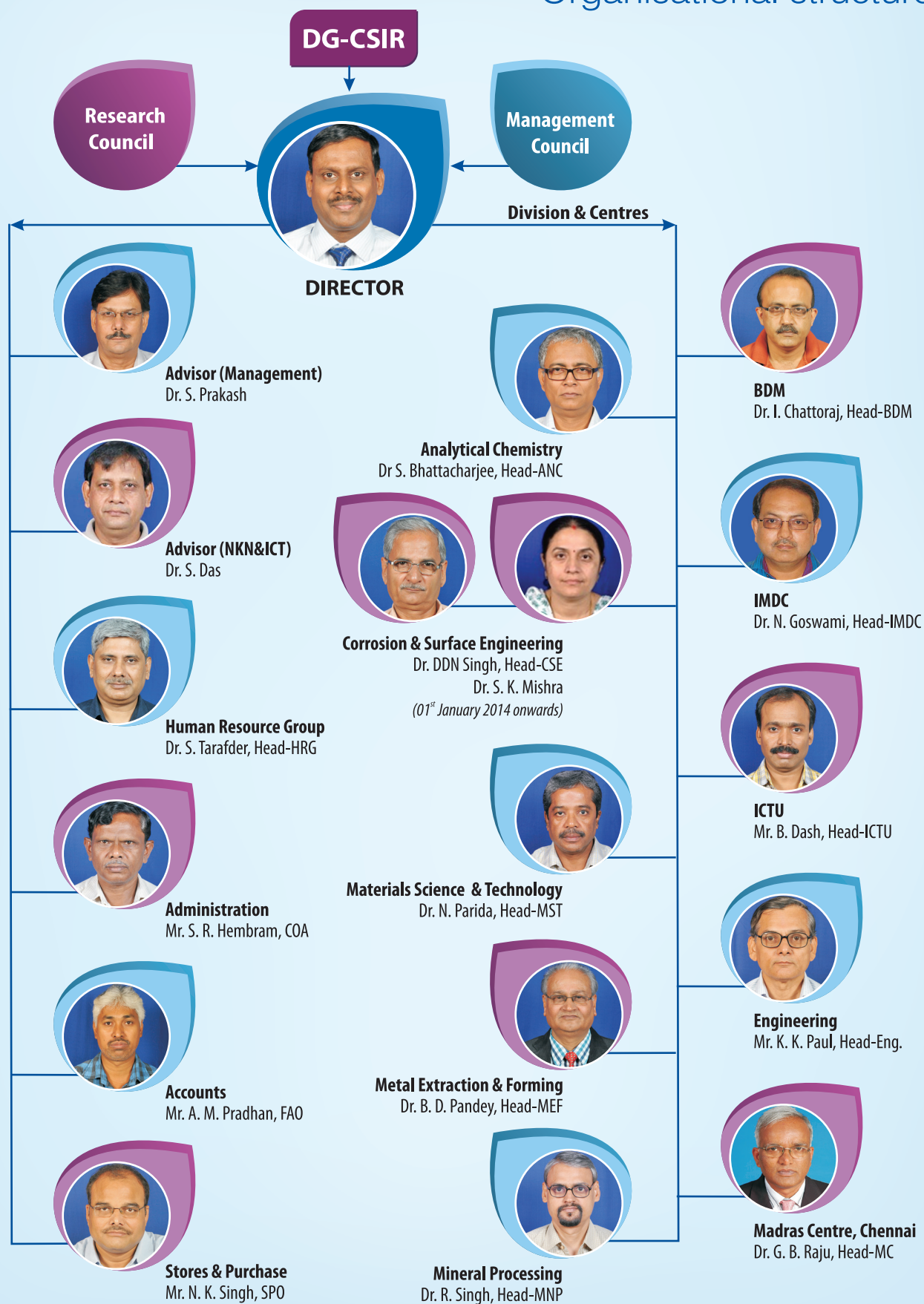
The Inspiration

"....But when I come to Jamshedpur it is not the past of India that comes up before me but some vision of the future comes before my eyes."

"I do not wish any worker to come to these laboratories merely with the aim of earning his living. What I wish is that our young men and women who come here should have a zeal for working out problems which would have great consequence. That would give vitality to these Institutes. They should realize that service to science is real service to India – no, even to the whole world – science has no frontiers".

- Pt. Jawaharlal Nehru

Organisational structure



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Research Council (2011-2013)



Shri. H. M. Nerurkar
Chairman RC
Managing Director
Tata Steel Limited
Jamshedpur 831001



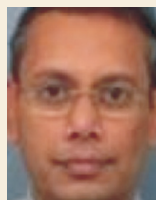
Dr. Biswajit Basu
Joint Executive President
Aditya Birla Science &
Technology Centre
TALUKA PANVEL,
Maharashtra



**Director/ Sr. Scientist
of Sister Laboratory**
Prof. Indranil Manna
Director
CGCRI, Kolkata



Dr. Pradip
Group Leader
Materials and Minerals
Processing Technology
Tata Research
Development &
Design Centre
(A Division of Tata
Consultancy Services Ltd.)



Dr. Arun Kumar
Lab Group Manager
General Motors India
Science Lab, Bangalore



Cluster Director
Prof. Gautam Biswas
Director
Central Mechanical Engg.
Research Institute
Mahatma Gandhi Avenue
Durgapur



Dr. G. Malakondaiah
Director
Defence Metallurgical
Research Laboratory



Shri. Bhaskar Roy
Director
M.N.Dastur & Company
Limited
Kolkata



**Director of the
Laboratory**
Dr. S. Srikanth
Director
CSIR-NML,
Jamshedpur



Dr. Subir Kr. Bhattacharyya
Steel Chair Professor
Dept. of Metallurgical
& Materials Engg
Bengal Engineering
& Science University
Shibpur



Agency Representative
Shri. A. C. R. Das
Industrial Adviser
Ministry of Steel
Udyog Bhawan
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Permanent Invitee
Dr. Sudeep Kumar
Head , Planning &
Performance Division
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Industrial Research
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Dr. S. N. Ojha
Professor
Dept. of Metallurgical Engg
Institute of Technology,
Banaras Hindu University
Varanasi



DG Nominee
Dr. R. R. Hirwani
Head URDIP
Pune

Research Council (2013-2015)



Shri. H. M. Nerurkar
Chairman RC
Former Managing Director
Tata Steel Limited
Jamshedpur 831001



Shri. Bhaskar Roy
Director
M.N.Dastur &
Company Limited
Kolkata



Shri. Kamal Dasgupta
Acting Director
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Group Leader
Materials and Minerals
Processing Technology
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Dr. Om Prakash
Director, Materials & Processes
Boeing Research &
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Director
CSIR-NML,
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Division
Council Of Scientific &
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Dr. Biswajit Basu
Joint Executive President
Aditya Birla Science &
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Shri. S. S. Mohanty
Director, Technical
Steel Authority of India Ltd.
ISPAT Bhawan, Lodi Road
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FOREWORD

We have been quite sensitive to the cause of promotion of science and our social commitments to this region. Over the past two years, we have launched some new initiatives.....

As I reflect upon the performance of CSIR-NML last year and introspect on where we stand with respect to our vision of a "Self sustained technology centre in the areas of minerals, metals and materials" and the Goals and Targets that we set, I realize that there is some distance to go. Whereas in terms of industrial funding, number of patents and copyrights filed and the number of technologies developed and transferred we have surpassed our targets, the External Cash Flow, and the Number of SCI publications have fallen short of the target marginally. Against our targeted External Cash Flow of Rs 21 Crores, we could achieve only Rs 17.6 crores, falling short by about 15%. However, the bright side is that our industrial External Cash Flow (ECF) exceeded expectations to touch Rs 15.6 crores and our earnings from international clients also exceeded the Rs 2 Crore target that we set. Last year, we have filed thirty patents, double our target of fifteen patents. On the SCI publications front, we have missed the target of 125 by a small margin. However, the average impact factor of 2.2 last year represents a quantum jump from the past and further, the citations/paper has been exponentially increasing and as on date our citations/paper is 8.33 which is commendable.

Our focus and relentless efforts on technology development and their commercialization has yielded fruits. Last year, we have developed ten technologies, far exceeding the target of five. Further, we could transfer three high impact technologies namely "Recovery of lead from zinc plant residue" to M/s. Cinkom Zinc Metal Mining Co, Turkey, technology on "Tungsten powder from tungsten carbide hard metal scrap" which was transferred to M/s. Minestone Minerals, Mangalore and the technology on "A Cheap and Energy Efficient Brass Melting Furnace" could be transferred to Moradabad Industrial Development Corporation (MIDCo).

Another major milestone that we achieved last year was the implementation of ERP and the complete switchover to online processes in Administration, R&D management, Stores & Purchase and Finance, making CSIR-NML one of the first of the CSIR laboratories to go paperless.

Our 12th plan mission mode projects have made good progress. In the project on "Development of a Cheap and Energy Efficient Magnesium Production Technology", the installation and commissioning of the 300 kg Mg pilot plant was completed in August' 2013. Since then, five pilot scale campaigns were carried out including a test campaign for curing the lining and testing the condenser. It was a herculean task, many times frustrating and we had to traverse a difficult path. In the first four campaigns, we met with a variety of challenges including several engineering issues with respect to vacuum leakage and clogging of the pathways and the re-oxidation of Magnesium by the carbon monoxide generated. However, the project team's persistence, ability to learn from mistakes and correct them and their determination has paid off and in the 5th campaign, we could produce more than 10 Kgs of Mg sponge. The mission project on "Development of Zero Waste Technology for Processing and Utilization of Thermal Coal" taken up with the aim of developing a dry beneficiation technology for coal and for the gainful utilization of (for pavement blocks & tiles) and recovery of valuables from combustion products (cenospheres, rare/rare earth metals such as Ga, Se, Te, Gd, Nd, Sa etc.), is also on track. Although the final approval and sanction from Ministry of Steel, on the CRGO project which is a collaborative project between CSIR-NML-Tata Steel-RINL and Ministry of Steel is awaited, three internal projects have been initiated for the design and evaluation of new compositions, design of the thermo-mechanical processing schedule and evaluation and design of new coatings. We keenly look forward to the launch of the CRGO project.

Our collaboration with Tata Steel has gone from strength to strength. Over the past three years, we have pursued/pursuing sixty eight collaborative projects between Tata Steel and CSIR-NML. A large majority of these projects have been successful in terms of plant application, new technology development, creation of entrepreneurship, creation of Intellectual Property, pilot scale trials for techno-economic evaluation and publications in high impact journals. In the past three years, we have filed more than twenty five joint patents and sixteen joint publications in SCI journals (8) and conference proceedings (8). We are hopeful that in the course of time, several of the technologies that have been developed and are in their stages of evaluation have the potential to be commercialised.

Our academic activities and programs under the Academy of Scientific & Innovative Research (AcSIR) have increased many folds. As on date, there are twenty five students registered for Ph.D, including industry sponsored candidates, trainee scientists, Junior and Senior Research Fellows, Quick Hire Fellows and some of our younger scientists. This is a substantial increase from last year. If we have to sustain this momentum in the years to come and maintain high levels of excellence, we have to build systems of excellence and substantial infrastructure.

Our international collaborations, especially with multinational companies have shown a considerable increase over the past four years. In addition to the strong ongoing collaborations with BOEING, KIGAM (Korea Institute of Geosciences Mineral Resources), Swerea MEFOS Sweden, CARIRI, General Electric, Korea Maritime University we have signed up agreements with SIEMENS, UK and M/s. John Keells Holdings PLC, Sri Lanka. We continue to have a strong collaboration with several international academic institutes.

We have been quite sensitive to the cause of promotion of science and our social commitments to this region. Over the past two years, we have launched some new initiatives. In a program christened as the School-NML Interaction Program (SNIP), we invite school students every week to come and visit our laboratory. Over the past two years, more than 9000 students from 105 schools along with their teachers have already participated in the programme and derived the benefits. The programme has been designed to give the

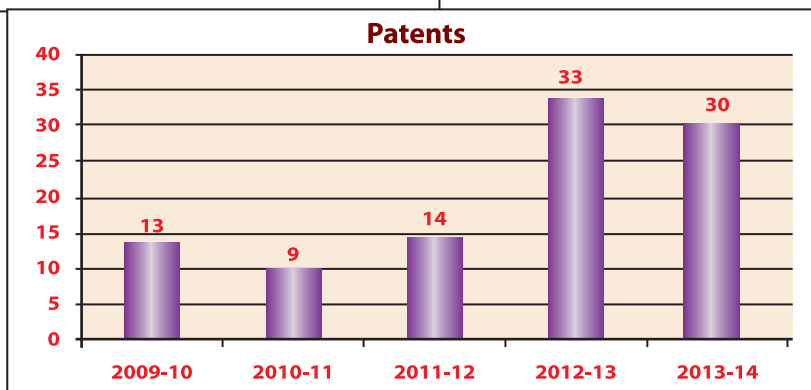
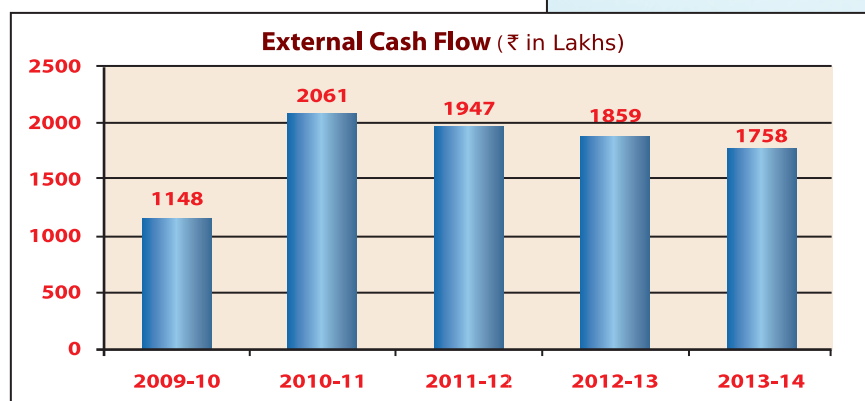
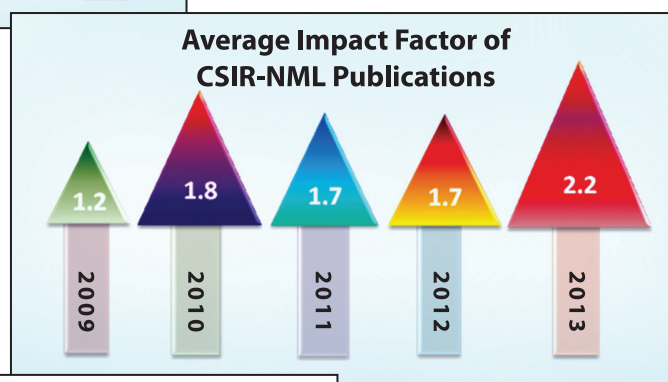
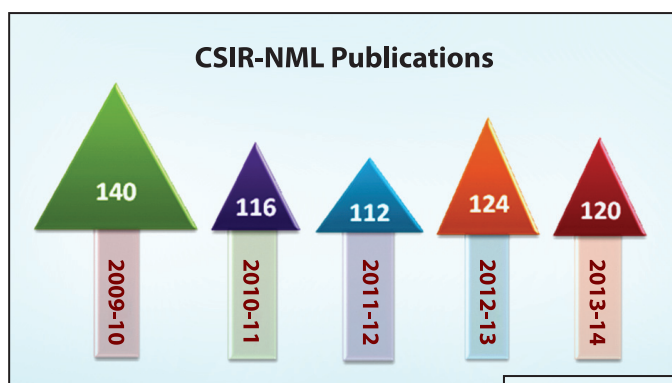
students an exposure to modern laboratory conditions and to inspire students to pursue a career in science. In another initiative aimed at a capacity building exercise for teachers, about 200 Government school Science teachers across the district have been exposed to CSIR-NML. It comprises of a day-long orientation session which included motivational lectures towards fundamental science, information on ways to upgrade school infrastructure and insights into recent scientific developments. Already more than 200 teachers across East Singhbhum district in four batches have undergone the program.

As I was penning this foreword, I just received information that our beloved former Director Dr Balraj Nijhawan is no more and has attained heavenly abode on 6 April 2014. For all of us at NML, Dr Balraj Nijhawan was a legend and a visionary and inspirational leader who laid the foundation of NML. The core values and culture that he created at NML through his visionary leadership have stood the test of time. NML surely would not have been what it is today but for him. NML will always remain his legacy. I nostalgically recall the words of Dr Balraj Nijhawan in his message to NML on the occasion of the Diamond Jubilee: *"I have been privileged and honoured to have lived long enough to be a small part of the history of India, and to have been one of the members of this leading and prestigious international institution. To say that I am proud of my association is an understatement....I am humbled to have had the opportunity as a young man to have experienced the joy and inspiration of the founding fathers of India, and the founding visionaries of the laboratory. NML has been my life and joy.....My mission is almost done, but yours is still growing. I know that when I am gone, my heart will still live in the hallowed halls of the National Metallurgical Laboratory in Jamshedpur....May your spirit live long and your visions be fulfilled"*. We salute this visionary founding father of NML.



(S. Srikanth)

R & D OUTPUTS



Products in the Market



The label showing CSIR-NML name printed on the reagent drums being supplied to JSW for iron ore fines beneficiation by flotation

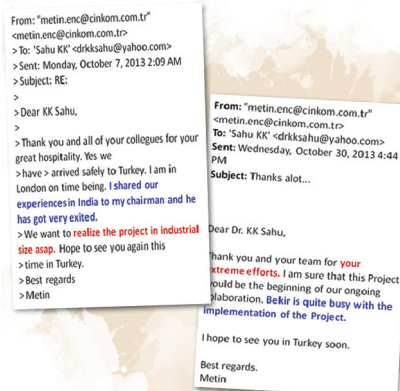


NML Flotation Column Lab Model installed at IIT Hyderabad for academic and R&D purpose

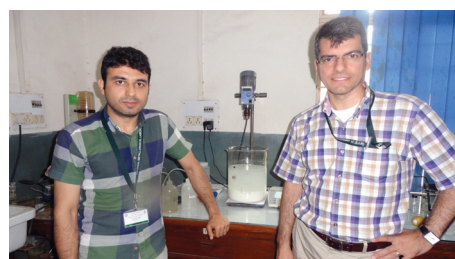
Impact Making Technology Transfers

Process for removal and recovery of lead from CINKOM zinc plant residue

Presence of lead in the final leached residue of zinc plants are considered to be a big threat to the environment. It falls under the category of hazardous wastes as defined by the Environmental Protection Agency. Therefore, removing lead from the residue and recovery in usable/marketable form before its dumping is essential not only to minimise the environmental pollution but also derive economic benefit. A simple hydrometallurgical process was developed at CSIR-National Metallurgical Laboratory to remove and recover lead and other valuable metals from the residue. The process uses low cost chemicals and does not generate any liquid effluents as it operates in a close loop. This technology was transferred to M/S Cinkom Zinc Lead Metals & Mining Industry Co., Turkey for the treatment of their plant residue containing 15.2% Pb after successful demonstration on kilogram scale.



Demonstration of removal and recovery of lead from Cinkom Zinc Plant residue



Mr. Ahmet Metin ENC, General Manager and Mr. Bekir UNGUR, Chemical Engineer visited during first week of October 2013 for the demonstration process

Tungsten powder from tungsten carbide hard metal scrap Minestone Minerals, Mangalore

Tungsten (W) is a rare and strategic metal having a number of critical applications in defence, energy and mining sectors. A simple and innovative process technology was developed at CSIR-NML for processing of various tungsten bearing scrap materials to produce high pure (>99.9%) tungsten powder of desired specification and high yield (W recovery >98%). The developed technology is economical in comparison to existing processing routes such as "Zinc Process" and "APT Route", which involve complex process flow-sheets with low overall tungsten recovery (<85%). The process know-how developed at CSIR-NML has several advantages such as minimum number of unit operations, operation in closed-loop with no solid or liquid effluent generation,

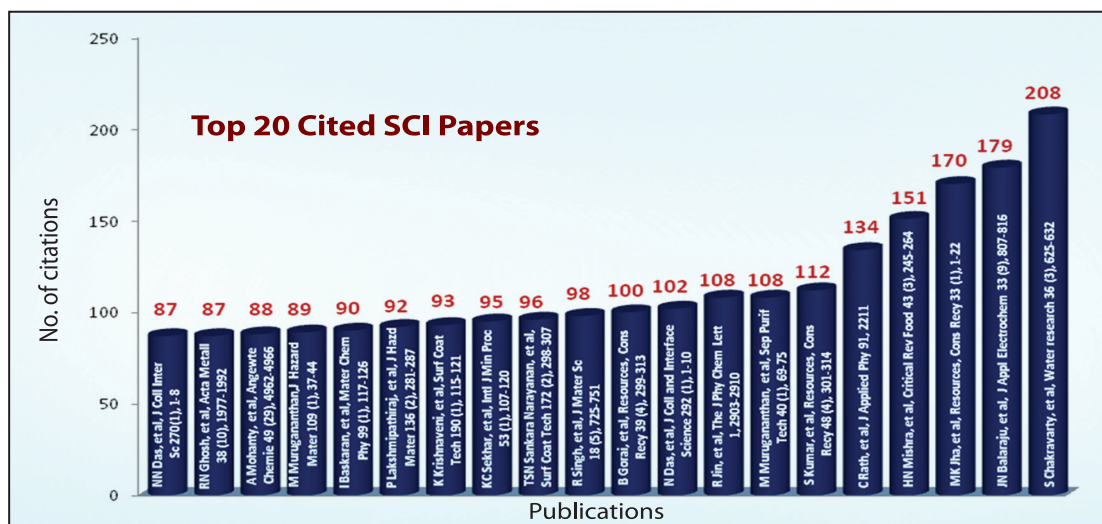
high overall tungsten recovery (>98%) with simultaneous recovery of other base metals present in the scraps with equally high yield (>95%), low unit processing cost (INR 400-500/kg) in comparison to existing conventional processes (INR 700-800/kg) and low capital investment.

This process has been transferred to two Indian industries (Bharat Futuristic Corporation, Bangalore, Minestone Minerals, Mangalore) and few others, including DMRL, Hyderabad are under negotiation.



Impact Making Science

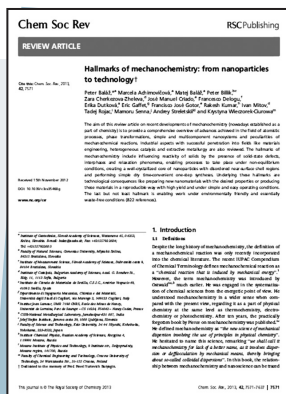
CSIR-NML Citation Report



The following paper was published in the journal Chem Soc Review with an impact factor of **28.76**



A paper titled "Biogenic signature and ultra microfossils in ferromanganese nodules of the Central Indian Ocean Basin", published in the Journal of Asian Earth Sciences, 2013; 73() : 296-305 has drawn the attention of the international media and has appeared in the news column published by Vertical News. This article can be accessed at <http://chemical-and-chemistry.verticalnews.com/articles/10425342.html>



A paper titled "Biogenic signature and ultra microfossils in ferromanganese nodules of the Central Indian Ocean Basin", published in the Journal of Asian Earth Sciences, 2013; 73() : 296-305 has drawn the attention of the international media and has appeared in the news column published by Vertical News. This article can be accessed at <http://chemical-and-chemistry.verticalnews.com/articles/10425342.html>

The article has also drawn the attention of the visual media of Los Angeles and some of the images shall be included in the television series: "Cosmos: A Spacetime Odyssey".

Subject: Cosmos: A Spacetime Odyssey - Searching for SEM of Manganese Nodule Bacteria

From: Robert Oltra <bob.oltra@gmail.com>

To: brn69@rediffmail.com

Dear Mr. Nayak,

I'm reaching out with interest in the images found in the attached article. Fig.5 I'm working on the television series: "Cosmos: A Spacetime Odyssey". This 13 part series, is a successor to the original series hosted by Dr. Carl Sagan. Our current host is astrophysicist Dr. Neil de Grasse Tyson. As with the original series, the overarching themes will be the revolutionary ethos of science and the revelatory power of its cosmic perspective. The series is airing on FOX and National Geographic.

In one of our episodes we take a look inside a manganese nodule and discuss how they're formed. Through visual effects we will be taking the images we license and animate them to try and visualize the process.

Do you have the copyright to these images and are they available to license? If so, what is the highest resolution you could provide? The rights we would need are *non-exclusive, Worldwide All Media, in perpetuity, including in context ad and promo.*

I hope this finds you well and thank you very much for your time, I look forward to your response.

Very Best,

Robert Oltra

*Research Coordinator | Cosmos** | **Voyager Pictures, LLC*
1800 Vine St., 2nd Floor Los Angeles, CA 90028 USA

Impact on Society

School-NML Interactive Programme (SNIP)

Since last two years, more than 9000 students from 105 schools along with their teachers have already participated in the program and derived the benefits. The program has been designed to give the students an exposure to modern laboratory conditions and to inspire young students to pursue a career in science.

Under the program, CSIR-NML has also helped 35 schools to set up science clubs in their campus to ensure that budding young minds who earlier visited the laboratory to maintain their focus and develop a passion towards science. As a part of the initiative, the laboratory also shared science literature and expert advice in putting up the science club. The concerned school faculties were given counselling for the maintenance of the clubs. As a result, most of the participating schools are now initiated to organize annual science exhibition wherein their students



prepare scientific models, posters and different types of display materials and showcase them.

Launched in June 2011, the School-NML Interactive Program (SNIP) has captured the imagination of the students and teachers in this region and has received appreciation from a cross section of society, including schools, press, District Education Department and public at large.

Industry sponsored students-NML Interactive Programme (INDSS-NIP)

CSIR-NML has initiated an interactive programme with Industry sponsored students deputed by academic institutes. Under this programme, two batches of students from Aditya Institute of Technology, Adityapur representing different sponsored Industries (Tata Steel Ltd.; Alfa Motors Mahindra & Mahindra; RSBT Ltd.; Brakes India Ltd.; JMT Auto Ltd.; Ramakrishna Forging Ltd.; Tata Consultancy

Engineering Ltd.; Tayo Rolls Ltd.; RSB Transmission India Ltd.; Kross Manufacture Ltd. and Adhunik Alloys & Power Ltd.) visited CSIR- NML and interacted with the scientists. The industrial students were deeply inspired and motivated with the exposure to NML expertise and facilities. The participants felt enlightened through this interactive programme and expressed their desire to utilize this opportunity to build a strong bridge between the industries and CSIR-NML.

CSIR-NML and Tata Steel jointly developed the technology for making paving blocks from steel slag. Tata steel has roped in four entrepreneurs to use our technology for making paving blocks and slabs from steel slag.



Original Message

Subject: Thank you for your help in our Swaspur-water testing project

From : "Amol Khavaskar" <amolkhavaskar@hotmail.com>

Date : Thu, September 5, 2013 1:59 am

To : "santanu@nmlindia.org" <santanu@nmlindia.org>

Cc : "b13003@astra.xlri.ac.in" <b13003@astra.xlri.ac.in>

"b13009@astra.xlri.ac.in" <b13009@astra.xlri.ac.in>

Dear Santanu Sir,

Hello Sir. I am Amol Khavaskar, student of XLRI. Me & my colleague Abhra had come to meet you (approx a month back) at NML regarding water testing process & solution implementation in Swaspur village. Sir, with your advice, we had got 3 samples from Swaspur village tested at NML. As per your guidance, we implemented the alum method & 3-pot method. Those tests yielded limited results, primary parameters like smell, taste showed improvement but some issues persisted when cooking. Since, this is a critical threshold, we could not advise them to drink such water.

For overcoming this problem, we have approached UCIL & also, XLRI officials. We are hoping for positive development on those fronts. Due to paucity of time & our other commitments, we as a group might not get involved in future activities, but your junior batches will take the matter forward. Sir, your consultancy, technical, practical inputs & most importantly, time were of huge help in our attempt to take 1st steps in solving drinking water issues. Another take-away for us in these interactions with you was that how a job can be driven purely by interest & not for any self-benefits. On behalf of our group, I sincerely thank you for all your help and enlightenment.

Thanks & Regards,

Amol Khavaskar

XLRI, Ph : 8757706845



TEACHER-CSIR-NML INTERACTIVE PROGRAMME (TECNIP)

The proposal of District Education Officer, East Singhbhum for carrying out a capacity building exercise for about 200 government schools Science teachers across the district has been undertaken. The first phase comprises of a day-long orientation session which include motivation towards fundamental science, information on ways to upgrade school infrastructure and insights into recent scientific developments. Already, more than 180 teachers across East Singhbhum district in four batches had undergone the course. The second phase has been planned for a two to three days subject oriented residential training programme at the laboratory which is expected to start in April 2014.

THE FINANCIAL EXPRESS
KOLKATA | THURSDAY | JULY 26 | 2012

NML, Tata Steel develop building material from waste

NML tech to help IBCL beneficiate low-grade baryte

India's plan to make CRGO steel indigenously to take off soon

NML's innovation to the rescue of Moradabad brassware artisans

NML develops erosion-resistant steel for hydel projects

Targets Achieved 2013-14

Performance Targets

	Objectives	Planned	Achieved
1.	ECF	₹ 21 Crores	₹ 17.58 crores
	Industrial ECF (a part of ECF)	₹ 13 Crores	₹ 15.55 crores
	International ECF (a part of Industrial ECF)	₹ 2 Crores	₹ 2.18 crores
2.	Laboratory Reserve Generated	-	₹ 10.51 crores
3.	Customer Satisfaction Index	4.35	4.37
4.	Publications	125	120
5.	Patents	15	30
6.	Copyrights	5	6
7.	Technologies Developed	5	10
8.	Technologies Transferred	3	3

Technologies/Knowhow Developed

- i) A process for the synthesis of load bearing biphasic calcium phosphate nanocomposite blocks as bone grafts and scaffolds
- ii) Recovery of gold from the waste printed circuit boards (PCBs) of used and discarded mobile phones
- iii) Process for beneficiation of iron ore fines
- iv) Improved coke based energy efficient brass melting furnace
- v) Anti-tarnishing lacquer for silver and copper based alloys
- vi) Production of Yellow Tungsten Oxide (YTO) and cobalt hydroxide from supplied W-C hard metal scrap.
- vii) Production of high purity Yellow Tungsten oxide (YTO) & Tungsten Metal Powder from W-C hard Metal Scrap and alloy Turnings/Swarf

- viii) An Improved process for preparation of Pellet-Sinter composite Agglomerate (p-SCA) of iron oxide fines for use in blast furnace
- ix) Defect evaluation in pipes using magnetostrictive sensors made from nanostructured soft magnetic materials
- x) Synthesis of biomimetic electrospun collagen-graphene nanocomposites with varying graphene content and its feasibility for hydrogen-storage/supercapacitor/conductive glue.

Technologies Transferred to Industry

- i) Recovery of lead from zinc plant residue
- ii) Tungsten powder from tungsten carbide hard metal scrap
- iii) A cheap and energy efficient brass melting furnace.

Major Technological & Scientific targets Planned and Achieved in 2013-2014

Targets Planned	Targets Achieved
Development of zero waste technology for processing and utilization of thermal coal i) Air table separation methodology development and modeling of the same. ii) Cenosphere separation using dry techniques	i) Air Table separation technology for coal developed at lab scale ii) Proof of concept for cenosphere separation using a dry technique developed. Laboratory scale experiments on.
Development of Magnesium Metal Production Technology i) Set-up 300 Kg capacity pilot plant	i) The detailed design, fabrication, technological structure, integration, installation and commissioning of the magnesium pilot plant at the scale of 300 kg Raw Materials/batch have been completed. Five pilot scale campaigns were carried out for producing Magnesium. ii) Standardization of the process parameters for the calcination of dolomite in the pilot scale rotary kiln (100 kg/h dolomite) was carried out. iii) The simulation of the Mg generation in terms of temperature, concentration, and pressure profile is done and further fine tuning is under progress. The modeling of electrothermal process consisting of detailed 3D-computational fluid dynamics (CFD) modeling of the magnesium reactor along with the condenser and the alkali sleeve is in progress.
Studies on creep behavior of Zr-2.5Nb alloy Nuclear reactor grade Zr-2.5Nb alloy tubes to be evaluated for creep strength behaviour. Stress rupture life data generation for master rupture life plot, creep testing up to 30,000h to understand the creep mechanisms, role of microstructural parameters and texture to be carried out.	Zr-2.5Nb (90mm dia) tubes prepared by extrusion-pilgering-annealing route were tested for stress rupture and short term (<15000h life) and long term (15000-33000 h life) creep strength in the temperature range of 275 to 450°C at 25°C intervals. A total of 84 nos of tests were conducted. Of these 64 tests were completed (a total of 3.5 lakh test hours). Rest of the tests are in progress. Additionally, 12 nos of test samples from 110mm dia Zr2.5Nb tube processed through forging-annealing route were tested and evaluated for macro texture and creep life. Fractography and SEM microstructural analysis were also carried out. Analysis of results showed that change in process route in the making of the tube affected the texture and phase fraction of Nb rich precipitates was also found to vary. Such variations get reflected in creep life of the tube material.

Targets Planned	Targets Achieved
Development of a process and design of a closed cell for production of sodium metal by fused salt electrolysis of sodium chloride Scaling up activity for operation of 2000A cell at Heavy Water Board, Baroda	The scaling up activity has been completed successfully. A 2000A cell has been fabricated, installed and commissioned by Heavy water Board at Baroda with assistance from CSIR-NML. A substantial amount of sodium has been produced with moderate process efficiency.
Non-destructive assessment of Creep In collaboration with NTPC_NETRA, this activity will be initiated as a major programme	A collaborative project with NTPC-NETRA on "Creep damage Assessment of High Temperature Headers and Pipelines Using Multi Parameter Non-Destructive Examinations" was started in June 2014 with financial outlay of Rs.130 Lakhs. The virgin P22 and P91 materials were received from NTPC and identification of creep conditions have been initiated which is required for the preparation of creep damaged specimen in the laboratory. The first review meeting was held at CSIR-NML on Feb. 27, 2014 where NTPC personnel expressed their satisfaction with the progress of the project.
Remaining Life assessment and failure analysis of strategic components RLA and root cause failure analysis of strategic components like aero engines, buffer couplers, power plant components, etc. will be carried out.	RLA and failure analysis has been carried out for several critical components for the strategic sector viz. Indian Air Force, Indian Railways, various power plant components, HAL Koraput etc.
Coal core analysis In collaboration with CIMFR, Dhanbad & CMPDIL, this programme will provide coal core analysis of at least 5000m of coal core samples	3000 m of coal core samples were analyzed in collaboration with CIMFR Dhanbad and CMPDIL.
Feasibility studies on low shaft furnace operation with wastes/ leans - Development of iron ore slime-Jhama coal composite briquettes. - Carry out plant trial in low shaft furnace for production of iron using the composite briquettes of slime and Jhama coal.	- Iron ore Jhama coal composite briquettes have been developed and the patent in collaboration with Tata steel has been filed. Plant trials at Tata Steel on these briquettes were also successfully carried out. - Plant trial with the developed briquettes in collaboration with Tata Steel and M/S Polybond has been conducted in the Low Shaft Furnace of Polybond Insulation Pvt Ltd in December, 2013.
Evaluation of Residual stress of HSS Rolls using Ultrasonic and X-ray diffraction based techniques Optimum grinding state for HSS rolls to be determined based on ultrasonic observations during campaigns	Optimisation of grinding process during profiling of new rolls and for in-service mill-out rolls is established. Developed in-situ surface-wave velocity difference based ultrasonic technique for stress condition evaluation of rolls.

Targets Planned	Targets Achieved
High strain rate deformation of automobile grade steels High strain rate properties (mechanical and physical) of different auto grade materials like IFHS, EIF, BSK46, DP590/780, BH220 etc., to be determined.	- Optimization of test velocity and specimen geometry for high strain rate testing. - Development of filtering procedures to eliminate noise from high speed test data.
Development of GMI-based Portable Magnetic Sensing Device for Detection of Carburization of Structural component of petrochemical / Refinery Industry Evaluation of Giant magneto-impedance properties of in-house prepared amorphous wires	Carburization and heat treatment of steel used in petrochemical industry has been carried out
Development of Gas based Brass Melting Furnace for Rural Artisans Installation of NML designed and fabricated furnaces in the Moradabad Brass Cluster for performance evaluation	Technology transfer of energy efficient coke based brass melting furnace to Moradabad Industrial Development Co Ltd
Tailoring of geopolymer properties by mechanical activation of fly ash In this Indo-Hungarian collaboration, reactivity of fly ash will be altered by mechanical activation.	Mechanical activation of flyash has been carried out in different mills and used for geopolymers. A significant improvement in the geopolymer properties were obtained.
Technology for production of pig iron and slag wool from iron ore slimes and Jhama coal in low shaft furnace Plant trials in the low shaft furnace at M/s Polybond Co., Durg to be carried out	Plant trials carried out using NML produced briquettes. Initial results are quite encouraging.

Business, Administration & other targets Planned & Achieved in 2013-2014

Targets Planned	Targets Achieved
Installation and full functionality of CSIR ERP system at NML	ERP implemented at NML
Enhance AcSIR PhD enrollments to at least 10 students per year	16 students have enrolled for the AcSIR PhD Programme in the year 2013-2014
Facilitate post-graduate students in utilizing NML facilities at nominal rates	Facilities are being provided to students at nominal rates

Flagship Projects

Development of Magnesium Metal Production Technology

Magnesium is a strategic material which is used in various applications like defence, automotive industry, aerospace, and steel making. The main objective of the project is to develop a cheap and energy efficient magnesium production technology and explore its commercialisation. The development will be carried out in two phases: (i) at a 300 kg capacity (raw material) pilot plant working in batch mode. (ii) at a pilot plant of 1 ton capacity (raw material) working in semi-continuous mode with a basic engineering package. The installation and commissioning of the Mg pilot plant (Fig. 1) was completed in August 2013. After that, four campaigns were carried out including the trial campaign of curing the lining and testing the condenser heater in steps up to 900°C. The average voltage and current ranges used were 20 – 70 V and 1800 – 3300 A for a melting duration of 60 hours approximately for around 280kg.

The content of magnesium in the crucible and metal trap were 4.9% and 28.9%, respectively. Preliminary CFD modelling of the process in collaboration with IIT Kharagpur has also been done. Validation of the model under actual conditions is under progress.



Fig. 1: Magnesium Pilot Plant facility at CSIR-NML

Development of zero waste technology for processing and utilisation of thermal coal

Coal washing is predominantly carried out using water as the carrier fluid and wet processing is the dominant mode of coal beneficiation. However, dry beneficiation of coal does offer a number of advantages. The enormous amount of fly ash generated after combustion poses a grave environmental problem. Besides, the fly ash contains a number of high value metals although in trace quantities. This ambitious project was taken up with a view to harness the advantages of dry beneficiation. It was also aimed at finding an eco-friendly bulk

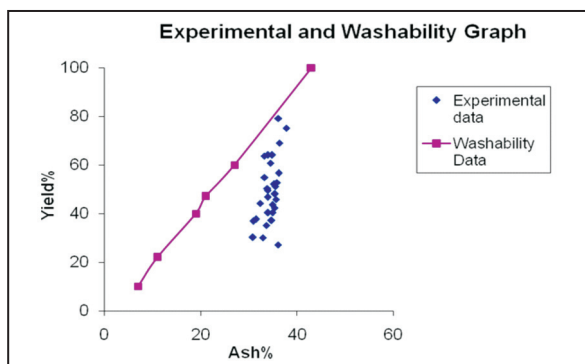


Fig. 2 : Dry beneficiation of coal using air table

utilization scheme of fly ash and recovering some valuable metals from it. The objectives are:

- To develop suitable technology for dry beneficiation of thermal coals from India to produce 34% ash and 25% ash clean coal
- Wet beneficiation of the rejects of dry circuit for maximum recovery of combustibles from thermal coal
- To develop green technology for gainful utilization of and recovery of valuables from combustion products. These include dry separation of cenospheres from fly ash and recovery of rare and rare earth metals from fly ash

Two coal samples, from Dakra, CCL and Gare Block, SECL were procured and complete characterization, including petrology, was completed for both. Processing and optimization studies with both coals in the fines range (-1.0 mm) were completed using Air Table. It

was observed that 9-10% reduction in ash level (absolute) is possible in single stage operation in the air table. Further work is in progress.

Several fly ash samples have been collected and their characterization studies completed. A preliminary scheme for bulk utilization of fly ash has been developed. Further testing for bulk utilization is under way. Significant understanding of recovery of cenospheres and rare metals from fly ash has been accomplished. Further experimentations for extracting them are in progress.

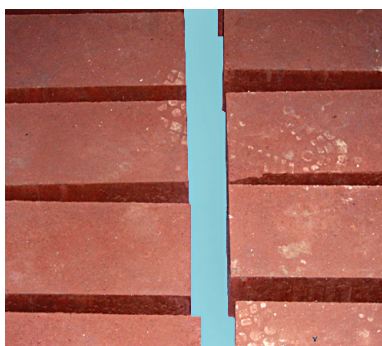


Fig. 3 : Bricks made from ash by geopolymerisation process

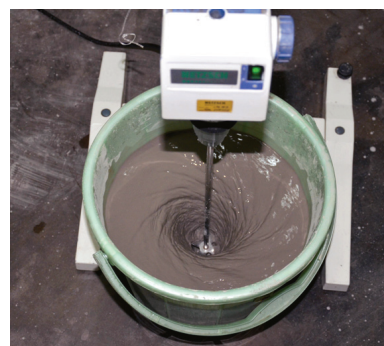


Fig. 4 : Experimental setup for assessing the cenosphere content by wet methods

Research Focus



Marie Curie,
Physicist, Two-time Nobel Laureate (1867-1934)

"Scientific work must not be considered from the point of view of the direct usefulness of it. It must be done for itself, for the beauty of science, and then there is always the chance that a scientific discovery may become like the radium, a benefit."

Applied & Analytical Chemistry

Inventorization of Lead, Cadmium, Mercury and Arsenic in paints, distempers and pigments

The project work aims to make an inventory of lead, cadmium, mercury and arsenic, present in paint, distemper and pigment samples, manufactured by companies in the organized and unorganized sectors in India. A database has been developed based on the number of paint industries in the organized and unorganized sectors, various types and grades of paints manufactured, production capacity, quantum of paint manufactured, exported from, imported to and used within the country and the possible sources of heavy metals in the process stages. Representative samples of the organized and unorganized sectors have been collected from retail shops from four places in India and subjected to quantitative chemical analysis. Based on the data, the present load of lead, cadmium, mercury and arsenic in the environment and the future trends have been predicted. The outcome of this project has been useful for the Ministry of Environment and Forest (MoEF) to draw guidelines and/or to come out with a directive to ban/restrict the use of toxic heavy metals in paint and related materials in India.

Fig. 1 shows the average concentration of lead of different colours of different brands collected from western region. Concentration of yellow colour paints of all the three brands have highest value but among the three companies Pashupati paints have higher value followed by Usha Paints and Baron Paints.

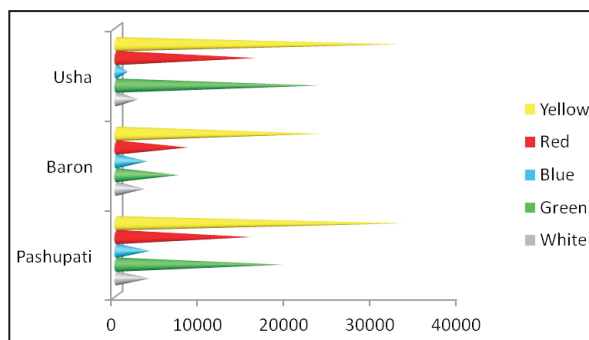


Fig. 1 – Average concentration of lead of different colours of different brands collected from western region

The results of Pb and Cr concentration in some local brand paints are presented in Fig. 2.

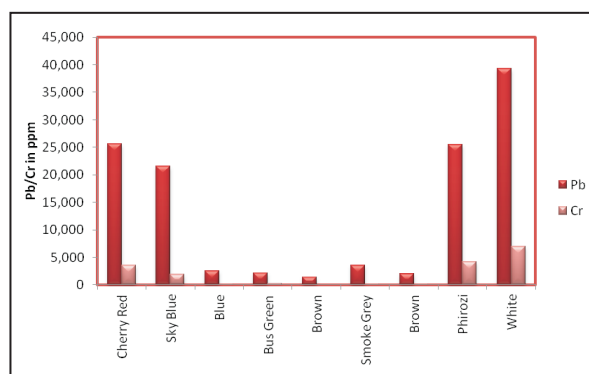


Fig 2 The results of Pb and Cr concentration in some local brand paints

Seam overall characteristics of coal core Samaleswari and Projapara, IB river coalfield, Orissa

The relationships between the chemical and mineral matter species of coals at different seams from Samleswari Ib block river valley, India have been investigated. Pertaining to it, complete data from chemical (proximate, ultimate and ash analyses) and mineral composition (major and minor minerals) of these samples have been used. The chemical and physical properties of coal are directly related to

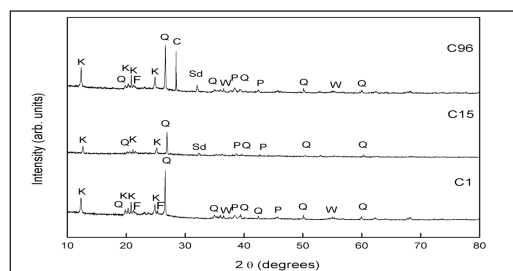


Fig.1 XRD patterns of coal. Q-quartz; K-kaolinite F-feldspar; P-pyrite; W-whitlockite; Sd-siderite

gasifier behaviour and vary widely from source to source. Due to the large variation in coal properties from various sources, detailed coal and feedstock characteristics are essential to predict gasification performance when a specific coal source is to be gasified. The principle aim of the present study is to obtain mineral species-specific information on coal and its corresponding ash and its effect on ash fusion temperature (AFT). The Factsage model has been applied to predict the probable equilibrium phases in coal and its ash.

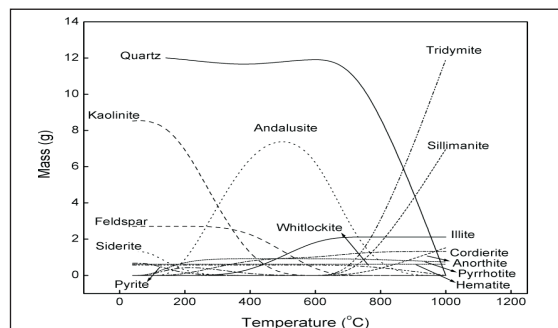


Fig.2 Phase transformations of coal using FactSage model (a) C1; (b) C15; (c) C96

Quality Evaluation of Coal-Cores explored from different regions of India

Chemical fractionation reflects the mode of occurrence of mineral phases associated in coal samples which selectively extracts the elements from coal based on their solubility. Present project aims to obtain mineral species-specific information on different coal seams of a particular borehole of Samaleswari block, Ib river coalfield, Orissa, India. Chemical fractionation is applied to determine the mode of occurrence of inorganic elements present in coal mineral phases based on their solubility. The results of chemical fractionation test have been correlated with the mineral phases identified by X-ray diffraction (XRD). A thermodynamic equilibrium calculation based on FactSage using "Equilibrium module" was used for predicting the multi-phase equilibria and their proportions for different coals mentioned at various temperature ranging from 40°C to 1200°C at a pressure of 1 atm.

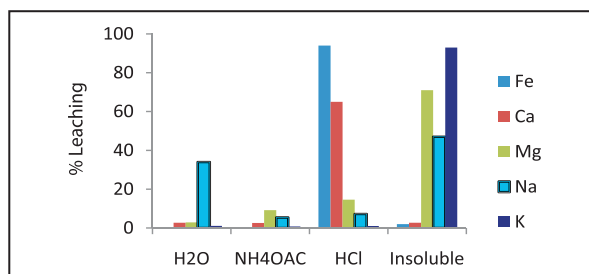


Fig. 1 Chemical fractionation of coal sample

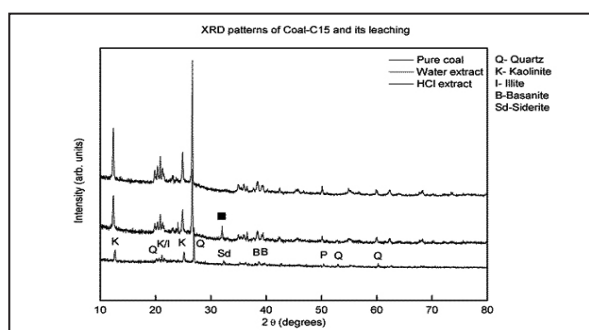


Fig.2 XRD analysis after chemical fractionation

Evaluation of Materials

High strain rate deformation behaviour of polymer and steel

The project is aimed at evaluating the high strain rate tensile deformation behaviour of various grades of polypropylene used in the automotive industry. The objective of the project also includes similar investigation on advanced high strength steels at a later stage. The project involves the following work elements:

- Design and fabrication of loading fixture for high strain rate deformation studies on polymers.
- Evaluating the high strain rate deformation behaviour in different grades of polypropylene in the strain rate regime of 110 and 100/s.
- Examining the high strain rate behaviour using different specimen sizes as recommended in different test procedures for polymers.

- Understanding the influence of specimen geometry (if any) on high strain rate deformation behaviour of polymers.

A fixture design has been made and fabricated for testing the polymer specimens. Four different grades of polypropylene materials have been tested in the strain rate regime mentioned above to study their deformation behaviour at high strain rates. Investigation on other grades of polypropylene is in progress. Typical photographs of specimens and representative high rate deformation behaviour is given below.

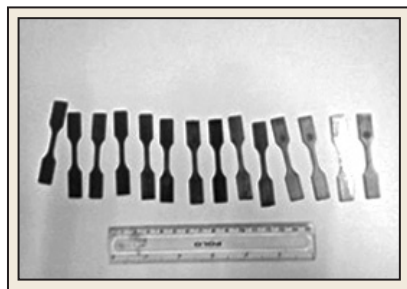


Fig. 1: Polypropylene specimens used for tensile testing at different strain rates

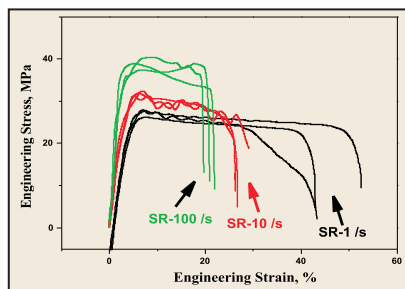


Fig. 2 : Engineering Stress-strain curves at different strain rates (1, 10 and 100 /s) for Grade D polypropylene.

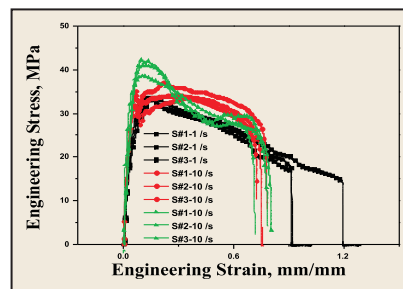


Fig. 3 : Engineering Stress-strain curves at different strain rates (1, 10 and 100 /s) for Moulded Grade polypropylene.

Studies on stress rupture behavior of alloy 690 material

Nuclear waste vitrification process uses pots made of Alloy 690, a solid solution strengthened nickel base superalloy. The proposed project aims at evaluating the stress rupture behavior of alloy 690 material at high temperature in the temperature range of 700 – 1100°C using constant load creep test method. A total of 41 nos. of creep tests will be carried out in the expected life range of 15 to 10,000 hours. A better understanding of the stress rupture behavior of the alloy will help in assessing the life of the vitrification

pots at higher operating temperatures. In addition to this, tensile, metallurgical investigation such as microstructural characterization and fractographic examination (of failed specimens) would also be carried out on the creep tested samples. Alloy 690 plates (10mm thick) manufactured at MIDHANI, Hyderabad (India) was received from BARC and initial microstructure evaluated. Creep tests at 70, 800 and 900°C are in progress.

Creep damage assessment of high temperature headers and pipelines using multi parameter non-destructive examinations

Headers and pipelines of power plants operating at high temperature and pressure undergo creep deterioration during exposures for a long time. In NTPC, the headers and pipelines operated at high temperature are aging and the current emphasis is on life optimization of the pipes. The project intends to develop NDE tools for assessing the creep damage of components made of P22 and P91 materials. Two NDE techniques would be used for analyzing the creep exposed samples:

- (i) Magnetic Hysteresis Loop (MHL) & Magnetic Barkhausen emissions (MBE)
- (ii) Non-linear Ultrasonic (NLU)

Presently, the creep life of P22 is being studied at three conditions, i.e., 550C / 115MPa, 575C / 115MPa and 600C/100MPa (Stress / Temperature). It has been observed that the measured rupture time of P22 is

mostly similar to that determined from ECCC data sheets. Moreover, the microstructures of as-received and creep expended P22 samples were found to comprise of a distribution of pearlite in ferrite matrix.

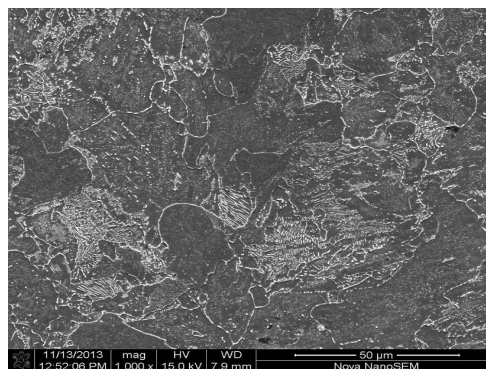


Fig. 4 : SEM image of P22 specimen after 60% creep expended life at 600°C/100MPa

Defect evaluation in pipes using Magnetostrictive sensors made from nanostructured soft magnetic materials

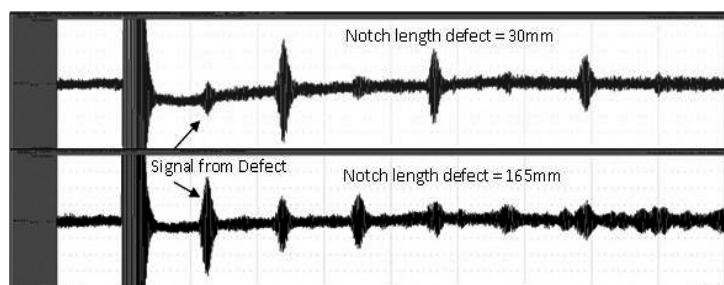


Fig. 5 : Typical signals obtained for notch length of 30mm and 165mm

CSIR-NML already has expertise on development of rapidly solidified amorphous and nanostructured magnetic materials. Activities on inspection of pipes using Magnetostrictive sensor (MsS) is being carried out in the laboratory using the developed materials. The objective of the project is to modify the magnetostrictive sensor (MsS) for enhanced sensor

output signal and detection of different types of defects in the pipe using the MsS sensor. Amorphous or nanostructured sensing core in the form of $\text{Fe}_{80}\text{Si}_8\text{B}_{12}$ melt spun magnetostrictive ribbon was used. The sensor comprised of a transmitter (T_c) cable, receiver coil (R_c) and DC biasing cable (B_c). Defects with increasing notch lengths were created in the pipe. The amplitude of reflected signal from the defect increases with increase in length of the notch and thus the defect size in a ferrous pipe. Typical signals obtained for notch length of 30mm and 165mm is shown in Fig-5.

Creep strain behaviour of 12%Cr Ferritic steel

The main objective of this project is to interrupt the creep tests at minimum creep rate region to see changes in the structure and creep-damage accumulation. The material was received in the form of a bar and it was confirmed as 12Cr steel with tempered martensitic structure. Creep specimens were made along the length of the bars having 90 mm gauge length and 6.25 mm gauge diameter as per standard specifications. Creep tests were conducted in Mayes, as well as, new applied test system in the temperature range of 427-482°C at four strain level (0.2, 0.5, 1.0 and 2.0 %) in each temperature and stress level. All the creep tests were run for short (<1000 h) and long duration at the specified strain of 12Cr steel.

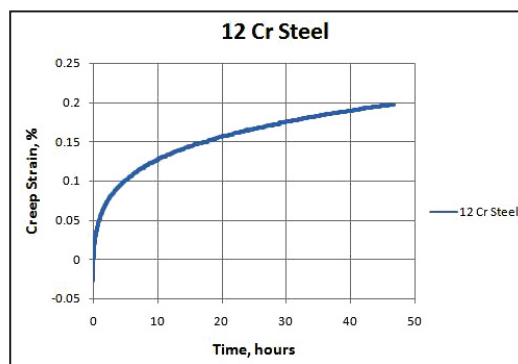


Fig. 6(a): Creep curve of 12Cr steel performed at 482°C/414 MPa upto 0.2% strain

Development of low cost online defect detection system for high end drawn wires

In industrial processes, high end wires/rods with various geometry are drawn through multi pass wire drawing machines. Quality assurance of these high end drawn wires/rods is of paramount importance to the industry. Any defects like seams, cracks, pits, slivers, weld-line defects and internal discontinuities on these wires/rods would compromise the performance of the wires/rods. Sometimes, surface defects are observed in the finished wires which can be caused due to wire rod surface quality or can be generated during wire drawing process. Surface quality of the entire length of drawn wire cannot be ensured by the existing system causing defective wires to be delivered to customers. Generally, quality assurance of these wires/rods is done by visual inspection. Furthermore, sophisticated defect detection systems of these wires/rods are too costly. Therefore, a solution for cost effective online defect detection system is currently under development.

This project aims to develop a cost effective tailor-made system for the detection and identification of defects in high end wires of diameter 1.6 – 1.8 mm and its implementation in the wire mill lines at Tarapur, Tata Steel. Presence of transverse cracks in these wires leads to premature failure at the

customer end during its use or in-service. Hence, the demand on quality from the customer end has become very stringent. It is desirable to detect the defects during the manufacturing stage itself and subsequently, filter out the defective wires, for the retention of customer.

Development of a low cost system will make it viable to implement the technique in a large number of production lines at Tarapur wire mills of Tata Steel that will help them to supply quality materials at customer end. Customer satisfaction and customer retention by supplying defect free wires will be the most significant impact of the project.

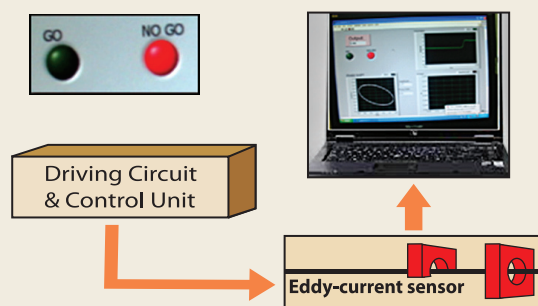


Fig 6(b): Schematic of Eddy current based defect detection system

Microstructural characterization of fusion boundary of ferrite-nickel based alloy in dissimilar metal weld

The objective of this project is to study the microstructural features across the fusion boundaries of welded joint consisting of low alloy and stainless steel using different filler alloy, electrode and method. Attempts will be made to reveal the in-situ deformation characteristics in scanning electron microscope to identify the location of crack initiation. The final aim is to identify the predominant microstructural factors for de-bonding / reduced toughness of weld joints through structure-welding parameter correlation.

One welded joint was received, which consisted of low alloy steel (SA 508 Gr.3 Class I) - buttering with 309L (GTAW using wire) - heat treatment - root welding with 308L (GTAW using wire) - welding with SA 312 Type 304LN by SMAW using electrode of 308L. Structural characterization included optical imaging, scanning electron microscopy using energy dispersive spectroscopy and x-ray diffraction study. Low alloy steel contained ferrite-pearlite/tempered martensitic structure. Close to the fusion boundary, low alloy steel exhibited a fine grain structure. Discontinuous Type-II boundary and occasional Type-I boundary were found within the transition region of the butter layer. Rest of the filler alloy exhibited dendritic microstructure.

Adjacent to fusion boundary between filler alloy-stainless steel illustrated polygonal grain structure. X-ray diffraction endorsed the presence of a thin layer of martensite within LAS near fusion boundary.

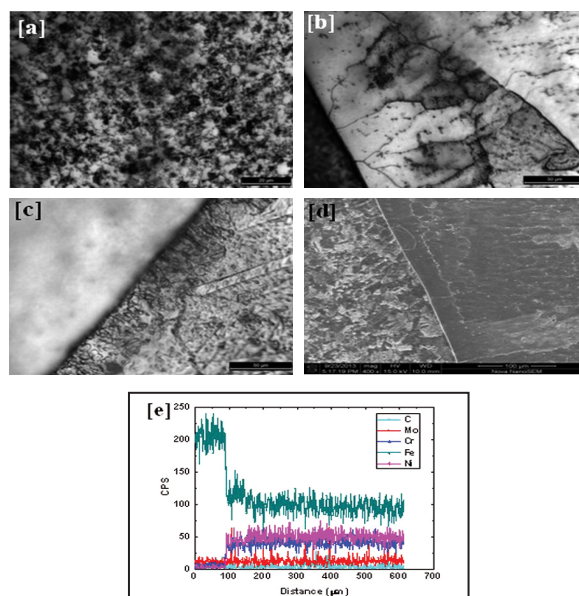


Fig 7: Microstructure of dissimilar weld across fusion boundaries (a) fine grain structure in LAS close to fusion line, (b) Type-I & II boundary in butter layer, (c) polygonal grain structure within stainless steel near interface (d) SEM image of fusion boundary of LAS-butter layer and (e) elemental profile across LAS-butter layer bond line

Arriving at a threshold value of EMS parameters for casting of high carbon billets

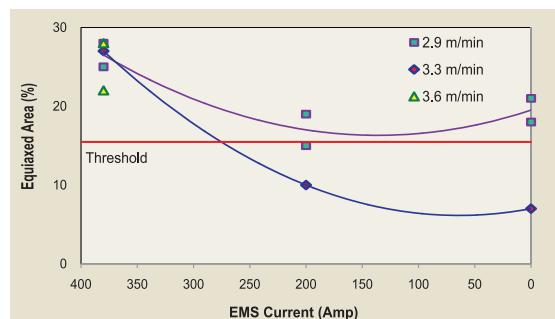


Fig 8(a) : Variation of Equiaxed area with casting speed at high superheat

This project aims to optimize the EMS (Electro Magnetic Stirring) currents at different superheats and casting speeds for high quality high carbon steel billets with desired parameters i.e. Equiaxed zone >16%, Central porosity <3 mm and Segregation index <1.12. To achieve the objectives of the project, trials were carried out on strand 3 at CC1, LD1 of Tata Steel in two phases. In the first phase, two different superheat ranges: low superheat range (42-34°C) and high superheat range (50-43°C) were evaluated keeping

casting speed constant at 3.3 m/min. In the second phase, casting speed was included as a variable and trials were conducted at two different casting speeds: 3.6 m/min and 2.9 m/min. The EMS Current was varied from 0–380 Amp keeping the frequency constant at 4 Hz. Under this project, it has been verified that when EMS current is high, irrespective of superheat and casting speed, equiaxed area is always large. Large equiaxed area can also be obtained without any EMS up to the casting speed of 3.3 m/min when superheat is low and up to the casting speed of 2.9 m/min irrespective of superheats. This project establishes the optimized parameters with respect to casting speed, superheat and EMS current for the continuous caster

of LD1, Tata Steel to produce good quality billets. This result will help them in making a decision on when to stir and when not to stir.

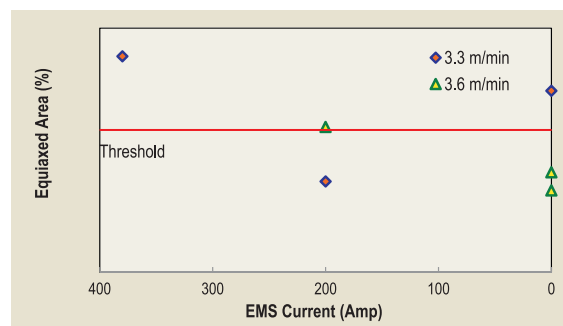


Fig 8(b) : Variation of Equiaxed area with casting speed at high superheat

High strain rate deformation of automobile grade steels

The investigation aims at determining and understanding the effect of strain rate on material properties. Generally, when an automobile crashes, the local strain rate reaches up to 100 to 500 /s. Therefore, it is necessary to determine the material properties at these regimes, so that we can predict the crashworthiness of the components of an automobile properly. Presently, materials like dual phase steels, interstitial free steels, TRIP/TWIP are extensively used in automobile components for their high strength to weight ratio. Therefore, it becomes necessary to evaluate their dynamic properties and understand their deformation mechanisms at such high strain rates. In this current investigation, a series of automobile grade steels like IF, DP600 and DP800, C-Mn-440, HSS800 have been selected. The different grade steels selected have different strengthening mechanisms at quasi-static strain rates. However, the strengthening mechanisms of these steels at higher strain rates, where deformation mechanisms changes are still unknown.

Key results:

(a) Tensile properties of DP800 and HSS800

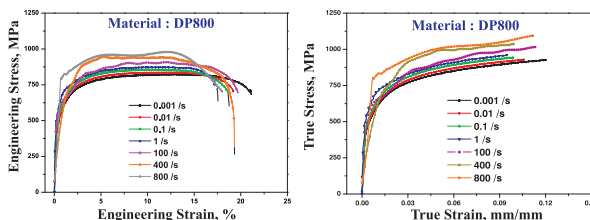


Fig 9: (a) Engineering Stress-strain and (b) True stress-strain curves for DP800 at different strain rates

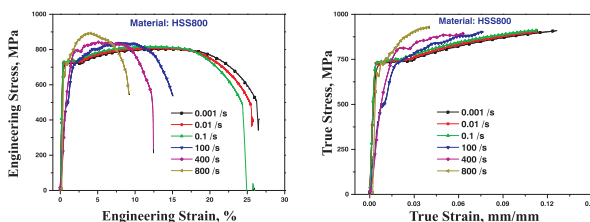


Fig 10: (a) Engineering Stress-strain and (b) True stress-strain curves for HSS800 at different strain rates

Extractive Metallurgy

Studies on the effect of process parameters on properties of iron ore pellets

A study on the effect of the process parameters on the properties of iron ore pellets with high level of fineness (Blaine numbers 2700 – 3250 cm²/g) was carried out. Important process parameters for making good quality pellets were optimized using high Blaine Noamundi iron ore fines used in Tata Steel's pelletization process. The effect of fineness, basicity, carbon content and MgO (olivine) content was studied to identify their optimum level. Calcined or hydrated lime showed very good performance in pellets in place of carbonate lime (limestone) that could replace

bentonite completely as lime has a good bonding property. Up to 2% carbon addition was found to be suitable which could reduce the induration temperature and thereby the induration energy. A 0.6-0.9% MgO addition in the form of olivine is suitable to get a very low RDI of pellet at a basicity level of 0.25. This laboratory scale study provides the effect of several process parameters on pellet properties and provides a technique to obtain good quality pellets from the given Noamundi ore with high Blaine fineness.

Process for production of DRI using iron ore slime with middling and rejected coal

The objective of the present investigation is to ascertain the feasibility of process development for production of highly metalized low sulphur direct reduced iron (DRI) utilizing waste iron ore slime and waste reducing agents. Waste middling coal and reject coal are used as reducing agents which contain more than 30 and 50% ash respectively. Iron ore slime pellets of 12 – 20 mm were made by the conventional method of pelletizing with optimized moisture content to obtain optimum green and dry strength. These iron ore slime pellets were dried in an ambient atmosphere and reduced in a bed of middling and reject coal containing premixed desulphurizing agent. Reduction temperature, time, size of pellets and reducing agents were optimized to yield highly metalized (>95%) low sulphur DRI. It is interesting to note that reduction of iron ore slime pellets were carried out without indurations/firing at high temperatures compared to the conventional DRI route. In addition to this, the reducing agents required for the present invention is only

about 5 to 8% higher than the theoretical value which is 40 to 50% less than the conventional DRI process. An innovative process with optimized process parameters has been developed for production of highly metalized low sulphur DRI utilizing waste iron ore slime with waste middling and rejected coal. The DRI produced from this process have high metallization (> 96%), low sulphur content (< 0.006), high cold crushing strength (> 200 Kg) suitable for blast furnace, induction furnace and electrical furnace for iron and steel making.



*DRI from iron ore slime
and middling coal*



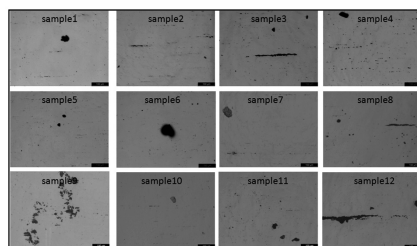
*DRI from iron ore slime
and reject coal*

The effect of combination of synthetic slag and carry over slag of LF to control the inclusions in high carbon steel wire rod

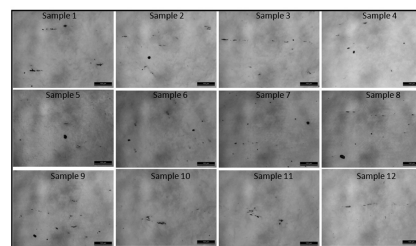
In this project, suitable synthetic slag compositions were developed pertaining to inclusions control in high carbon wire rods suitable for making wires for special applications. Significant improvement in steel cleanliness of hot rolled specimens prepared by melting the Tata Steel wire rods in a vacuum induction furnace was obtained keeping the residence time across the slag-metal reaction at about 30 minutes.

As the ladle furnace invariably contains some carryover slag generated during secondary refining, both the composition and quantity of the slag would vary from heat to heat. Therefore, in the present investigation, experiments were carried out by adding varying amounts of LD slag with appropriate composition of synthetic slag after melting the high carbon wire rods in a vacuum induction furnace.

Slag-metal reactions were continued for a residence time of about 30 minutes inside the furnace before tapping inside the vacuum chamber. These experiments were conducted to study the effect of a combination of synthetic slag and LD slag on the inclusions type, composition and extent of their presence in the steel. A significant improvement was observed in the inclusion rating of hot rolled specimens prepared by induction melting for a few combinations of synthetic slag with LD slag.



Optical micrographs of 5.5 mm diameter wire rod of Tata Steel (without synthetic slag treatment)



Optical micrographs of specimens treated with synthetic slag (1 wt pct of liquid steel), LD slag (20 wt pct of synthetic slag) & Quartz (10 wt pct of synthetic slag)

Technology development for iron ore slime briquettes

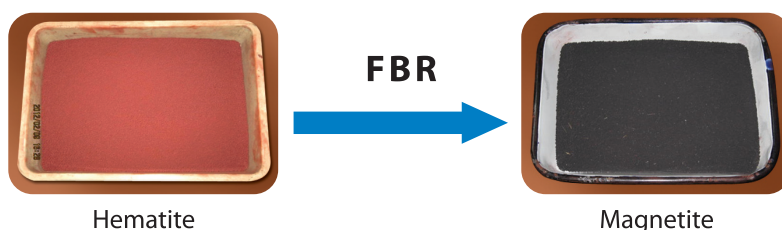
This is a collaborative project between Tata Steel and CSIR-NML. Iron ore slime is generated during the washing of iron ore. It is a very fine material comprising mainly of iron oxides along with a minor amount of SiO_2 , Al_2O_3 and other materials. Tata Steel has generated a huge amount of iron ore slime which is presently stockpiled in Noamundi area. With the increasing cost of disposal, less availability of land for disposal and environmental issues related to it, disposal is a less favored option. As the slime contains a significant amount of iron oxide, it was decided to use it as a resource material by converting it into briquettes for use in the LD converters as a coolant. However, making briquettes from very fine slime is a challenge. Earlier studies indicated that due to its high density and fine particle size ($<40\mu\text{m}$), most of the binders give very low strength to the briquette. During

experiments, various types of hydraulic and non-hydraulic binders were tried. Based on the results, it was found that hydraulic binders are suitable under optimized process parameters. Once established at lab, the process was up-scaled at pilot scale with the production capacity of 1.5 tons/ day using hydraulic binder of tailored properties. 25 tons of briquettes have been prepared and cured to get the required strength. These briquettes have shown compressive strength $>100 \text{ kg/cm}^2$ after proper curing. They have also shown a good shatter index. The cured briquettes were subjected to trial at LD converter of Tata Steel. The trials have proved the suitability of these slime briquettes for LD converter. More trials have been planned in the coming months before going for technology commercialization.

Scale-up studies for fluidized bed conversion of hematite powder into magnetite suitable for application in heavy media separation

A process has been developed to convert hematite powder into magnetite suitable for application in heavy media separation. Hematite powder is generated during acid pickling of steel in iron and steel plants. Several experiments have been conducted at the scale of 0.5 and 1 kg and process

parameters have been optimized. Different gaseous reductants including CNG (compressed natural gas), hydrogen, ammonia and coke oven gas were used. Experiments at a scale of 15 kg are being planned for commercial exploitation of this process.



Potash recovery from feldspar with simultaneous recovery of ferro-silicon

India neither has any high grade primary potash reserve nor produces any potash based fertiliser. Total potash requirement of our country is met through imports. India has a reasonably good amount of low grade surface deposit of potash in the form of glauconite and feldspar with average potash content of about 5-12%. However, the K present in this explored mineral is chemically bound with aluminum and silicon and is not in water soluble form, which cannot be absorbed by plant crops. Hence it is not suitable for direct application in the fields. Potash from such minerals needs to be recovered as K_2O / potash salt for agricultural purposes. Feldspar containing 10-12% K_2O can be considered as a very good raw material for recovering potash for its use in agriculture. Therefore, it is necessary to explore our available potash sources to meet part of our demand for K fertilizers.

With the sponsorship from FCI, Aravali Gypsum and Minerals India Limited, Rajasthan, CSIR-National Metallurgical Laboratory developed an interesting process for the recovery of potash from feldspar ($K_2O \cdot Al_2O_3 \cdot 6SiO_2$) containing about 11% K_2O . The process recovers potash by volatilization during smelting and simultaneously producing metallurgical grade Fe-Si. Various smelting parameters were optimized and tested on a two kg scale. However, the potassium vapor generated during smelting could not be collected in the open arc furnace. Therefore, in the second phase of the work, CSIR-NML has undertaken a project for recovery of potash from the volatile gases during the smelting process to produce both potash and commercial grade ferro-silicon through proper design and fabrication of a closed type arc furnace.

Green separation of rare earth metals using ionic liquid as extractant



Fig 7: Synthesis of Ionic liquid

Rare Earth Metals (REMs) are used in magnets, batteries, tube lights, catalyst etc. because of their unique properties. As the physical & chemical properties of REMs are almost similar, their extraction and separation become difficult. The conventional extractants used in solvent extraction process has some limitation for the efficient and "Green Separation" of REMs.

Use of Ionic liquid in the solvent extraction process is an emerging field for the extraction of metals. Ionic Liquid (IL) is the organic salt formed by interaction of two organic compounds at room temperature. The electrostatic force of attraction between the cation and anion present in the ionic liquid can help in the better extraction of metals as it can provide more

stability to the metal in organic phase. Separation of individual rare earth metals is the most challenging task of rare earth technology; Ionic liquid can help in this area by providing better selectivity. High escaping tendency of conventional solvents leads to solvent loss in the process. Therefore, negligible vapor pressure of IL can be important for clean and green separation of metals. Two ionic liquids based on phosphoric acid and amine were synthesized and characterized by FTIR. Basic extraction studies have been carried out on the extraction of lanthanum metal and the mechanism is being established.

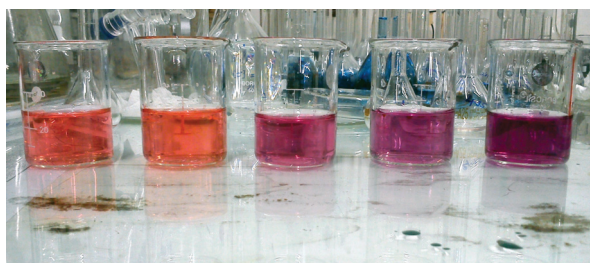


Fig 8: Metal ion at different concentration

Smelting study of chromite ore of different grades to produce ferro-chrome in 50 kVA EAF

Chromite ore mined in Sukhinda mines are rich in Cr and Cr:Fe ratio is increasing day by day which leads to increase in its refractoriness. Its reduction and smelting is very difficult. In the present practice, this high grade ore is being blended with low grade ores to maintain Cr:Fe ratio of 2.6. However, in practice difficulties in furnace operation and Cr loss in slag occurs due to the frequent fluctuation of blend percentage. Process parameters need to be established for smelting reduction of refractory chromite ore for their optimum utilization in existing submerged arc furnace (SAF) process with an aim to produce 62% Cr in ferro-chrome with a maximum of

10% Cr loss in slag. In this study, CSIR-NML has conducted experiments in 50 kVA EAF in 12 kg batch (ore in charge) to study the metallic recovery, optimum power consumption with varying ore grades and flux composition. Experiments are in progress. Tata Steel is conducting further study on produced slag and metals. Power requirement for smelting reduction in 50 kVA EAF is around 55 kWh. Soderberg paste (Graphite lining) has shown better performance than magnesite refractory. A good metallic recovery has been found in all cases, even for the refractory ores (Fe/ratio up to 4) and this is comparable with conventional sintered pellet charging.

Materials Engineering

An adaptive neuro-fuzzy inference system based model to predict mechanical properties of hot rolled TRIP steel

An adaptive neural network approach coupled with fuzzy inference system based model has been developed to predict mechanical properties of hot rolled TRIP steel. A data set containing critical information on the mechanical properties for different steel compositions and deformation conditions obtained from published experimental data for hot rolled TRIP steel has been employed to develop a neuro-fuzzy model. A vital set of process variables has been selected as model inputs for predicting tensile strength, yield strength, elongation and retained austenite for given finish rolling and coiling temperature. Figures (1-2) show the effects of coiling temperature on tensile strength and elongation of typical TRIP steel with five different compositions. It may be observed that initially the tensile strength decreases rapidly with increase in coiling temperature and then the rate of decrease of tensile strength diminishes moderately. Elongation

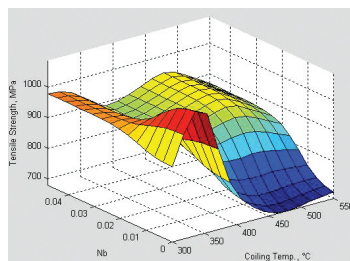


Fig.1 : Effect of coiling temperature on tensile strength

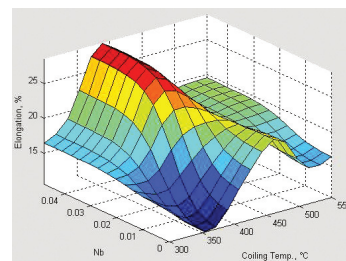
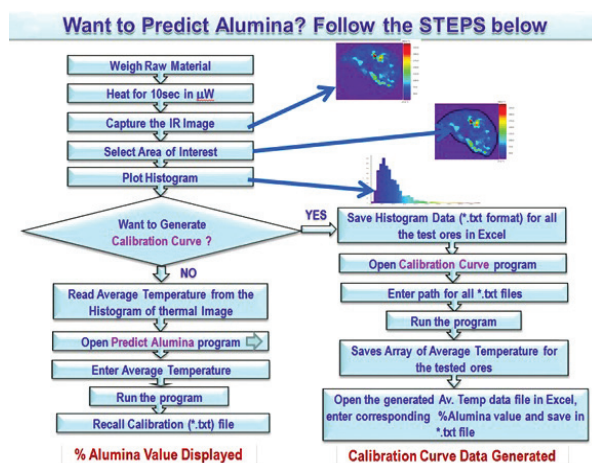


Fig. 2 : Effect of coiling temperature on elongation

increases with an increase in coiling temperature, attains the highest value at the coiling temperature of about 400°C and then decreases slightly with the subsequent increase in coiling temperature. The fuzzy modelling approach has been successfully applied to mechanical property prediction from measured experimental data and revealed useful quantitative relationships of the composition microstructure-property behaviour.

Development of advanced sensor-based technique for raw materials beneficiation

The aim of this project was to develop a technique for an online gradation of iron ores based on alumina content. After a preliminary exploration of the few existing techniques for ore gradation, IR thermography was selected for this purpose. Iron ores with Fe composition in the range of 58 to 67 wt. % and alumina (Al_2O_3) from 1.0 to 6.0 wt. % were collected from Noamundi mines, Tata Steel, Jamshedpur. The bulk amount of iron ore specimens was weighed and divided into portions of equal quantity. Each portion of ore specimens were taken in a petri dish and heated uniformly using a microwave oven for a duration of 10s which is sufficient to create a difference in IR emission between the ore specimens. Infrared Thermography (make FLIR Agema 550) with 0.1°C resolution was



configured to capture the thermal image of the heat radiated by iron ore specimens placed at fixed distance from the IR camera. Calibration was done on 150 samples collected from Noamundi. During this period, a flow sheet shown in the figure below was

prepared for predicting alumina in the iron ores. The technique was demonstrated and implemented at Noamundi in September, 2013. An on-site training to personnel was provided and this process has since been continuously used at Tata Steel, Noamundi.

Development of processes for making biphasic (Hydroxyapatite + β -TCP) nanocomposite blocks & transfer of technology

Recently, a commercially attractive and novel process for the synthesis of a three dimensional load bearing porous biphasic calcium phosphate (hydroxyapatite + β -tricalcium phosphate) nano-composites useful as bone graft and scaffold was developed at CSIR-NML. The process comprises of two steps: the first step is the biomimetic synthesis of calcium deficient hydroxyapatite with Ca/P ratio of 1.22 and the second step is the thermal decomposition of the calcium deficient hydroxyapatite at 900 °C to biphasic calcium phosphate nano-composite blocks. The highlights of the process and the product are (i) low energy consumption (ii) simple and cost effective method (iii) the product having a mechanical compressive strength of 26 MPa (iv) biphasic calcium phosphate is cyto-compatible to bone marrow driven

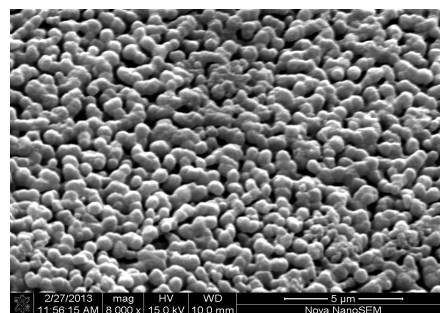


Fig. 4 : Microstructure of biphasic block

mesenchymal stem cells isolated from wister rat (v) capable of differentiating stem cells into new bone forming cells and (vi) particle size of the product is < 50 nm. The developed know-how was transferred to Surgiwear Ltd., Shahjahanpur.

Development of ferromagnetic shape memory alloys by rapid solidification route using melt spinning technique

The objective of the project is to develop ferromagnetic shape memory alloys (FSMAs) in the form of ribbons by rapid solidification route and optimise heat treatment schedules to modify magnetic and structural properties. X-ray diffraction studies of $\text{Co}_{64-X}\text{Ni}_{36}\text{Al}_X$ ($X=23, 24, 26$ and 28 at %) alloys melt spun into ribbons at CSIR-NML have been investigated. All the samples revealed a co-existing β and γ -phase at room temperature. Substitution of Co by Al, reduced γ -phase with increment in β -phase fraction. The presence of these phases influenced martensite transformation and magnetic field induced strain. The magnetic field induced strain plots obtained for the ribbon samples are shown in fig-5. Highest magneto-strain of 28 ppm was obtained in the

Al_{23} sample while the value goes on decreasing to 12 ppm for Al_{28} alloy. It appears that the austenitic dominance in combination with β -phase structure in low Al containing alloy (Al_{23}), facilitated magneto-strain.

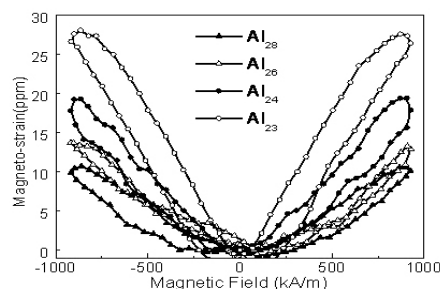


Fig. 5 : The magnetic field induced strain plots obtained for the ribbons samples

Development of rapidly solidified high induction alloys for transformer core

The amorphous metal based electrical power transformer decreases the core losses and heat generation during power distribution. In this context, a series of high induction FeCo based alloys within the compositional ranges of $(\text{FeCo})_{80+x}(\text{BSi})_{20-x}$ will be developed through rapid solidification technique using the single roller melt spinner. Some growth inhibitor element (Nb) and nucleating agent (Cu) will also be added for nano-crystallization in precursor amorphous matrix. Initially, Co substitution was investigated on the nano-crystallization behaviours and high temperature magnetic properties of the $(\text{Fe}_{1-x}\text{Co}_x)_{79}\text{Si}_{8.5}\text{B}_{8.5}\text{Nb}_3\text{Cu}_1$ ($x = 0, 0.35$, and 0.5) alloys. It was observed that the 0.35 fraction of Co addition caused maximum saturation magnetic flux density ($B_s > 1.5\text{T}$) and grain size (D) (Fig. 6). However, thermal stability (T_x) and primary crystallization temperature (T_{x1}) were lowest when Co fraction was 0.35. The alloys annealed at post primary crystallization temperature (400C) confirmed the formation of α -FeCo nano-crystallites in the amorphous matrix, while the annealing at 600C contributed to other non magnetic phases along with α -FeCo nano-crystallites

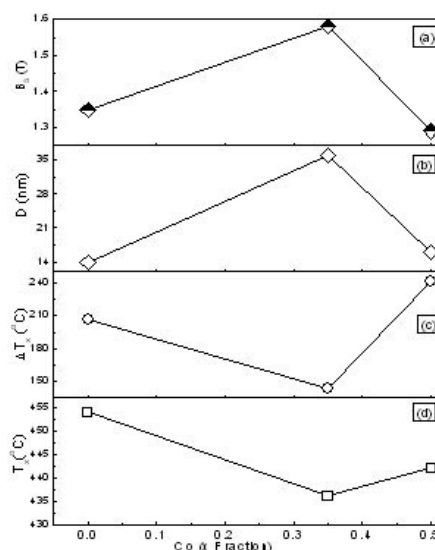


Fig. 6 : Compositional dependence of (a) saturation magnetic flux density (B_s), (b) mean grain size (D), (c) temperature difference between primary and secondary crystallization (ΔT_c) and (d) primary crystallization temperature (T_{x1}) for alloys $(\text{Fe}_{1-x}\text{Co}_x)_{79}\text{Si}_{8.5}\text{B}_{8.5}\text{Nb}_3\text{Cu}_1$ ($x = 0, 0.35, 0.5$). All measurements are made in as-quenched ribbons and mean grain size is measured after annealing at 400C.

Development of a process for making fibre reinforced hydroxyapatite nanocomposites three dimensional structure having load bearing properties

In this industry sponsored exploratory project, a biomimetic process for the synthesis of natural jute fibre reinforced polymer hydroxyapatite nano-composite blocks as bone graft was developed. The highlights of the process are: (i) in situ bio-mineralization process (ii) low energy process (iii) having mechanical compressive strength of 40 MPa and (iv) crystallite size of hydroxyapatite is 70 nm. In addition to this, another biomimetic in situ process for the synthesis of prosthetic carbon fibre reinforced polymer hydroxyapatite nano-composite three dimensional blocks having mechanical compressive strength of 70 MPa as bone graft and scaffold is also being developed.



Fig. 7 : Three dimensional C-fibre reinforced HA nanocomposite block

Graphene based composite coating for corrosion inhibition of steel

Graphene, a single atomic layer of fused sp^2 hybridized carbon atoms, exhibits unusual electronic properties owing to the linear dispersion of valence and conduction band. Besides, it has been shown recently that the graphene sheet is impermeable to all the chemical ions, which motivates many researchers to use graphene as a coating material on metals for corrosion inhibition. However, a simple eco-friendly process that is capable of coating graphene at large scale is desirable for commercial usage. In our project funded by Tata Steel, we have developed a process for coating of graphene on steel from seedlac as a carbon source. Subsequently, coating of a layer of cooked oil on the graphene coated steel followed by heating yields a composite coating. The composite coating showed good corrosion inhibition of steel in 3.5 wt.% salt solution. The corrosion properties measured by salt spray technique revealed that the coating lifetime of composite on steel is more than 200 h. The developed process has potential to make cost-effective graphene coated steel for corrosion inhibition.

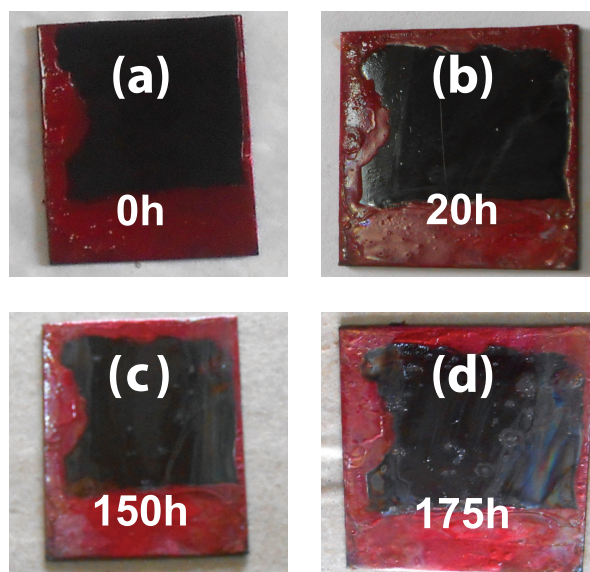


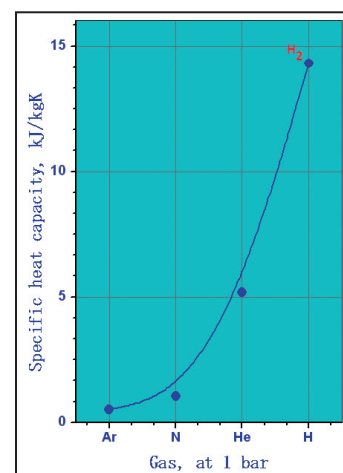
Fig. 8: The images of the composite coated steel that was performed for the salt spray experiment at different exposure times (a) 0h, (b) 20h, (c) 150h and (d) 175h. The sides were blocked using nail polish. It can be revealed from the images that the coated graphene film remains intact on the steel surface after a long exposure time.

Multi-functional Metallurgical Process Reactor Chamber



Several metallurgical reactions require controlled process environment besides the temperature. CSIR-NML designed and developed a reactor chamber that enables controlled process environment and heating and cooling rates. Heating and cooling rates used in actual annealing can be achievable in desired controlled environment so as to avoid,

namely, oxidation in case of steels. The reactor was successfully used to simulate several applications that are commonly and not so commonly practiced in steel industry. For example; IF steel batch and continuous annealing processes with desirable dew point setting, ultrafast cooling for dual phase or complex phase steel annealing cycles, etc.. Multiple options for cooling medium is available with the system; such as hydrogen, nitrogen, or mixture of these two, water injection, air humidification etc.. Flexibility in selecting cooling medium provides wide range of control on cooling rates and process environment.



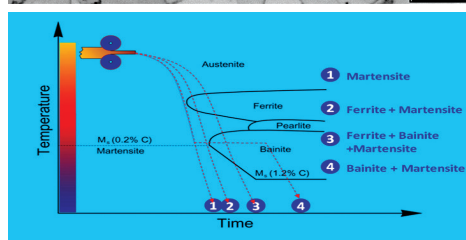
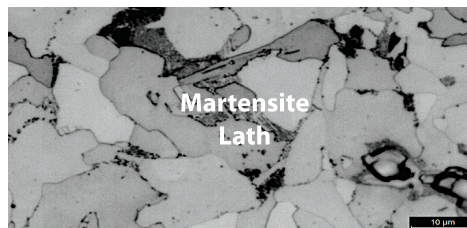
Plot showing specific heat capacity of various gases. Hydrogen has highest capacity. Cooling efficiency can be varied by increasing H_2 fraction in the gas mixture.

Process Environment or cooling efficiency :

Specific heat capacity of various gases indicating their cooling capacity is shown in the plot.

Batch and continuous cooling line simulations :

Cooling rates of $100^{\circ}/s$ can be programmed by appropriate use of gas mixture under controlled reducing atmosphere or in air. Cooling system available with the system facilitates controlled phase transformation that would lead to single, dual or complex phase steel production. It also enables simulation of batch or continuous annealing line processes in steel industry. A schematic illustration of the process is shown in figure.



A typical example of dual phase steel composed of ferrite and martensite phases produced by inter-critical annealing and rapid cooling cycle "2".

Mineral Processing

Development of beneficiation strategy for low grade copper ore from Zambia

Silica, magnesia and alumina are the major gangue materials in this sulfide ore of copper. The objective was to develop a strategy for enhancing the concentrate grade of the copper ore to a level of 10% insoluble. Detailed physical, mineralogical and chemical characterization of the ore was carried out to establish the nature of the ore. Having understood the characteristics of the ore, a bench scale beneficiation scheme was developed to achieve the objective through the flotation route. It was observed that the sample was 95% liberated at 75 micron size and liberation was not a major issue with the sample. Effective depression of the gangue was of major concern. It was established that a pH of around 10 in the roughing stage and around 10.5 in the cleaning stages was required for effective flotation of the ore and no regrinding stage was necessary. A flow sheet with one cleaning stage and three re-cleaning stages was recommended

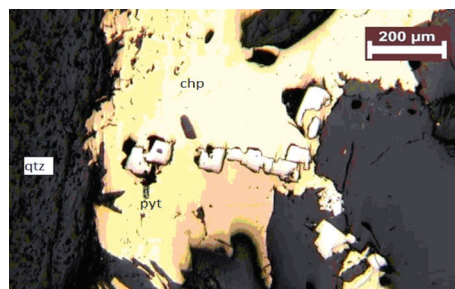


Fig 1. Optical photomicrograph of the ore; Inclusions of pyrite (pyt) within chalcopyrite (chp) and quartz (qtz).

for the ore. Several depressants were investigated to bring down the gangue content to around 10% and the most effective depressant was recommended. The insoluble content was brought down to slightly below 10% in the final concentrate with this depressant. It was recommended that the pulp density must be low in the re-cleaner stages. The suggested PD values are around 30-34% in the rougher, scavenger and cleaner. The PD values must be gradually decreasing in the re-cleaners in the range of 15-25%. It was also established that the efficiency of the suggested circuit would improve if the ore is mixed with another ore investigated in this study in the ratio of 80:20.

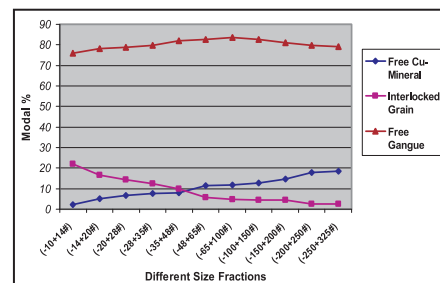


Fig 2. Liberation characteristics of the ore.

Flotation studies on limestone samples of M/s ACC, Madukkarai

M/s ACC Limited, Madukkarai, Coimbatore requested CSIR-NML to study the present flotation process practiced in the plant through M/s McNally Bharat Engineering Co. Ltd. Bangalore. CSIR-NML conducted a detailed study on the limestone sample being used in the plant. The studies include the liberation, flotation by forward and reverse processes with

different reagents adopting conventional and column flotation techniques in the laboratory. The report consisting of the results and recommendations was submitted. CSIR-NML has suggested to discontinue some of the reagents which are not necessary for the present process.

Industrial Flotation Column supplied to M/s Andhra Barites Corporation Ltd

A commercial 2.5 metre diameter Flotation Column to treat 700 tpd of low-grade barite was designed with state-of-the-art control systems and installed at M/s Andhra Barite Corporation Limited, a joint venture with M/s Andhra Pradesh Mineral Development Corporation. The project was carried out collaboratively between CSIR National Metallurgical Laboratory and McNally Bharat Engineering Company Limited. The trial runs were successfully completed. The results of trial runs are above the expected / envisaged results and the column is delivering the rated capacity with excellent metallurgy. The plant is yet to be formally commissioned and operated continuously, due to the unstable political conditions prevailing in the state of Andhra Pradesh.



Fig 3. Flotation Column

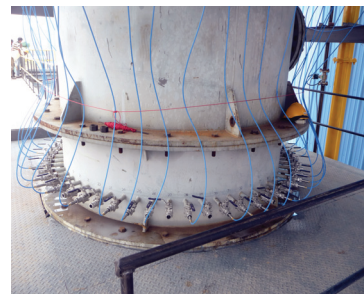


Fig 4. Sparging arrangement



Fig 5. Column Control Panel



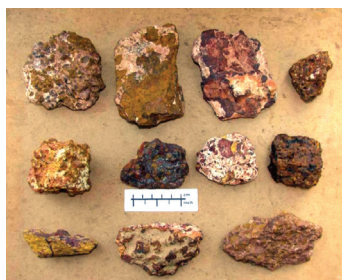
Fig 6. Column Froth.

Studies on characterization and beneficiation of low grade Iron ore sample from Shire-Mentebteb, Ethiopia

About 500 million tonnes of iron ore resources are located in Shire-Mentebteb region of Ethiopia. The deposit is a lean grade goethitic ore and it is to be concentrated to a level suitable for utilization through blending with high grade concentrate for iron and steel making. The detailed characterisation and beneficiation studies were carried out. The objective of the study was to develop a process flow-sheet for beneficiation of the low grade iron ore assaying 33.17% Fe to produce concentrate with 51% Fe.

Mineralogical studies of the ore revealed that goethite is the main iron-bearing mineral although its abundance is less compared to the gangue minerals. Major gangue minerals are quartz and clay. Clay, which forms the main matrix, contains finely dispersed goethite, quartz and occasionally hematite. From the texture of the ore it may

be inferred that while the minerals like oolitic/pisolitic goethite, quartz will be liberated at a relatively coarser size, the finely dispersed goethite and clay at extremely fine sizes below 63 μm . The lean grade, complex mineralogy and goethitic nature of the ore posed a challenging task in meeting the objective set by the sponsor.



(a) Individual lump-pieces showing variegated colors



(b) Gibbsite and quartz are bound by colloform goethite.

Fig. 7 : Characteristics of the low-grade Ethiopian iron ore showing the modes of occurrence of various minerals

Bench scale beneficiation of the sample was carried out involving different beneficiation techniques. The sample responded better to magnetic separation over gravity separation. Studies were also extended to processing by froth flotation, but due to the complexity of the ore, the conventional techniques did not respond. The concentrate assaying more than 48% Fe could not be achieved. In view of the above, an alternate process involving reduction roasting was carried out using coal as reductant followed by wet

low intensity magnetic separation (LIMS). The concentrate assaying 51.48% Fe with 60% iron recovery was recovered from magnetic separation of the roasted sample. For a concentrate with 49% Fe, it would be possible to get 73.2% recovery of iron values. Recycling of the middlings is expected to increase the overall recovery. Based on these studies, a flow-sheet has been developed for concentration of the lean grade iron ore from Shire-Mentebteb, Ethiopia.

Study of the sintering with reference to Tata Steel using ferruginous materials : pre-balled iron ore concentrates and beneficiated sinter grade feed

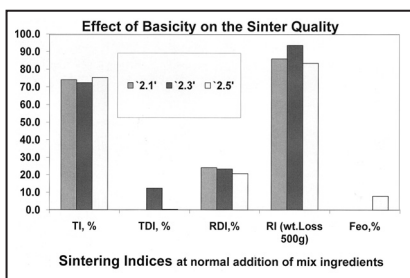
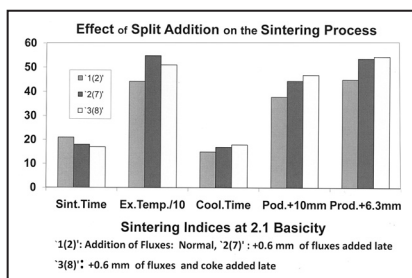
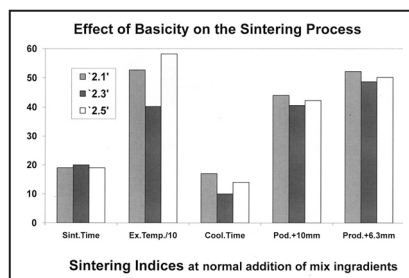
Granulation of the sinter mix is an important parameter to affect the sinter productivity and its quality. Several studies carried out in the recent past have correlated the pre- ignition permeability with the granulation of sinter mix vis-à-vis the sintering speed. In general, the concentrate which is generated from the lean grade ores or slime after intense beneficiation has poor permeability on account of its fineness. This can be improved through proper granulation. The project was sponsored by Tata Steel Limited with the following objectives:

- To produce sinter of desired quality and enhanced productivity from raw mix incorporating pre-balled concentrates
- Utilization of ultra-fines through the sintering route (instead of pelletisation)

Detailed characterisation of Joda ore fines, fluxes and other raw material ingredients, received from Tata

Steel, were undertaken for their chemical and size analyses and thermal and mineralogical characteristics. Pot (600 mm bed height) sintering experiments (120 kg per batch) were conducted to establish the effect of sinter basicity (CaO/SiO₂), mode of addition of fluxes and solid fuel vis-a-vis the mixing and balling conditions of the raw mix on the sintering indices.

Sinter basicity of 2.3 seems to be optimum with respect to the granulation of the mix with harmonic mean diameter of the mix (-1.68 mm size fraction) 1.04 mm as against 0.94 and 0.84 mm at 2.1 and 2.5 basicity, respectively. Near to maximum sinter (+6.3 mm) productivity [49.82 T/(sq.m/d)] was observed at this basicity and the sinter having lowest RDI (23.4%) and near to highest tumbler index, TI (72.4 %). The times of sintering and cooling were 20 and 10 minutes (600 mm) respectively. With split addition, when the coarser (+0.6 mm) fraction of fluxes were added late in



wet mixing, the sinter productivity and TI improves to 54 T/(sq.m/d), 73.3%, respectively, however, sinter RDI (32.3%) deteriorates. A further improvement in the productivity (55.9 T/(sq.m/d)) was observed with the sinter quality (TI and RDI) remaining same when +0.6 mm coke was late added compared to all coke added late.

Further studies on granulation of sinter mix with divided addition of MgO bearing fluxes and improvement in the process through auxiliary fuel addition during the sintering are being undertaken.

Energy assessment in the comminution of heat- treated BHQ from Tata Steel

The objective of the project was to assess energy requirements in the comminution of thermal treated BHQ/BHJ. The banded hematite jasper is considered as a mines waste. About 1 ton of BHJ sample was collected for the present work which has a bulk chemistry of 34.5% Fe, 49.13% SiO₂ and 1.45% Al₂O₃. This material is of extremely poor grade. BHJ comprises of dense hematite, martite, microplaty hematite, goethite, and microcrystalline to cryptocrystalline quartz. The uniaxial compressive strength of the ore was found to be 1596 kgf/cm². The

Bond work index of the sample was found to be 14.2 kWh/mt (kWh per metric ton). The heat treatment protocol for BHJ was developed by which the Bond work index was observed to be lowered to 12.9 kWh/mt. The ore showed development of microcracks. About 100 kg of BHJ was heat-treated and was subjected to jigging. The pre-treated BHJ, subjected to jigging, generates a concentrate with minor improvement to 36.6% Fe. An exploratory work on response of BHJ to microwave indicated its positive result on self-heating.

Resource, Energy & Environment

Biosynthesis of iron oxide based magnetic nanoparticles from industrial wastes

The objective of this project was the development of a scientific basis of bio-processing to recover iron oxide based magnetic nanoparticles from pickle liquor of steel industries. In one method, facultative iron reducing bacteria isolated from iron mineralized zone of copper mines were able to synthesize maghemite particles of 10-20 nm diameter (Fig. 1), with high coercivity and magnetization of 110 Gauss and 66 gmu/g respectively at room temperature. Alternatively, iron oxidizing bacteria of *Leptospirillum* and *Acidithiobacillus* genera were also employed on diluted ferrous solution, yielding by virtue of biologically induced mineralization an array of FeOOH particles (Fig 2) of ultrafine nature (<5nm) in the cellular entities and good coercivity of 40-45G.

In another attempt, the bacterial species of *Klebsiella oxytoca* was found amenable to convert ferrous compounds in the

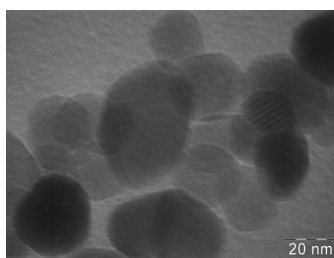


Fig. 1 : TEM micrograph of maghemite nanoparticles iron reducing bacteria

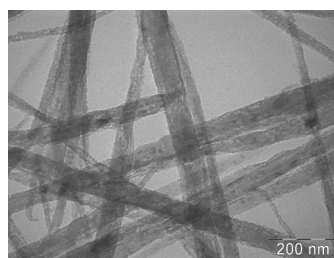


Fig. 2 : TEM micrograph of goethite using nanoparticles using iron oxidising bacteria

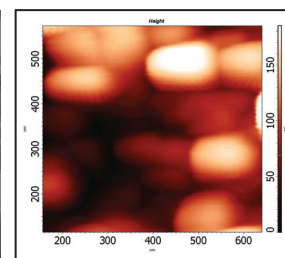


Fig. 3 : AFM image of ferrihydrite nanoparticles using heterotrophic bacteria (*Klebsiella* sp.)

model industrial waste solutions, by way of ferritizing, into iron rich sediments rich in Fe-oxy hydroxides. Atomic Force Microscopy identified three image types – small, medium and large particles close to 2 - 4 nm synthesized intracellularly and identified as superparamagnetic (Fig. 3). Mössbauer spectral analysis and X-ray Photoelectron Spectroscopy indicated the product to be a surface of iron hydroxide (III)-FeOOH or Fe(OH)₃ and prominence of deep layers of ferrihydrite (2.5 Fe₂O₃·4.5H₂O oxide) or Fe₂O₃. Uniqueness of the process is the microbial conversion of ferrous to maghemite nanoparticles of high coercivity (110G) and magnetization (66gmu/g) at room temperature.

Processing of spent lithium ion batteries

The objective of this project was the chemical and bio-hydrometallurgical treatment of calcined spent Li-ion batteries and purification of metal salts of Li, Co, Mn, and Ni for development of proof of concept.

Raw material calcined at 800°C received as battery ash contained copper, nickel, cobalt, aluminium, manganese, lithium, carbon and sulphur (Fig. 4). The aim was to selectively remove copper and aluminium to yield Li-Mn-Co-Ni product. In the hydro-metallurgical approach, sulphuric acid leaching at high temperature extracted all metals, which was then

subjected to solvent extraction process to eliminate copper. This was then subjected to precipitation to remove aluminium. Resultant precipitate of hydroxides of mixed metals was roasted to form the desired product. Fungal species (*Aspergillus niger*) adapted on synthetic solutions of Li, Mn, Co, Ni, Cu and Al in presence of sucrose media at room temperature and acidic pH was able to solubilise >95% Li and Mn, with very low recovery of Cu, Co, Al and Ni. Second stage leaching with organic acids resulted in complete extraction of Li, Mn, Co and Ni, with less Al and Cu in solution.

The processes developed clearly limit the content of undesired elements in the product, meeting specifications with respect to selectively (Fig 5) and yield. The flowsheets are now being evaluated for tech-economics and the desirable one shall be submitted for joint patenting by the sponsor. Uniqueness of the process is the selective leaching and separation of desired metals (Li, Ni, Co, Mn) from calcined LIB ash in the product both by chemical and biohydrometallurgical processing, taking care of impurities (Cu, Al, F, P, S).

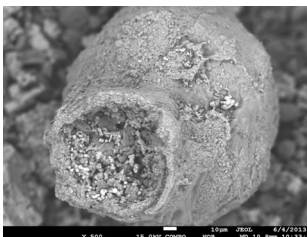


Fig. 4 : EPMA micrograph of Spent LIB ash (The body is rich in Cu and Mn; and the rim is purely Al. The inner reserve is very dense, with abundance of Mn (white matter), and Carbon (grey matter), with interstitial distribution of Li, Ni, Co)

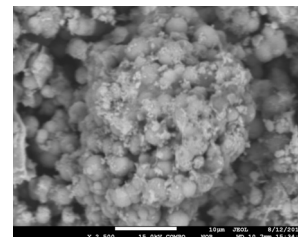


Fig. 5 : Li-Mn-Co-Ni rich product synthesised

Development of processes for recovery of Cobalt from discarded Li-ion batteries of mobile phone

Science & technology have provided us a whole new array of electrical and electronic products and rendered many of them affordable to billions of people both in developed and developing countries. This development has not only revolutionized the world but has also gathered momentum owing to high obsolescence rates of electronic and electrical appliances which subsequently raise a new environmental challenge: electronic waste (E-Waste) or waste electronic and electrical equipment (WEEE). Mobile phone batteries constitute a major fraction of e-waste, which contain rare and strategic metals such as cobalt, lithium, nickel etc that can be recovered in an eco-friendly manner following the zero waste concept. In order to recycle and extract cobalt metal from discarded Li-ion batteries (LIBs) of mobile phones, the sample supplied by ADV METAL COMBINE Pvt. Ltd., is being dismantled, beneficiated to obtain metallic concentrate (black powder containing LiCoO_2), metal sheets and polythene. The metallic concentrate is further treated with suitable lixiviants such as sulfuric acid, hydrochloric acid etc. for the dissolution of metals. The leach liquor generated will be employed for removal of impurities following precipitation, solvent extraction or ion-exchange techniques. The purified solution containing cobalt in

sulfate medium will be used for the recovery of cobalt as salt or metal using crystallization/electro-winning processes. M/s ADV METAL COMBINE LTD. for whom the process was transferred is satisfied with the project thus far and scale-up studies are underway at ADV in association with CSIR-NML. The developed cost effective process can successfully help in reduction of e-waste and its inefficient recycling.

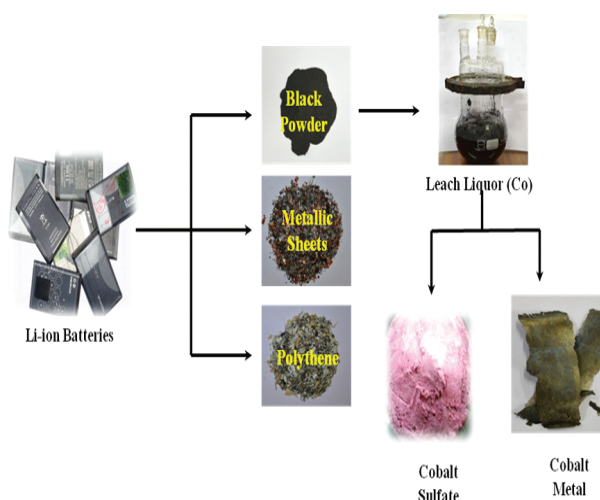


Fig 6 : Process flow sheet for recovery of cobalt

Recovery of Gold from the scrap parts of telecommunication and medical equipment

Technological advancement and the obsolescence of electronic equipment have infinitely enhanced the generation of e-waste globally. These wastes not only contain hazardous but also valuable and precious metals. Therefore, efficient recycling of e-waste is required for both resource conservation and environmental protection. Especially, the recovery of gold from e-waste has received much attention due to its presence in considerable quantity. Electronic components such as connectors, switches, relay contacts, soldered joints, connecting wires, connection strips made of gold or coated with this metal. The objective of the present work is to recover gold from scrap parts of telecommunication and medical equipment supplied by M/s. Eco Recycling Limited, Mumbai. Initially, the gold plated components were leached in suitable lixiviants such as cyanide, thiourea, thiosulfate, aqua-regia, etc. depending on the composition of the scrap. Different process parameters viz. time, temperature, concentration, pulp density were studied and optimized. The leach liquor generated was then treated by adsorption and fusion process to recover gold in pure form at lab scale. A complete process flow-sheet for the recovery of gold from scrap parts of telecommunication and medical equipment has been developed. It is an innovative method and further, the composition is different from the primary resources of gold and the waste electrical and electronic equipment (WEEE) generally used for recycling. In these scraps, gold is found to be plated on different

base metals such as aluminium, copper, iron, etc. Therefore, selective recovery of Au from these scraps is a big challenge. Moreover, no basic systematic and scientific work has been reported for the recovery of metals from the scrap parts of telecommunication and medical equipment. This process will be feasible for the commercial exploitation after scale up studies and will also be helpful for the unorganized recyclers. This method will also be useful in terms of environmental protection as well as conservation of energy and natural resources.

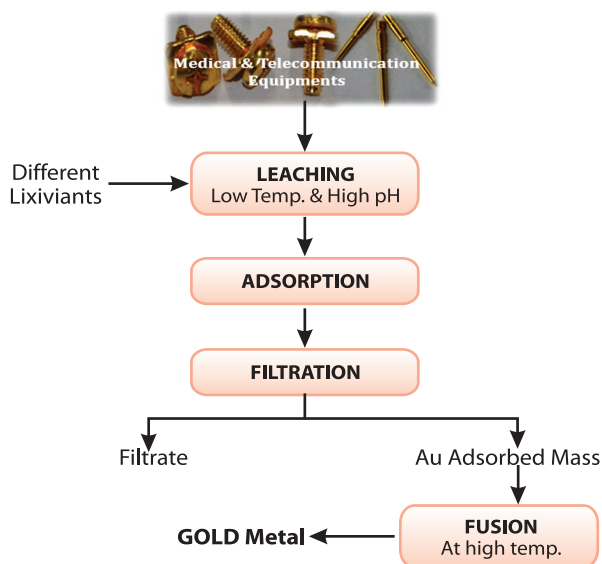


Fig. 7 : Process flow-sheet for the recovery of Gold from the scrap parts of telecommunication and medical equipment

Extraction of valuable metals from Lithium ion batteries

Lithium is one of the rare metals with a variety of applications and demand for lithium is expected to increase with ever increasing use of electrical and electronic devices, and hybrid electric vehicles. In order to bridge the gap between the demand and supply of lithium, its extraction from primary and secondary resources needs to be augmented. Lithium ion batteries (LIBs) consist of valuable metals in the proportion of 5-14% Al, 5-20% Co, 5-10% Cu, 5-10% Ni,

5-7% Li, trace amount of Mn, and 15% organics and 7% plastics. The composition may vary slightly with different manufacturers and very significantly with its intended application. Therefore, the objective of this work was to develop an efficient hydrometallurgical process for recovery of a pure and useful form of each metal component as metal powder/salt from the spent LIBs.

With the above aim, spent LIBs (20 kg lots) were dismantled manually after discharge. Out of the two types of active materials in the LIBs of laptop, one is rich in cobalt (52% Co) and low in Ni (~1.75%) and Mn (1-1.25%), while other contains ~35% Co, 11% Ni and 12% Mn. Both the samples have about 6-7% Li. XRD results show that LiCoO_2 is the major phase present in the first sample and Li_2MnO_3 and $(\text{Li}_{0.69}\text{Ni}_{0.69})\text{NiO}_2$ are the major phases in the second sample. Before embarking on the

leaching of the metals, potential (Eh)-pH diagrams relevant to $\text{Li-H}_2\text{O-Cl}$ and $\text{Ni-H}_2\text{O/Co-H}_2\text{O/Mn-H}_2\text{O}$ were constructed taking into account the metal concentration in the material obtained from the spent LIBs. The second sample was particularly investigated for the leaching of metals. Leach recovery of >88% was attained for most metals, lithium recovery being above 99%. Residues are being characterized to determine the mechanism of leaching.

Technology development for making paving blocks through geopolymerisation of AOD slag

This project is sponsored by Shyam Ferro-Alloy Co Ltd. Argon-Oxygen Decarburization (AOD) is a process primarily used in stainless steel making and other high grade alloys development. The slag generated in the above process is known as AOD slag. Chemically, AOD slag is a complex matrix structure consisting primarily of oxides of calcium, silicon, magnesium, aluminium and manganese in complexes of calcium silicates, magnesium silicate, alumino-silicates and calcium magnesium silicate. Presently, there is no commercially established use of AOD slag. The project has been carried out with an objective (a) to establish proof of concept for utilization of AOD slag for making

paving blocks using geopolymerisation process, the physical properties of which should confirm to IS 15658:2006 i.e. "Precast Concrete Blocks for Paving", and (b) the process should be low energy consuming and produce little or no emission. The process at lab scale has been established. It was found that AOD slag can be used in making paving blocks using geopolymerisation process. The product developed is aesthetically attractive, meets BIS specification and is environmentally safe. Currently the process is established at pilot scale. Durability studies are under progress. It is expected that M/s Shyam Ferro Alloy will go for a full scale plant at their premises.

Production of ferrite and pigment grade monodispersed nano iron oxide

Synthesis and study of metal oxide particles in submicron and nano range has been the focus of intense fundamental and basic research with emphasis on their dispersion. Efforts are continuing to produce mono-dispersed hematite particles, uniform in shape, size and composition as an ideal constituent for a variety of advanced materials. Mono-dispersed iron oxides also have various important applications as catalysts for rocket fuel and high quality pigments. Due to the increasing trend of production of galvanised steel, generation of waste pickle liquor is increasing day by day. The volume of pickle liquor generation is about 30-50 L/MT of steel containing about 20-50 g/L of acid and >100 g/L of iron. Utilization of these waste materials for production of high value iron oxide will not only generate revenue

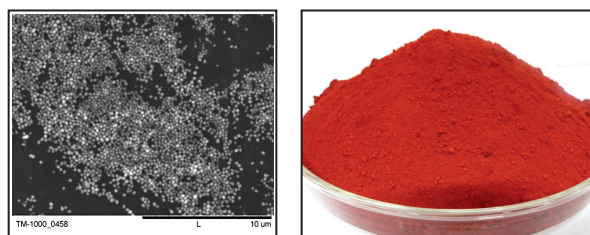


Fig 8 : Nano / submicron size iron oxide (200 nm) produced from waste chloride pickle liquor in kilogram scale

out of the recovered product, but will also prevent environmental pollution. Since the last few years, CSIR-NML has been actively involved in producing a variety of iron oxides from a variety of iron rich sources including waste pickle liquor and developed an interesting process.

Under a joint collaboration with TATA STEEL, the process was further upscaled (kilogram scale) and a complete flow-sheet was developed using pickle liquor of composition : 127.6 g/L Fe, 25.4 g/L HCl, 177 ppm Mn, 25 ppm Cr, 16 ppm Ni, 56 ppm Cu, 12 ppm Zn. Processing steps consist of oxidation of iron followed by direct conversion of iron hydroxide slurry to iron oxide under hydrothermal conditions at moderate temperature (90-150°C). The process is so well tuned that a particular size and shape could be engineered with required magnetic properties. The major advantages of the process are that it involves

low temperature synthesis and takes care of various impurities present in the system and does not involve any major impurity removal steps. Out of a variety of iron oxide produced, submicron/nano size iron oxides (150- 500 nm) produced were tested and found to be promising with respect to its application as high grade pigment as well as a precursor for soft magnetic material. The process recovers ammonia by lime boil method to be recycled in the system. Tata Pigment, Jamshedpur is interested to set-up a demonstration plant of 100 kg capacity per batch for confidence building for putting up of a commercial plant.

Use of slag from non-ferrous industries in geopolymeric material

This project was carried out under Indo-Russian ILTP program along with Kola Science Centre, Russia. The objective of this project was to enhance the reactivity of copper and zinc slag by mechanical activation and use of this slag for making geopolymers. Interesting results were obtained when Cu-Ni slag was mechanically activated under CO₂ atmosphere. It was found that prolonged grinding of silicates is accompanied by absorption of large amounts (>10 wt %) of atmospheric CO₂ by these materials. The carbonization effect is enhanced in the case of MA in a purely CO₂ atmosphere. Under the influence of a

mechanical activation, CO₂ molecules penetrate into the bulk of a structurally disordered silicate matrix to give distorted carbonate groups. As a result, not only the structure, but also the chemical composition of outer layers of particles directly involved in hydration reactions is strongly modified. This knowledge serves as a foundation for developing alkali activated material with tailored properties. Under this project, three joint publication in SCI journal and four in conference proceedings were achieved. Further, three Indian scientists visited Russia and one Russian scientist visited India.

Immobilization of toxic wastes through geopolymerisation

The specific aim of this project is to immobilize arsenic containing wastes in a suitable matrix so as to make it safe for disposal. The approach adopted towards realizing the objective of stabilization is geopolymerisation, which has emerged as a possible technological solution for the effective stabilization /immobilization. Geopolymers have been prepared using alumina-silicate materials of natural and synthetic origin. Geopolymer samples with natural kaolinite have been found to be of inferior quality.

However, geopolymers with industrial by-products such as blast furnace slag and fly ash have been found to be of required strength. Having fixed the geopolymer composition, arsenic in the form of arsenite and arsenate has been incorporated in to geopolymers. Immobilization capacity of geopolymers is being analysed. Tools being used to analyse the immobilization include TCLP (USEPA 1311) test, EPMA etc.

Surface Engineering

Effect of welding heat inputs on low temperature sensitization and thermal ageing on embrittlement of austenitic steel

The objective of the project is to study the low temperature sensitization and thermal aging embrittlement behaviour of 304LN stainless steel aged at a temperature ranging from 400-450°C for various durations upto 10,000 hours. The effects of welding heat inputs on LTS of stainless steels will be emphasized and be compared with the base substrate. In-depth investigations on sensitization in weld pool, HAZ with respect to distance from the center and fusion line will be carried out. The sensitization will be quantified by DLEPR and ASTM A262 practice 'A' and 'E' methods (by quantifying the depth of IGC attack). The detection of carbides before and after ageing will be confirmed by TEM/ SEM. Susceptibility of the weld pool to thermal embrittlement shall be investigated by subjecting specimens (extracted from weld) to the impact test

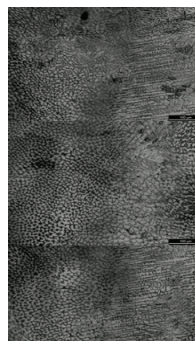


Fig. 1 : showing microstructure below the notch

at -50°C. The ferrite contents along the notch and hardness shall be measured before and after the ageing performed at 400 and 450°C. The embrittlement behavior with respect to heat inputs shall be correlated with the ferrite contents and temperature.

Development of nano-composite TiSiBC hard and tough coatings by magnetron sputtering and structure property correlation

The oxidation behavior is an issue for any engineering applications at higher temperatures. For nano-composite coatings, it is still not understood and studied properly. In the present investigation, the oxidation behavior of nano-composite titanium silicon boron carbide (Ti-Si-B-C) hard coatings deposited by magnetron sputtering is being studied. The films were deposited by magnetron sputtering on SS 304 substrate. The as deposited films had hardness and modulus of 33 GPa and 370 GPa respectively. The films were found to be stable up to 800°C, the hardness and modulus decrease was not very significant, it remained around 28 and 340 GPa respectively. The hardness and modulus values were found to be decreased to 20-23 GPa and 300 GPa respectively when the samples were oxidized at 900°C. However the film degradation was more at 1100°C. The presence of oxides of titanium and silicon was

observed by X-ray diffraction analysis. The microstructural changes are found to be insignificant and the average grain size remained around 20 nm up to 800°C. However, significant grain growth was observed from 900°C. Further studies on effect of thickness, duration of oxidation at 800°C is under progress.

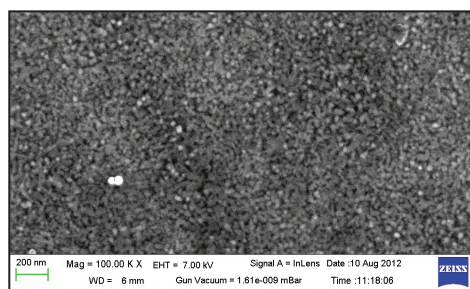


Fig 2 : Nano-composite Ti-Si-B-C hard coating surface Micrograph after 800°C oxidation.

CSIR-NML Madras Centre

Laboratory Column

Designed and installed a fully automated 4" Laboratory column at IIT, Hyderabad for academic and R&D purpose. The system is equipped with state-of-the-art instrumentation, for conducting fundamental studies in column flotation.



Column Flotation Technology



Pilot Column

A 0.5 m dia automated pilot flotation column is installed at TATA steel Jamadoba Coal Processing Plant site to study the amenability of flotation column for upgrading coal fines. Test work is in progress to optimize the process and system parameters/scale-up data for designing commercial scale flotation column.

Commercial Column

Designed, installed and commissioned 700 tpd beneficiation plant to treat low grade barite for M/s Andhra Barite Corporation Ltd., at Mangampet, Kadapa, Andhra Pradesh, for value addition. The plant is producing high grade barites as per the rated capacity. The product is suitable for chemicals manufacture and as drilling mud in oil well drilling industry.



Services & Facilitation



Gertrude B. Elion,
Biochemist, Nobel Laureate (1918-1999)

"Don't be afraid of hard work. Nothing worthwhile comes easily. Don't let others discourage you or tell you that you can't do it. In my day I was told women didn't go into chemistry. I saw no reason why we couldn't."

Engineering Division

1. Introduction:

The Engineering Division caters and co-ordinates the engineering needs, both R&D and infrastructural, of the laboratory. Majority of the needs are non-repetitive in nature though some are routine. The facilities of this division include civil engineering unit, electrical engineering unit, central workshop and drafting unit.

The major categories of activities of the Division are:

1. Design and Development of prototypes
2. Project Engineering
3. Engineering Consultancy
4. Infrastructural Development
5. R&D in Welding Technology
6. Up-keeping of residential premises
7. In-house maintenance and support
8. Workshop facilities

2. Design and Development

2.1 Fuel efficient Coke based Brass melting furnaces for artisans

An eco-friendly and energy efficient coke based brass melting furnace has been designed and developed for artisans engaged in manufacturing brass artefacts. This furnace is capable of melting upto 10 kgs of brass per batch using 20% less coke than the existing one and also maintains a pollution free environment. This technology is being demonstrated to the artisans from brass melting cluster of Orissa and West Bengal.



Furnace in operation

2.2 Pilot plant for extraction of Magnesium Metal

A 300 Kg raw material capacity pilot plant was designed for extraction of magnesium from indigenous raw materials. This pilot plant has been successfully commissioned and is presently in operation.



Developed Magnesium pilot plant

3. Project Engineering

3.1 Set-up of real size tensile specimen Annealing Simulator

This in-house designed equipment has been successfully commissioned. Main highlights of the equipment are controlled atmosphere furnace (with hydrogen environment) up to 1200°C, fully automatic and programmable movement of annealing chamber into the furnace, high and controlled heating and cooling rates to simulate the batch and continuous annealing operations in a steel plant and treatment of tensile specimens in H_2-N_2 environment.



Real size tensile specimen annealing simulator

4. Infrastructure Development & Engineering Support Activities Rendered

- 4.1 Building for coal core testing facilities at LSTF pilot plant.
- 4.2 Renovation of Executive Centre with state of art facilities at Agrico residential complex.
- 4.3 Renovation of elevators in residential complex.
- 4.4 Development of infrastructure facilities in Hydrometallurgy bay
- 4.5 Installation of more than one hundred, 3-Star rated Energy Efficient Air Conditioners (A/C), in place of old energy inefficient A/Cs as per the recommendation of PCRA.
- 4.6 Air Conditioning, Civil and Electrical infrastructure development for new TEM room.
- 4.7 Conversion of erstwhile printing press to research & experimental facility for scientists of MEF Division.
- 4.8 Upgradation & modernisation of Gustad Club at NML Housing Colony, Tuiladungri.
- 4.9 Conversion of erstwhile EMD Bay for housing new Thermo-Mechanical Simulator (Gleeble) facility at the main laboratory.
- 4.10 The infrastructure management team has successfully completed more than 1200 maintenance jobs related to civil, electrical, air-conditioning work from various residents /scientist while maintaining time schedules.
- 4.11 During the last year, more than 250 job requests were received in central workshop from various divisions of the laboratory. These requests included various fitting, machining, fabrication & specimen machining jobs for various types of materials.
- 4.12 A new CNC lathe was procured and installed. This is helping in much faster & accurate machining of various specimens required by the laboratory.
- 4.13 A support platform has been designed and fabricated by central workshop for the Mg pilot plant.



Hydrometallurgy, Electro winning and leaching facility under a single roof in Magnesium Plant Area



Conversion of erstwhile printing press to research & experimental facility for Scientist of MEF Division



Upgradation & Modernisation of Gustad Club at NML Housing Colony, Tuiladungri



Renovation of Seeting Arrangement for Scientists of MEF Division at Main Laboratory



Newly installed CNC Lathe at Central Workshop

Administration

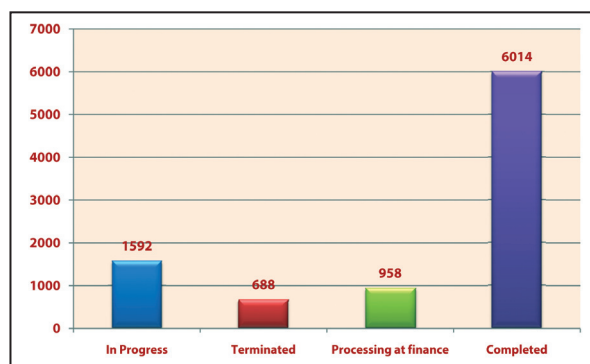


Administration is the crux of the laboratory that provides the support system to R&D and has aligned itself positively to realize the Vision of CSIR-NML as well as enable the system to meet the goals and targets set. Right from the recruitment of the staff to their sustained care through facilitation of their academic, career related needs and vital needs like housing & health, administration forms the nerve line.

This year, the Administration has undergone major shift in terms of work culture and going paperless. It has evolved a faster delivery system with CSIR-Enterprise Transformation initiative undertaken by CSIR to focus on building electronic workplaces and re-engineering processes for augmented service delivery by implementing the integrated ERP system

through ICT interventions. It has become possible due to the inculcation of an improved work culture and decentralized leadership at all levels.

Process Transactions (ERP) as on 22 Apr 2014



Finance & Accounts

Finance & Accounts Division of CSIR-NML is actively engaged in planning, organizing, directing and controlling the financial activities of the Lab including accounting of all the financial transactions of the year as per CSIR guidelines. This division provides a central accounting and financial information to Director and CSIR through the management information system.

Following are the major activities of the Finance & Accounts Division

- To ensure that there are adequate funds available to acquire the resources needed to help the organization to achieve its objectives
- To ensure cost control
- To ensure adequate cash flow
- Implementation of ERP system in Finance & Accounts Division to establish a procedurally correct and accurate system with cost effectiveness.
- Managing the budget and expenditure of ACSIR in CSIR-NML
- To provide appropriate financial information relating to different heads of accounts and projects to Director of the Lab and decision maker in order that informed judgments and decisions are made.
- To prepare financial documents like Revised Budget Estimates and Budget Estimates, Receipts and Payments account and Balance Sheet of the organization on a given date for submission to CSIR and decision makers including submission to CAG-Audit for certification of accounts
- Preparation and Submission of utilization certificate to sponsors for all the projects sponsored by them
- Pre Audit of all the bills before making final payment to avoid any irregularity
- Promptly, accurately and efficiently recording all the receipts and payments in the relevant ledgers and books of accounts
- Closing of GPF/CPF accounts, remittance of funds to NSDL relating to New Pension Scheme and remittance of service tax, income tax and other remittances within schedule date to appropriate authority
- To monitor cash management including transfer of funds from CSIR and other sponsors and a reconciliation of bank statement with our cash book



Performance

1. 100% utilization of Budget Grant allocated by CSIR- Rs 6088.8 lakhs
2. Utilization from Laboratory Reserve- Rs 816.44 lakhs
3. Settlement of outstanding CAG Audit Paras – 6 out of 11
4. Generation of EBR by investment of surplus funds- Rs 361.8 lakhs
5. Settlement of outstanding advances of O.B. amounting to - Rs 550.4 lakhs
6. Generation of Lab Reserve - Rs 1057.9 lakhs.
7. Bank reconciliation of the Cash Book completed up to 31st March, 2013
8. All Pension cases (14 nos superannuation pension + 11 nos family pension cases) have been settled. 24 nos of pension revision cases vide GOI OM No. 10/02/2011-EIII/A dated 19/03/2012 and 34 nos (including 28 nos superannuation pension + 4 nos family pension cases) vide GOI OM No. 38/37/08- P & PW (A) dated 28/01/2013 have been settled
9. GPF Account as on 31-03-2013 has been closed and GPF statement provided to all subscribers
10. Remittance of service tax / income tax and submission of returns to appropriate authority has been completed
11. CENVAT credit amounting to Rs 18.5 lakhs availed during the financial year.

Stores & Purchase



The Stores & Purchase Division is mainly responsible for procurement of capital equipments, spares and consumable items including import. It is also responsible for maintaining a minimum inventory of some essential consumable items. Different committees like Technical & Purchase Committee, Purchase Committee, Equipment Prioritization Committee and Standing Disposal Committee help the Stores & Purchase Division in arriving at suitable decisions as per the CSIR Purchase Rules of Goods & Services, 2008. The major procurements for which orders have been placed during 2013-2014 are: 1) Computer Controlled Long Range Infrared Camera, 2) Electromechanical Compression Testing Machine, 3) Thermo-Gravimetric Analyzer, 4) Simultaneous TG-DTA Analyzer with all Accessories, & 5) Automatic Isoperibol Calorimeter with Combustion Vessel. Apart from these, many other minor equipments, accessories and spares were ordered.

The Stores & Purchase Division has taken up the challenging task of the implementation of the ERP

package for Stores & Purchase with an objective of automation of process and a paperless office. It is co-ordinating with the CSIR team in ensuring a speedy implementation of Enterprise Resource Planning solution. Apart from the ERP, the Stores & Purchase Division has already initiated the process of getting all inventories RFID enabled. Apart from the normal task of procurement and maintenance of equipments and facilities, the Stores & Purchase Division will handle the challenges of ERP implementation and RFID labeling in the current financial year.

The Stores & Purchase Division is headed by Shri Nalin Kumar Singh as Stores & Purchase Officer, who is assisted by Shri A.K. Pandey, Shri L.N.Singh & Shri Amrendra Kumar, Section Officers. The Stores & Purchase Division also has a team of committed Assistants who take care of procuring the materials for the R&D programs within minimum time duly following the purchase procedure.

Knowledge Networking



Maria Mitchell,
Astronomer (1818-1889)

"We have a hunger of the mind which asks for knowledge of all around us, and the more we gain, the more is our desire; the more we see, the more we are capable of seeing. The world of learning is so broad, and the human soul is so limited in power!"

National Knowledge Network (NKN) and CSIR Enterprise Transformation Activities

NKN

CSIR-NML is linked to the National Knowledge Network (NKN) grid with a bandwidth of 100MBPs. In addition to providing high bandwidth for lab-wide Internet access, the National Grid computing network (grid GARUDA of C-DAC, Bangalore and CSIR High Performance Computing (HPC) at C-MMACS, Bangalore are being effectively utilized through NKN link to solve typical HPC oriented materials simulation problem(e.g Multi-scale Monte Carlo simulation etc.).

ICT Enterprise Transformation initiative

CSIR-Enterprise Transformation (ERP) is an organizational transformation initiative undertaken at CSIR to focus on Building Electronic Workplaces and re-engineering processes for augmented service delivery. This organization makeover includes an evolution of the work culture – A transformation by means of which Human Resource Management will move from a traditionally administrative function to a strategic one that recognizes the link between people and organizational success. Various ERP modules have been implemented successfully to a large extent at CSIR-NML. On-line utilization of the ERP package has been extensively made for all functional modules like Human resource, Research and Development, Materials management, finance management, Engineering, Infrastructure & facility management etc. Some of the achievements of ERP implementation efforts are enumerated below.

Human resource

All the prerequisite data entry has been completed for e-service books of all employees and has been made fully functional. Most of the employee self service functionalities like GPF, children education allowance, leave, loans & advances, medical and telephone reimbursement, monthly pay bill of employees etc. are made fully operational as on-line processes. This has eventually facilitated a faster and efficient way of processing files with least manual interventions.

R&D Planning

The information on the ongoing and completed projects have been processed through ERP package. Employee role mapping activities have been completed

and all employees are mapped with projects. Budget allocation to all notional projects has been made to facilitate the ERP work flow seamlessly.

Infrastructure and Engineering Services

Revised version of Materials Master Module (i.e. Stores & Purchase Module) has been deployed successfully. Under this version, a new set of category & sub-category of items have been introduced for entering and mapping items in the laboratory. Items entered earlier in the old version have been successfully migrated to the new version for updating the list of items for raising an indent by the user. Online submission of FVC for payments has been also successfully implemented. Stores Module for PIR entry has been functioning flawlessly and inconsistencies have been removed. DRR entry for generating SRV etc. under the ERP functionality has been tested. With regard to Engineering and Service module, passed Works and Services bill, Security deposit bill, Earnest Money bill and Service Tax Reimbursement Bill for Financial Year 2013-2014 have been raised on-line in the prescribed FVC Bill Format through the ERP work flow process. The on-line requests for works from the staff members can also be registered through the ERP system.

Finance and Accounts

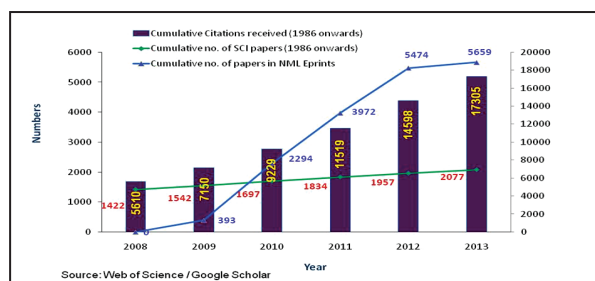
All the past transactions through FVC has been completed under the ERP system. All the bills are being processed online through ERP module except IR bills, TA, LTC, CENVAT Credit etc. These processes will soon be activated online through the ERP in near future after requisite testing. One of the crucial activities pertaining to validation of the financial data entered through ERP system is under progress.



Knowledge Management

SCI Publications and Citations

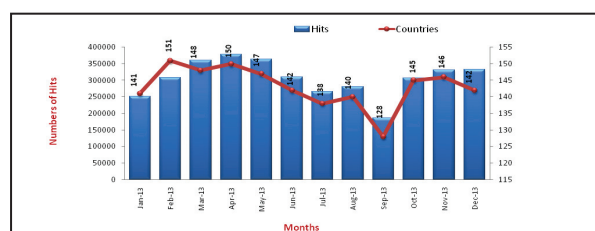
120 SCI papers were published from CSIR-NML during 2013 calendar year. These papers are regularly uploaded in Laboratory's Institutional Repository. The cumulative citation of all the SCI publications (1986 onwards) from CSIR-NML has increased from 15967 (in 2012) to 17305 (in 2013) over a period of one year registering an 18.54% growth. The average citation per paper is 8.33. Sixty four articles have received more than 50 citations/paper (source: Web of science / Google scholar) as on Jan 23, 2014.



Growth of Research Publications, Citation and NML IR (Eprints)

Institutional Repository

The NML Institutional repository (<http://eprints.nmlindia.org>) has maintained its global visibility and popularity with average hits of over 0.2 million per month and a cumulative total of over 9.63 million hits since inception (2009). The researchers from 192 countries have accessed NML repository and 151 countries (highest users) have accessed the database during last February, 2013. Among the global users, the top twenty countries were: United States, India, Russia, China, Turkey, Iran, Malaysia, Ukraine, UK, Hong Kong, Germany, Netherlands, Japan, France, Italy, Canada, Korea, Brazil, Australia and South Africa.



NML Eprints in terms of hits / downloads

Information under RTI Act

In the last one year, 8 RTI applications were received and all of them were responded to within the time schedule. So far, no appeal was referred to Central Information Commissioner (CIC) for review. The data regarding RTI has also been uploaded in laboratory's Transparency portal.

Information Products

- CSIR-NML Annual Report 2012-13
- Director's Desk-July 18, 2013 and February 6, 2014
- Journal of Metallurgy and Materials Science, Vol. 55 (1-4), 2013. ISSN 0974-1267 (Online) (<http://www.indianjournals.com>) and ISSN 0972-4257 (Print)
- NML Record Book 2014 and Monthly Calendar
- Brochure, Information Folder

Transparency Portal

The Transparency portal (<http://library.nmlindia.org/tp/tp.html>) containing all information pertaining to staff pay & allowances, immovable property, foreign and local travel, Honorarium, project details, expenditure pattern, local purchase data, works and services, CAG report, Research publication, Citations, Patents, Technology transfer etc. was maintained and updated periodically. This information helped in reducing RTI enquiries and also served the information need of a citizen. It is appropriate to mention that CSIR-NML launched transparency portal in the first week of May 2012.

Hindi Cell

Official Language Implementation

CSIR-NML has a structured and active program for the implementation of official language (Rajbhasha) Hindi. In addition to the regular official work and translations, CSIR-NML proactively initiated a series of activities throughout the year which include: publications, conducting training, workshops, talks and annual competitions and divisional inspections for enhancement of Hindi use in the divisional activities. NML's website has also been designed completely in Hindi (http://www.nmlindia.org/Hindi1/index_h.html)

Publications in Hindi

Annual Report, CSIR-NML Newsletter, Director's Desk and Brochures have been published in Hindi and English, which was circulated to CSIR units and various organizations of Govt. of India. Press releases were issued in Hindi and published in daily newspapers.



Promotional Activities for Hindi Implementation

- Four inspections were conducted by Hindi Officer covering various divisions for identifying the areas of Hindi implementation and enhancing the use of Hindi in divisional activities.
- Incentive Scheme for working in Hindi was introduced and employees are actively participating in the scheme. Five employees namely Shri Parmarth Suman, Shri Nandlal

Paswan, Shri Akhilesh Kumar Nigam, Shri Sudhir Kumar and Shri C.R. Chakraborty were given award in this scheme.

- As part of the Hindi teaching scheme, fifteen employees (10 of Praveen and 5 of Pragya) completed their training and successfully passed their exams conducted by Hindi teaching Scheme, Govt. of India.

Hindi Workshop

- Four Table Workshops were conducted in Administration. The objective of the workshop was to address the issues encountered for preparing the Quarterly Hindi Progress Report, Hindi Noting and Drafting and imparting training of Unicode.
- As part of the Hindi popular programme, Hindi Play "Savaser Genhu" written by Premchand was played on 13th September in NML Auditorium by the students of SDSM School for Excellence.

Hindi Competition

"Hindi Competitions" were organized from 9th to 13th September, 2013 for NML Employees. The competitions included: Essay writing, Noting / Drafting, Hindi dictation and Self-written poetry recitation etc.

Activities of Hindi Implementation for Tolic, Jamshedpur



CSIR-NML is the Secretariat of Town Official Language Implementation Committee (TOLIC), Jamshedpur and CSIR-NML's Director is the Chairman. It has 65 Members from all the Central Govt. offices located at Jamshedpur and adjacent regions. This committee is

playing vital role for enhancement of Hindi use in these offices. TOLIC, Jamshedpur has been adjudged 'First' for commendable performance in implementing the Official Language policy of the Union by Ministry of Home Affairs, Govt. of India, this year.



Inspection of CSIR-NML by Committee of Parliament on Official Language at New Delhi.

CSIR-NML was inspected for the first time by committee of parliament on official language on 29.11.2013 at New Delhi. Dr. S. Srikanth, Director NML, Dr. N.G. Goswami Chief Scientist and Dr. Purushottam Kumar, Senior Hindi Officer represented NML.

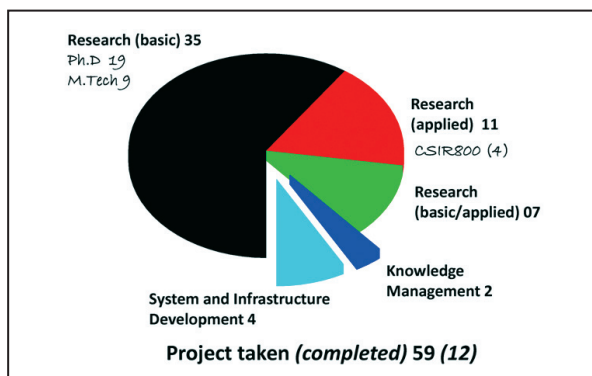
Hon'ble members of the committee expressed their satisfaction while reviewing the performance of the laboratory regarding implementation of official language policy. However NML being in group 'A' region, they have suggested that the shortfall in the targets for some of the parameters should be met within six months.



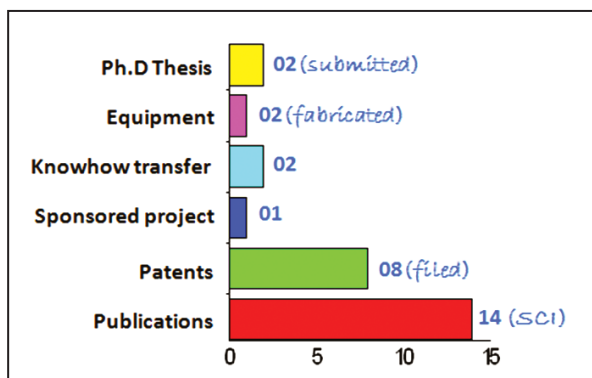
In January this year, the performance of CSIR-NML in the implementation of Rajbhasha and achieving the targets set as per the Constitution was reviewed by the Parliamentary Committee chaired by Hon'ble Shri Satyavrat Chaturvedi.

In-house Project Support Group (i-PSG)

The open door meetings of i-PSG were held on September 10 & 11, 2013 and March 6 & 7, 2014. The progress of ongoing and completed projects was reviewed in the meetings. The profile of the projects undertaken/in-progress during 2013-14 and deliverables achieved (Jan-Dec, 2013) are summarized below:



Projects profile (2013-14)



Deliverables achieved

Significant achievements include: design of an improved suction casting attachment for the preparation of bulk metallic glasses; and, design and development of a commercially viable semi automated annealing simulator device. In addition, the technology on energy efficient coke based brass melting furnace is transferred to Moradabad Industrial Development Company (MIDCo).

Prof. Shilowbhadra Banerjee Award 2013 for the best "In house project" was awarded to the team comprising of C. Soupramanien (PL), K.K. Paul (Co-PL), S. Sivaprasad, S. Tarafder, N. Narasaiah for their project, entitled, "Design and Development of Loading Fixture for Mixed Mode I/II Fracture Studies". i-PSG projects completed during January-December 2011 were considered for the award.



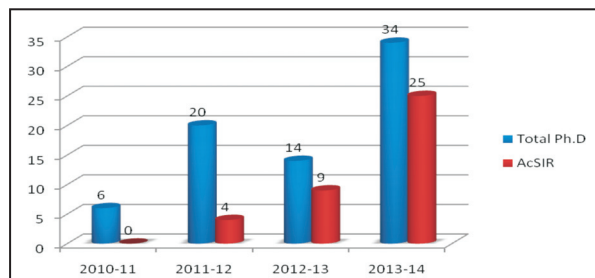
Shri C. Soupramanien receiving Prof. Shilowbhadra Banerjee Award 2013 from the Chief Guest, Shri Anand Sen (Tata Steel), during the NML Foundation Day function, November 27, 2013

Academy of Scientific and Innovative Research-NML

Established in 2011, as an 'Institution of National Importance', the Academy of Scientific & Innovative Research (AcSIR) by an Act of Parliament, vide The Gazette of India No. 15 dated February 07, 2012 and notified on April 03, 2012, has adopted the mandate to create and train some of the best of tomorrow's Science & Technology leaders through a combination of innovative and novel curricula, pedagogy and evaluation. AcSIR's focus is on nurturing creativity and providing research opportunities in such areas as are not routinely taught in regular academic universities in India.

Academics at AcSIR-NML

Under the AcSIR, CSIR-NML has initiated PhD/Integrated M.Tech-Ph.D programs in the emerging and trans-disciplinary areas of Materials and Metallurgical Engineering. Direct Ph.D. course at CSIR-NML has started from January 2012 session while Integrated M. Tech-Ph.D course was initiated from August 2012 session with total student strength of nine. In 2012-13 four students were admitted for Ph D degree, while five for int. M. Tech-PhD. In 2013-14 seven students have been admitted to Int. M. Tech-Ph D while nine for Ph D degree including six industries sponsored students. All the Ph D students admitted during 2012-13 have completed their required course work including CSIR 800 project, also all of them have successfully defended their comprehensive examination.



CSIR-NML has designed various courses keeping in view the scientific and technical excitement expected from younger generation as well as contemporary and futuristic scientific and industrial needs of the country specifically in field of Minerals - Metals & Materials for different industrial sectors. Course work at CSIR-NML is being conducted through an integrated approach involving eminent faculty from prestigious academic

institutions, industries (TATA STEEL) and scientists /technical officers from CSIR-NML. During the session 2013-14, the following experts from industries and academia have been appointed by AcSIR as Adjunct Professors at AcSIR-NML:

Course

Transport Phenomenon in Metallurgical Processes



Prof. Sirshendu De
IIT Kharagpur

Life Cycle Analysis



Dr. Shantanu Chakrabarty
Former Head Research Application,
Tata Steel, Jamshedpur

Course : Advanced Iron Making



Dr. Ashok Kumar
Chief Technology Officer, Tata Steel



Dr. Achintya Kumar Das
Advisor, M N Dastur & Company

Besides the class room teaching and regular laboratory exercise, AcSIR –NML's students have been provided the opportunity to visit ferrous and non-ferrous metallurgical industries in and around Jamshedpur to enable them to appreciate the industrial and technological real life experiences, excitements and challenges, that needs to be solved.

AcSIR-NML-Students Club

To create an academic ambience and to develop the leadership, team-work and social consciousness, an AcSIR-NML-Students Club has been created. The Club organizes technical lectures, science movies, entertainment programs and several other academic and social activities. Students could evolve a system based on self-sustenance to run the day to day activities of the club. This will help the students to refresh themselves in a productive manner during their free time.

Impressions

Thanks a lot for sending the nice group photograph as a memorable souvenir for the many fruitful days spent by us together with the NML family during the past three years. As always I enjoyed my visit to this great city of Jamshedpur and the great institution, NML. I am grateful to Dr. Srikanth, yourself and all your colleagues at NML for making our stay in Jamshedpur pleasant and our association with NML a professionally rewarding experience during the past few years.

I take this opportunity to thank all the members of the NML family all the very best in the coming months and years. Please consider us members of your larger family of NML well wishers on whom you can bank on always. We would like to see NML seize new opportunities and scale new heights of engineering excellence in the years ahead. I am sure NML shall rise to its true and remarkable potential and secure its niche in the challenging times ahead for all of us who have anything to do with minerals, metals and materials processing.

With best wishes and warm regards to all

Dr. Pradip

Group Leader

Materials and Minerals Processing Technology

Tata Research Development & Design Centre

(A Division of Tata Consultancy Services Ltd.)

Thank you for sending me a copy of the 2012-13 Annual Report. I am very glad to note the ambitious targets you have set for NML by 2016 and the substantial progress you made towards it. The current difficulties you face in making further progress towards the target are formidable. But, I am sure your past achievement will inspire you all at NML, to reach your target. I note with interest NML's achievements and contributions in several fronts. But, the Citation Index of some of the papers are impressive. Though high SCI is not directly related to the scientific and technical worth of a paper, the scientists should be encouraged to submit papers for publication in high SCI journals. While obtaining acceptance for publication in such journals is tough, the Reviewers' comments from such journals, are an education by itself for a researcher. I wish you and one and all at NML, all success and glory in your onward march.

Best Wishes from

S. Banerjee,

Former Director, CSIR-NML

Recognitions & Resources



Rosalind Franklin,
Biophysicist, Physical Chemist (1920-1958)

"You look at science (or at least talk of it) as some sort of demoralising invention of man, something apart from real life, and which must be cautiously guarded and kept separate from everyday existence. But science and everyday life cannot and should not be separated. Science, for me, gives a partial explanation for life. In so far as it goes, it is based on fact, experience and experiment."

National / International Awards & Recognitions

Dr. Srinivasan Srikanth,
Director, CSIR-NML

- APPRECIATION PLAQUE from Institution of Engineers(India)
- VASVIK AWARD 2011 in the field of Material and Metallurgical Science and Technology



Dr. Ratnakar Singh,
Chief Scientist

IIME Mineral Beneficiation Award for the Year 2013



Dr. Debajyoti Bandyopadhyay,
Chief Scientist

Metallurgist of the Year 2013 (Ferrous Group)



Dr. Narayan Parida,
Chief Scientist

Indian Society for Non - Destructive Testing National NDT Award for Excellence in Contribution to Research & Development



Dr. Kanai Lal Sahoo,
Pr. Scientist

Metallurgist of the Year 2013 (Non-Ferrous Group)



Shri. Kanchan Kumar Paul,
Chief Scientist and Head, Engg

ENGINEERING ACHIEVEMENT AWARD from Institution of Engineers (India) during the Engineers Day Celebrations



Dr. Sanjay Kumar,
Pr. Scientist

Metallurgist of the Year 2013 (Environment, Energy Conservation and Waste Management Group)



Dr. Abhilash,
Scientist

- INS Young Scientist Award 2012 in the category of Nuclear Fuel Processing
- AMI Young Scientist Award-2013 in the area of Environmental Microbiology



Dr. S Prabhakar,
Chief Scientist, NML Madras Centre

Life Time Achievement Award for Leadership in Development and Commercialization of Column Flotation Technology in India





Dr. Vinod Kumar,
Sr. Technical Officer



Dr. Manish Kumar Jha,
Sr. Scientist



Dr. Ari Vidyadhar,
Sr. Scientist



Dr. Ratnakar Singh,
Sr. Pr. Scientist



Dr. Vinay Kumar,
Chief Scientist



Dr. Mamta Sharma,
Scientist



Dr. Jhumki Hait,
Sr. Scientist



Dr. Sanchita Chakravarty,
Pr. Scientist



Dr. B. D. Pandey,
Chief Scientist



Dr. RK Jana,
Chief Scientist



Uma Chandra Oraon,
Technical Officer



ECORECO - INNOVATION AWARD
for successful outcome in terms of commercial exploitation of CSIR-NML project titled "Physical and hydrometallurgical beneficiation of poly cracker ash to enrich the metal concentrate"

IIM - NMD Awards 2013 (Poster Presentation)

National Metallurgist Day / Annual Technical meet of Indian Institute of Metals (NMD ATM)

Awards 2013 held at BHU campus, Varanasi during 12 Nov - 15 Nov 2013.

Ferrous Group

2nd Prize for the paper entitled "Studies on utilization of Indian chromite fines through sintering"



Shri. Sanjay Agarwal,
Scientist



Dr. Satadal Ghorai,
Sr. Scientist



Dr. Jagannath Pal,
Pr. Scientist

Non-ferrous group

1st Prize for paper entitled "Hydrometallurgical extraction of REE's from Red Mud"



Dr. Abhilash,
Scientist



Dr. B.D. Pandey,
Chief Scientist



Dr. Vinay Kumar,
Chief Scientist

Selected in Invited Scientist Scheme "Brain Pool Program with outstanding performance of the year 2013" by Korean Govt.

14th Asia Pacific NDT Awards 2013 (Mumbai during 18-22 November, 2013)

2nd prize in oral presentation for the paper :
"Residual stress mapping of HSS steel using x-ray
diffraction and Rayleigh wave Ultrasound"



Dr. S. Palit Sagar,
Pr. Scientist



Dr. B Ravi kumar,
Pr. Scientist



Dr. GVS Murthy,
Pr. Scientist



Shri. Avijit Metya,
Scientist



Shri. Amit Prakash,
Technical Officer



Shri. B Mahato,
Technical Officer

2nd prize in poster presentation Category for the
paper: "Investigation of Carburisation in Stainless Steel
using Electromagnetic Non-destructive Evaluation
Technique"



Dr. Rajat Kr. Roy,
Scientist



Dr. Amitava Mitra,
Chief Scientist



Dr. Ashish Kr. Panda,
Sr. Scientist

MS Khan Memorial Award from IIM, Jamshedpur Chapter



Dr (Mrs.) Mita Tarafder
Sr. Pr. Scientist

Sahaj Memorial Lecture (an honour given by Indian
Ceramic Society for significant achievements in the field)



Dr. Arvind Sinha,
Sr. Pr. Scientist



**Individual Award for demonstrating
exemplary progress in exceeding
benchmarks on account of both
HR and Finance transactions
from CSIR-NML in ERP**



Shri. Parmarth Suman,
Asstt. Gr. II



Shri. Anjani Kumar Pandey,
SO (S & P)



Shri. Ashish Kumar Upadhyay,
Technical Officer



Shri. Uttam Kumar Jha,
SO



Outstanding Achievements Award-2013 for inspiring institutional leadership demonstrated in championing the transition to an electronic work culture, embracing performance driven evidence based operations & transcending beyond conventional confines.



Dr. Sital Kr. Pal,
Pr. Scientist



Shri. Nalin Kr. Singh,
SPO



Shri. Uttam Kr. Jha,
SO



Shri. Robert Barla,
SO (F&A)



Shri. Parmarth Suman,
Asstt. Gr. II



Shri. Anjani Kr. Sahu,
Technical officer



Shri. Byomkesh Dash,
Pr. Scientist & Head



Shri. A. M. Pradhan,
F & A Officer



Shri. Anjani Kr. Pandey,
SO (S & P)



Shri. Rachit Ghosh,
Sr. Technical Officer



Shri. A. K. Upadhyay,
Technical Officer



CSIR-NML participated in the Annual flower show and won the total 13 nos of Prizes in different categories in the 25th Annual Flower show organised by Tata Steel, JUSCO and Horticultural Society, Jamshedpur



CSIR-NML won the 2nd Prize on Garden of the Year 2014 Competition, organized by Horticulture Society, Jamshedpur, Tata steel, Jusco from 9Feb – 12 Feb 2014 in Jamshedpur.



Motivation Shield for the Blood donation Camp organized at CSIR-NML by The Voluntary Blood Donors Association, Jharkhand

**Town Official Language
Implementation
Committee (TOLIC)
Hindi Poem Writing
Competition**



Dr. Arvind Kumar Arya,
Sr. Technical Officer

First Prize



Shri. Parmarth Suman,
Asst. Gr. II

Consolation Prize

CSIR-NML Foundation Day Awards (27th November, 2013)

"Altekar Award for Best Technology for the Year 2012"



Dr. D. Mishra,
Sr. Scientist



Dr. K. K. Sahu,
Pr. Scientist



Dr. R K Jana,
Chief Scientist



Dr. S. K. Sahu,
Sr. Scientist



Shri. N. S. Randhawa,
Technical Assist.



Shri. J. N. Patel,
Technical Assist.



Dr. B. D. Pandey,
Chief Scientist

B R Nijhawan Best Paper Award 2012



Dr. Sabita Ghosh,
Pr. Investigator



Dr. Gautam Das,
Sr. Pr. Scientist

P. Ramachandra Rao Award of 2013 for Best Employee under Technical Category.



Shri. K Seetharaman,
Technician



Shri. Goutam Banerjee,
Lab Attend. (I)

Shilowbhadra Banerjee Award



Shri. C Soupramanien,
Technical Officer



Shri. Kanchan Kr. Paul,
Chief Scientist

P. Ramachandra Rao Award of 2013 for Best Employee under Non - Technical Category.



Dr. S Sivaprasad,
Pr. Scientist



Dr. Soumitro Tarafder,
Head-HRG



Shri. KG Simon,
Asst.(G)



Shri. Tapan Kr. Paul,
Sr. Steno

Editorial Board Memberships



Dr. Srinivasan Srikanth,
Director

- Transactions of Indian Institute of Metals
- Bulletin of Material Science
- Guest editor of Special Issue of Transactions of Indian Institute of Metals (Oct – Dec 2013) and Special Issue of Science & Culture special issue (Oct – Dec 2013)
- Science and Culture



Dr. Trilochan Mishra,
Pr. Scientist

- International Journal of Materials and Chemistry (SAP, USA)
- Editorial board member of American Journal of Physical Chemistry (Science publisher, USA)
- Guest editor of a special volume on "Layered clay material for functional application" published in "Key Engineering Materials Vol. 571 (2013) [Trans Tech Pub.]"



Dr. Soumitro Tarafder,
Chief scientist

- Guest editor of Special Issue of Transactions of Indian Institute of Metals (Oct – Dec 2013) and Special Issue of Science & Culture special issue (Oct – Dec 2013)



Dr. Ranjan Kumar Sahu,
Sr. Scientist

- Chemical Science Communications, India, Saraswati Publishing Corporation



Dr. Arvind Sinha,
Sr. Pr. Scientist

- Journal of Powder Metallurgy and Mining



Dr. Ashok Kumar Mohanty,
Sr. Scientist

- World Journal of Analytical Chemistry



Dr. Kanai Lal Sahoo,
Pr. Scientist

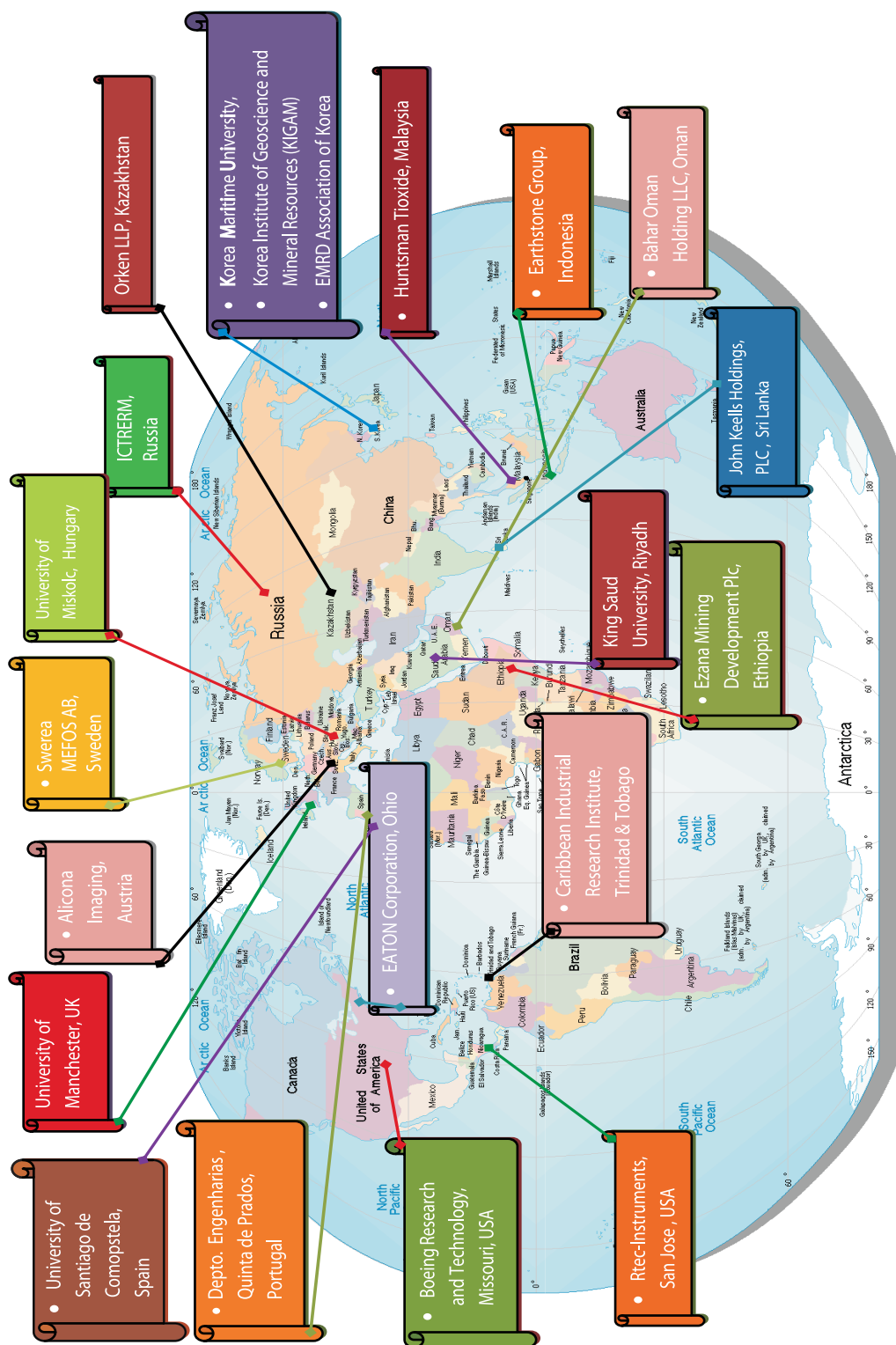
- International Journal of Metals
- Materials Science



Dr. Abhilash,
Scientist

- CIBTech Journal of Biotechnology (CJB)
- Scientific Journal of Environmental Sciences
- World Research Journal of Environment and Waste Management

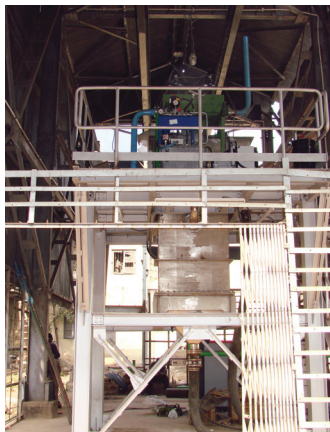
International Agreements/Collaborations



Facilities Created

Standalone Pneumatically Controlled Laboratory Instrumented Jig

Jigs are the process equipments available for lump and fine ores in mineral separation. The standalone pneumatically controlled laboratory instrumented jig under bed air pulsation is used for stratification of ores like iron ore, coal etc into different density fractions. The equipment is presently aimed to be used in the current projects funded by Ministry of Steel. The data will be used for generating engineering data required for scale up.



Ash Fusion Determinator

It helps to determine the coal Ash Fusion Temperature, Initial deformation Temperature (IT), Softening Temperature (ST), Hemispherical Temperature (HT), Fluid Temperature (FT).



Laboratory induced magnetic Separator

It is used to separate the magnetic material from the non-magnetic materials from different types of ore bodies containing a mixture of magnetic and non-magnetic material. This equipment has the facility to vary the magnetic field over a given range.

Knelson Concentrator

Knelson Gravity Concentrator is a continuous centrifugal gravity concentrator which utilizes the fluidization technology for high-mass yield recovery application. Knelson Concentrator is used primarily for bulk recovery of various base metals and industrial minerals such as Copper, Chromite, Iron ore & Coal. It uses centrifugal force field to enhance the settling kinetics of fine particles to improve their recovery.



Electromechanical Compression Testing Machine

Electromechanical Compression Testing Machine is software based and maximum capacity is 20kN machine for measurement of breaking load of pellet, rock and other materials.



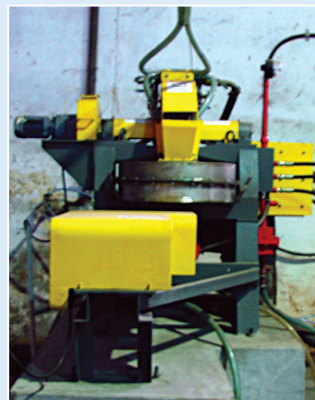
Ion Beam Milling Unit

This equipment is used for surface preparation of brittle samples. Gun energy from 10 KV to 100 ev with focused gun.



Slon 500 Vertical Ring and Pulsating High Gradient Magnetic Separator

Slon 500 Vertical Ring and Pulsating High Gradient Magnetic Separator (Slon 500 VPHGMS) is an advanced equipment for separation of paramagnetic minerals. It combines magnetic force, pulsating fluid and gravity forces for separation of fine grained paramagnetic minerals such as hematite, goethite, limonite, wolframite, chromite etc. The unique feature of pulsating mechanism and matrix design leads to improved performance over conventional magnetic separator. The equipment finds applications in beneficiation of low and lean grade iron ores and other ores containing paramagnetic minerals. It is also useful for separation of feebly magnetic impurities from ores and concentrates.



Plasma cleaner

This equipment is used for removing hydrocarbon contamination and hence improves image quality.



ENC Turning centre model sprint 16tc with FANUC Oi T mate model D CNC system

This CNC lathe will help to achieve faster machining, faster sample preparation and in obtaining better control on dimensional accuracy of repetitive type jobs. It is expected to substantially improve quality of various specimens prepared on lathe.



Versalab Vibrating Sample Magnetometer (VSM) Model: V530

This equipment can be used for measurement of magnetic moment of the materials up to 3T within the temperature range 50-400K for the research / industry working on high field materials. It is a part of the transport property measurement system (Versalab).



Labconco Freezone 6 Liter Benchtop Freeze Dry System (Model 77520 Series)

Freeze Dryer System is used for removal of water or other solvent from frozen material keeping intact the properties of materials.

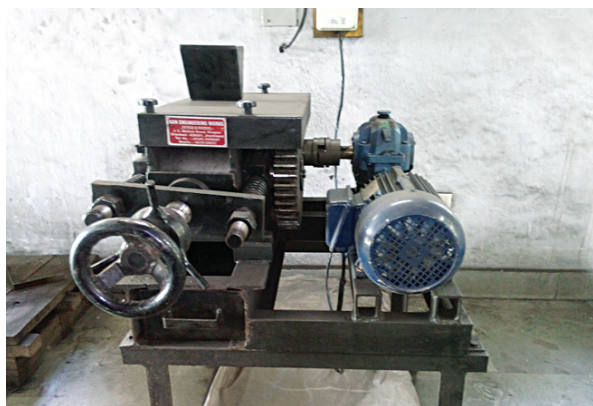
Sulphur Determinator

The SC-144DR Sulfur and Carbon Analyzer is designed to determine the carbon and sulfur content in a wide variety of organic materials such as coal, coke, and oils, as well as some inorganic materials such as soil, cement, and limestone by combustion with non-dispersive infrared detection.



Roller Crusher

Roller crushers are used mainly for crushing easily fractured materials such as soft limestone, chalk, and clay to between 1/3 and 1/5 of its original size. Double roll crushers are used for both, primary and secondary crushing. They guarantee a strictly defined final grain size with a minimum of fine grains. Raw materials, secondary materials and byproducts such as coke, sinter, coal, soft to medium-hard rock, ore, chalk, broken glass and similar products.



Planetary Ball Mill (INSMART SYSTEM)

Grinding is carried out by high-energy frequent impact of balls. The energy level of balls are as high as 50 times (at 400 rpm) the gravitational acceleration. The Insmart planetary system makes grinding extremely fast and efficient. Rotation of base plate provides the centrifugal force to the grinding balls and independent rotation of bowls (in opposite direction) makes the balls to hit the inner wall of the bowls several times more, because of the short returned path. Since the bowls are rotating in opposite direction a considerable part of grinding is done due to friction.



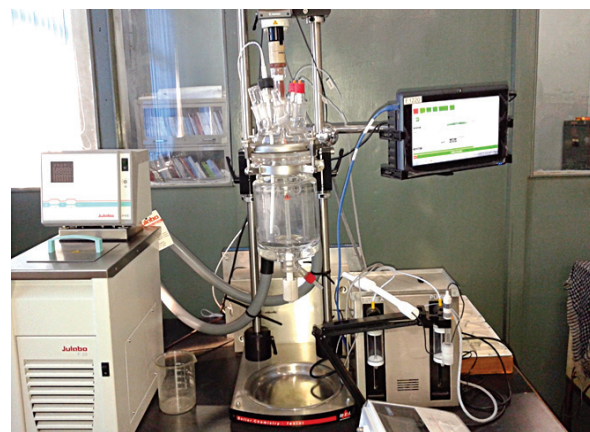
6200 Automatic Isoperibol Calorimeter

The Parr 6200 Isoperibol Bomb calorimeter (make: Parr, USA) is used to determine the gross calorific value (GCV) of fuels. The instrument can determine GCV in the range of 1,000 – 10,000 cal/g.



Automated Controlled Leaching systems (Model: HEL Autolab – Flex)

Automated Controlled Leaching System will be mainly used for leaching of wide variety of materials including ores/minerals/secondaries/wastes etc. The equipment comprises of three types of vessels e.g. 500 mL, 1 L and 5 L vessels to carry out leaching at small scale to bigger scale. The equipment automatically controls Eh, pH and temperature of the leaching system improving the efficiency of leaching. The equipment will be used for detailed scientific study on the dissolution of metals from various sources.



RI/RDI Equipment (Semi Automatic type) system

RI/RDI Instrument is purchased is used for measurement of Reducibility Index (RI) Reduction Degradation Index (RDI) and Thermal Degradation Index (TDI) of iron ore, iron ore sinter and iron ore pellets.



Converting Our Assets to Nation's Assets (Words of Appreciation)

Confocal Microscope

Transfer from CSIR-NML to CSIR-CFTRI, Mysore



The Confocal Laser Scanning Microscope (CLSM), LSM-700 model was transferred from CSIR-NML Jamshedpur to CSIR-CFTRI, Mysore on book transfer with your kind permission, has been installed in Central Instruments Facility & Services Department, CSIR-CFTRI. This instrument is being effectively used by our Scientists, Research Scholars and Students for research work. This is the first Confocal Microscopy facility created in CFTRI Mysore for the benefits of researchers working in various R&D departments. The Director, CSIR-CFTRI, Prof. Ram Rajasekharan, Staff members, Research Scholars and Students express sincere thanks for providing the instrument and kind gesture.

Thanking you,
Yours faithfully,
K.Vatcharavelu,
*Former Head & Senior Technical Officer (2),
Central Instruments Facility & Services Department,
CSIR-Central Food Technological Research Institute, Mysore*

Hot Isostatic Press(HIP)

Transfer from CSIR-NML to CSIR-CGCRI, Kolkata

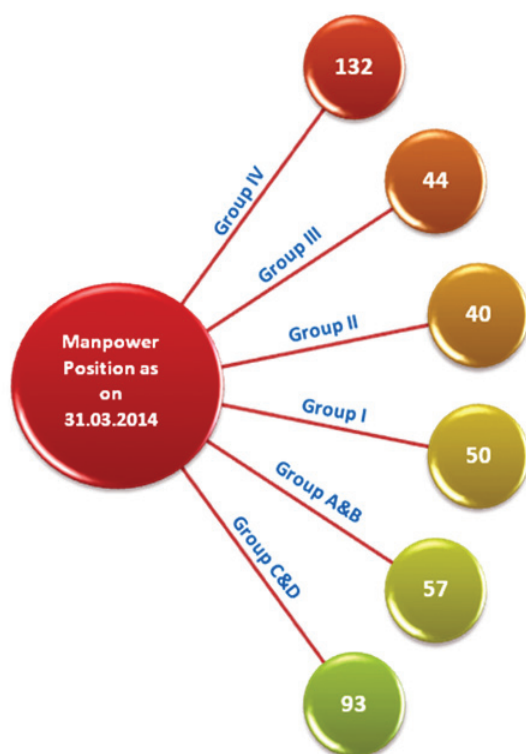


CONGRATS. The HIP has worked perfectly well upto 1750C/15000 psi/60 min/Nitrogen gas following a programme. We sintered silicon nitride balls in it. Thanks to the Director, NML for gifting us the system. Thanks Dr. Pathak, NML for his contributions on operation of the system. Thanks to the Stores and Purchase Officers, NML & CGCRI for clearing the papers. Thanks to Mr. Orcutt, AIP, for his continuous guidance and support for making the system operational. Thanks to Mr. Basu and Mr. Mondal, CGCRI, the key technicians for making the system fully operational. We shall keep in touch with Mr. Orcutt for spares and technical information.

Regards,
Probal Kumar Das, Ph.D.(Tech.),
*Scientist G & Head, Non-oxide Ceramics and Composites Division,
Central Glass Ceramic Research Institute, Kolkata, India*

Human Resource

CSIR NML Manpower



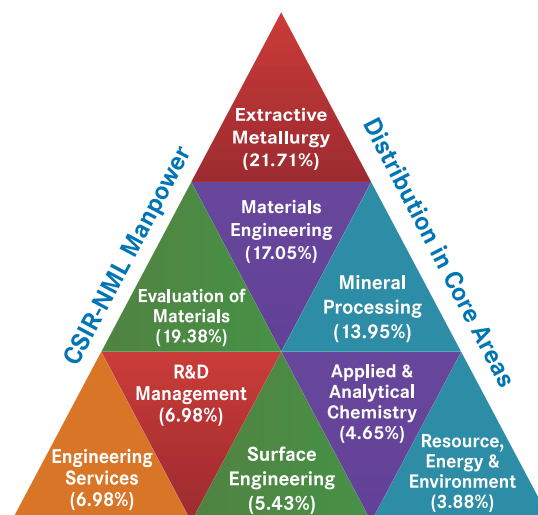
Qualification of Scientists



Qualification of Technical Officers



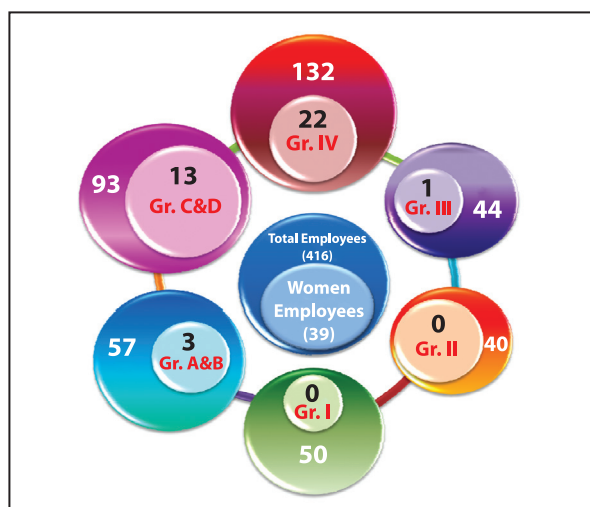
CSIR NML Manpower in Core Areas



SC/ST Employees at CSIR-NML



Women Employees at CSIR-NML



Trainings Imparted

- A training programme on Destructive Test was conducted for employees of the Office of the Chief Inspector of Boilers, Govt. Of Assam during 28 Jan – 31 Jan 2014 at CSIR NML. The programme involved an introduction to metallographic techniques which included both theory sessions and hands on experimentation. It covered sampling procedure, sample preparation, optical microscope (working principals, different components and lens defects), structural features like inclusion rating grain size determination observation of phases, acclimatization to different ASTM standards for microstructural investigation.
- The fourth batch of nine interns from South Korea was provided internship at CSIR-NML under KEMREP program between Republic of Korea and CSIR -National Metallurgical Laboratory. This program establishes a framework to provide an opportunity for students to apply educational, leadership and communication concepts and

theories in a practical context. Under this program, students from different universities viz. Korea Maritime & Ocean University, Hanyang University, Seoul National University, Chonnam National University and Yonsei University of Republic of Korea visit CSIR-NML, Jamshedpur for their internship. This KEMREP program enhances the exchange of scientific knowledge and communication between two countries which is helpful for the betterment and future development in different research areas. They were provided training in the areas of mineral processing, hydrometallurgy, analytical chemistry, recycling and information management.



Korean Interns at CSIR-NML, Jamshedpur, India



- A training programme for personnel from Sterlite Copper was conducted on various aspects of copper metallurgy during 15 Jan-20 Jan, 2014 at CSIR-NML. The program included Talks, Laboratory Demonstrations, Hands-on training on equipments and software. In all 11 persons attended the training programme.
- A training programme on "Water Treatment" was provided to one person from M/s. JUSCO, Jamshedpur, during 28 Jan – 31 Jan 2014 in the Analytical Chemistry department of CSIR NML.



- Kalyani Centre for Technology and Innovation of Bharat Forge Limited, Pune has set up a creep laboratory with guidance provided by CSIR National Metallurgical Laboratory, Jamshedpur, and has been deputing their engineers to CSIR NML for specialized training on "Creep of metals and alloys". The first batch consisting of 5 professionals were trained during 5 Dec – 9 Dec 2011. The 2nd advanced training programme in this series was organized for two engineers during 16 Dec – 20 Dec 2013. The program involved (1) Class room lectures by experts from CSIR NML on Creep, RLA studies and microstructural changes associated with creep deformation; (2) Acquaintance with various Standards (NABL /ASTM/DIN/ISO 9001 2008) and procedures for conducting creep/stress rupture tests; (3) Hands on training on creep/stress rupture testing, load and thermocouple calibration; (4) Data analysis. The program was rated excellent by the participants.

- Three (3) Days Short Course on "Metallurgy and Materials Science: an Overview of the Art and Application" was conducted at CSIR NML during 19 Jun – 21 Jun 2013 for Summer Trainees. About 90 Summer Trainees (Engineering Students) attended the course.



- Training Programme for Officers from Vizag Steel Plant (RINL) was conducted at CSIR-NML, Jamshedpur during 01 Jul - 12 Jul 2013. The programme was coordinated by Dr. Sandip Ghosh Chowdhury, Sr. Principal Scientist. Eight (8) Officers from Vizag Steel Plant participated in the programme.



- Training Course on "Destructive and Metallographic Test for Inspectorate of Boilers" was conducted at CSIR NML during 27 Jan – 31 Jan 2014.

Staff News

Staff Retired



Dr.(Smt) Kalpana Acharya
Sr. Med. Officer
on 30 Apr 2013



Shri. Bansidhar Bera
Security Guard
on 31 May 2013



Shri. Uma Prasad Das
Private Secretary
on 30 Jun 2013



Shri. Harbhajan Singh
Lab. Asstt.
on 30 Jun 2013



Dr. Phool Chand Ghosh
Jr. Sct.
on 30 Jun 2013



Shri. Kalyan Kr. Bhattacharyya
Chief Sct.
on 30 Jun 2013



Shri. Arun Alo Bhattacharjee
Asstt. (G) Gr. I
on 31 Jul 2013



Shri. Laliteswar Singh
Pr. Tech. Officer
on 31 Dec 2013



Dr. Devendra Deo Narayan Singh
Chief Sct.
on 31 Dec 2013



Shri. Devendra Mishra
Lab. Asstt.
on 31 Jan 2014



Shri. Kamaldeo Pathak
Sec. Officer(F&A)
on 31 Jan 2014



Shri. Sunil Kumar Roy
Lab. Asstt.
on 31 Jan 2014



Shri. Ashok Kumar Singh
Asstt. (G) Gr. I
on 31 Jan 2014



Md. Quasim
Lab. Asstt.
on 28 Feb 2014



Shri. Govind Prasad Roy
Private Secretary
on 28 Feb 2014



Shri. Jagannath Singh
Lab. Asstt.
on 28 Feb 2014



Shri. B Kameswar Rao
Lab. Asstt.
on 28 Feb 2014



Shri. Manik Chand Goswami
Chief Sct.
on 31 Mar 2014

New Joinees



Smt. Chanchala Mukhi
MTS05
on Sep 2013



Dr. Shantanu V Madge
Pr. Scientist
on 25 Sep 2013



Shri. Ranjit Sandilya
Asstt.(G) Gr.I
on 29 Nov 2013



Shri. Upendra Upadhyay
Asstt.(S&P) Gr.I
on 20 Feb 2014

Staff Deceased



Shri. T Tirupati Rao
Gr. I(4)
on 06 Nov 2013



Shri. Anil Behra
Safaiwala
on 29 Jan 2014

Staff Voluntary Retired



Shri. Jai Ram Singh
Asstt. (F&A)Gr.I
on 3 Feb 2014

Staff Transferred to CSIR NML



Shri Robert Barla
SO(F&A) on 10 Jul 2013
Transferred from CSIR HQ
and joined CSIR NML



Shri Amrendra Kumar
SO(G) on 03 Jul 2013
Transferred from CSIR HQ
and joined CSIR NML



Smt. Henal Shah
Scientist on 08 May 2013
Transferred from CSIR CMERI
and joined CSIR NML

Staff Transferred from CSIR NML



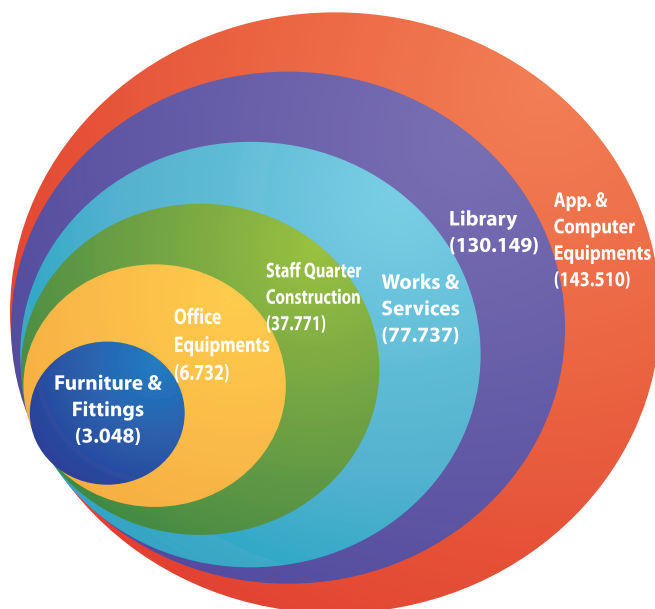
Shri KP Krishnan
Asstt.(G) Grade.I on 12 Dec 2013
Transferred to CSIR NIIST,
Thiruvananthapuram

Staff Resigned from CSIR NML

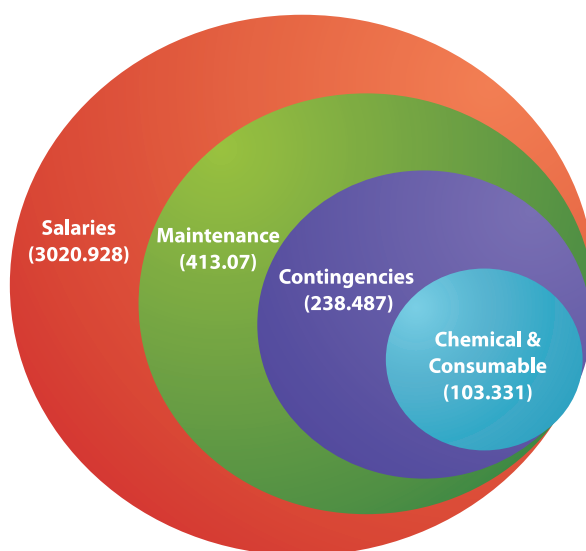


Dr. Atish Kumar Ray
Sr. Scientist
on 25 Sep 2013

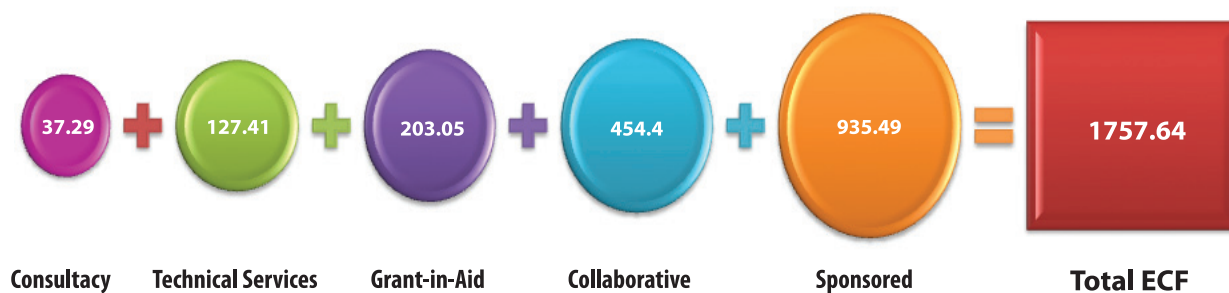
Budget 2013-14



Total Capital Expenditure:
Rs. 398.947 Lacs



Total Recurring Expenditure:
Rs. 3775.816 Lacs



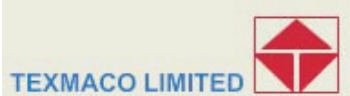
External Cash Flow in Projects (ECF) (Rs. in Lakhs)

Star Clients

NML's Fortune 1000 Clients

General Electric  imagination at work	Boeing 
Reliance Industries 	Oil & Natural Gas Corporation Ltd. 
Indian Oil Corporation  IndianOil	National Thermal Power Limited 
	Steel Authority of India Limited 
	Bharat Heavy Electrical Limited 
DLF  BUILDING INDIA	Natinal Mineral Development Corporation (NMDC) Ltd. 
GAIL (India) Limited 	Larsen & Tourbo Co. Ltd. 

CSIR - NML's ET 500 Clients

NHPC Ltd. 	Hindustan Zinc Ltd.  Hindustan Zinc Ltd.	Jindal Steel & Power 
Essar Steel 	Tata Motors 	JSW Steel 
Bharat Petroleum Corporation limited 	Texmaco Ltd. 	Usha Martin Ltd. 
Mahindra Ugin Steel Company 	Sterlite Industries 	CESC Ltd. 
Neyvelli Lignite Corporation Ltd. 	Mcnally Bharat Engineering Co. 	National Aluminium Co. Ltd. 

Impressions

It was a pleasure for me visiting NML, talking to you and your colleagues and also with Dr Venugopal and Dr. Sanjay Chandra on 4 March at Jamshedpur. I must admit that I saw new energy in your teams, lot more projects and much more collaborative effort between NML and Tata Steel. All these have been brought about by your able leadership and I wish to compliment you for your efforts and achievements. I enjoyed the NML trip and interactions immensely.

With warm regards,

B. Muthuraman,
Vice-Chairman Tata Steel & Director,
TATA Sons

I was reading 'Dainik Bhashkar' of 15th September and was extremely pleased to know that your able guidance and untiring efforts of Dr. Goswami and his team has been able to attract school students to study Science. Some 8000 students from 136 schools have visited NML. Now 80% of the students are interested in pursuing Science in their career. What a splendid achievement for NML. I wish to Heartily Congratulate everyone joining hands for this achievement.

Kedar Nath Gupta,
7148 BAYWOOD COURT,

I thank you profusely for your kind gesture and continued support to this department by permitting for our student Mr. Gangadhar B and Mr. Srinivas Naik PG. to carry out their dissertation work at your esteemed organization.

Working in your organization was a great learning experience for them. I really value the knowledge and insight you have and your willingness to share it with the students. I credit you for the success of their projects and understanding the practical aspects of mineral processing by their interaction with the Fellow Scientists and Engineers at your esteemed organization.

Further, I request you to extend your continued support in future too to our students and department.

Thanking You,

Prof. P.C Naganoor
Chairman,
Dept. Of Mineral Processing
VSK University P.G Centre
Nandihalli- Sandur.

Interactions & Reviews



Jane Goodall,
Primatologist (1934- present)

"There are an awful lot of scientists today who believe that before very long we shall have unraveled all the secrets of the universe. There will be no puzzles anymore. To me it'd be really, really tragic because I think one of the most exciting things is this feeling of mystery, feeling of awe, the feeling of looking at a little live thing and being amazed by it and how it's emerged through these hundreds of years of evolution and there it is and it is perfect and why."

Distinguished Visitors



Prof. Sangam Banerjee,
Saha Institute of Nuclear Physics,
Kolkata
*Graphene, Quasicrystals and
Nanoparticles : An overview*
9 Apr 2013



Dr. Pijush Pal Roy,
Acting Director, CSIR-CMERI,
*Emerging Techniques of Rock Blasting :
Effects and Operations*
26 Aug 2013



Mr. PS Dutt,
Chief Scientist, Head, Business
Development & Technology Transfer
Division, CSIR-NEERI, Nagpur
*Some Insights on Environmental
Legislations*
19 Apr 2013



Dr. Stephen Gaydos,
Scientist Boeing, USA
*Overview on Boeing's Coating
Programme*
7 Oct 2013



Mr. S. Sheethal,
M.Tech Student, NIT Trichy
*To Stir or Not to Stir is the Question-
Issues in Continuous Casting*
10 May 2013



Dr. Omprakash,
Scientist Boeing, INDIA
*Overview of Boeing's R&D
activities in India*
7 Oct 2013



Dr. Sanjay Kumar Agarwal,
MD, TMH, Jamshedpur
Life After Retirement
15 May 2013



Prof. Sushanta Dattagupta,
F. N. A. Sc, F. A. Sc, F. N. A, Vice Chancellor,
Visva Bharati University,
Shanti Niketan (Kolkata)
Diffusion
21 Oct 2013



Dr. Rajesh Bansal,
Asst. Professor, Faculty in Dental
Sciences Institute of Medical Science
Banaras Hindu University, Varanasi
*Translational Research and Development
of Biomaterials for Dental Applications.*
12 Jun 2013

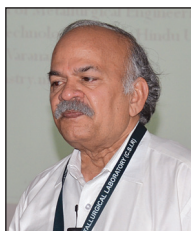


Dr. Sanjay Sondhi,
GE, Bangalore
*Computational Materials Engineering:
An Industrial Perspective*
25 Oct 2013

Distinguished Visitors



Prof. Anil K Gupta,
National Innovation Foundation
Grassroot Innovation
11 Nov 2013



Prof. GVS Sastry,
Head of the Department,
Department of Metallurgical
Engineering
IIT-BHU, Varanasi
*Optimisation of ECAP parameters for
strengthening Al-Cu-Mg precipitation*
11 Mar 2014



Shri. BL Shah,
Ex-Head and Scientist-in-charge,
CIMFR
Utilization of coal
19 Nov 2013



Dr. Eduard Schenuit,
Materials Testing Expert,
Zwick Roell, Germany
*Significance of different international
standards like ISO, EN in metal testing*
14 Mar 2014.



Prof. Vikram Jayaram,
Chairman & Professor,
Department of Materials Engineering,
Indian Institute of Science, Bangalore
*Microscale mechanical testing of Pt-Ni-Al
bond coats on Superalloys*
20 Dec 2013



Prof. Musci
Gabor and Associate Professor,
Earth Science & Engineering,
University of Miskolc, Hungary
*Research & Education at the Faculty of Earth
Science & Engineering at University of
Miskolc, Hungary (An insight on their
research projects on Critical Elements,
Water and Coal)*
20 Mar 2014



Dr. Sourav Das,
Principal Researcher,
High Strength Steel, R D & T Division,
Tata Steel Europe,
*Development of Third Generation AHSS :
A Tata Steel Approach*
30 Dec 2013



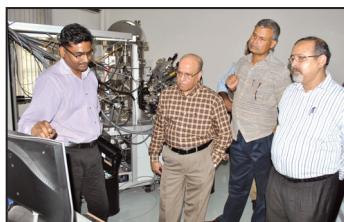
Prof. Akos Debreczeni,
Vice-Dean
Faculty of Earth Science & Engineering,
University of Miskolc, Hungary
*Research & Education at the Faculty of Earth
Science & Engineering at University of
Miskolc, Hungary (An insight on their
research projects on Critical Elements, Water
and Coal)*
20 Mar 2014



Mr. Santosh Pani,
University of Cape Town,
South Africa
*Study of Process Parameters and Their
Interactions on the Column
Flotation of PGM Ore*
10 Feb 2014

Special Events

Second Metallurgical Seminar for Students - Behind the Teachers' Desk (5 Apr - 6 Apr 2013)



Visit of Dr. K. Kasturangan (2 May 2013)

Dr. K. Kasturangan, M.Sc., Ph.D., F.A.Sc., F.N.A. Member (Science), Planning Commission and President, The National Academy of Sciences visited CSIR-NML and interacted with the scientists of CSIR-NML.

National Technology Day (11 May 2013)



Mr. Partha Sen Gupta, Vice President (Raw Materials & CSI), Tata Steel graced the occasion as the chief guest.



Short Term Training and Workshop on Fire Fighting, first aid & rescue operation (17 June - 18 June 2013)

Jointly organized by Civil Defense, Jamshedpur. Dr. Amitabh Kaushal, Deputy Commissioner, Jamshedpur graced the inaugural function as the chief guest.



Blood Donation Camp (16 May 2013)

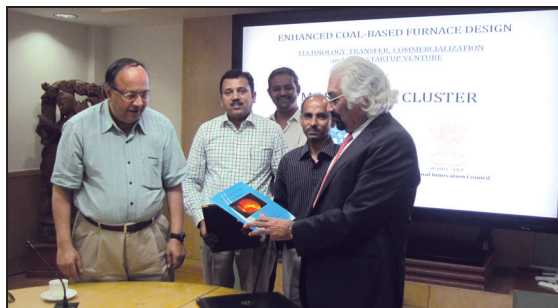
A Blood Donation Camp was organized by CSIR-NML Staff Club. 89 units of blood were collected during the camp and handed over to Jamshedpur Blood Bank.



Short term course on Metallurgy and Materials Science-an Overview of the Art and Application (19 Jun - 21 Jun, 2013)



MoU Signed with Moradabad Industrial Development Co Pvt Ltd, MIDCo (25 Jun 2013)



Visit of Mr. Jako Olavi Lepipen, Director (Concentrator Solutions) and Mr. Kari Mati Linama, Director (Experimental Research) from OUTOTEC, Finland (25 Jun 2013)



ISO Audit at CSIR-NML (8 Jul - 9 Jul 2013)



64th Research Council Meeting (17 Jul 2013)



Bramhananda Narayana Hridayalaya, Tamoliya, Jamshedpur- Free Medical Checkup Camp (24 Jul - 25 Jul 2013)



Prof. S. N. Sinha Memorial Materials and Metallurgy Quiz (SNSM3Q 2013) (30 Jul 2013)



Teacher-CSIR -NML interactive program (TECNIP)

Science teachers from Government schools in and around Jamshedpur participated in the program. The teachers were introduced to modern scientific tools and techniques by CSIR-NML scientists.



Visit of CSIR-ERP Team (6 Aug – 8 Aug 2013)

Dr. K. Jayakumar, Joint Secretary (Admin.) & Head IT, CSIR and Dr. G. Radhakrishnan, Scientist & Project Leader (CSIR Enterprise Transformation – ICT Initiative Project) visited CSIR-NML for full scale implementation of ERP system in the organization.



Independence Day Football League (15 Aug 2013)



71st CSIR Foundation Day Celebrations (27 Sep 2013)



Dr. P.R.Vasudeva Rao, Eminent Scientist and Director, Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu graced the occasion as the chief guest.

Vigilance Awareness Week (28 Oct – 2 Nov 2013)

Sri. Bhogla Soren, Vigilance Officer of BSNL, Santhali Writer and Dramatist and Sahitya Academy Award Winner was the chief guest of the program.



International Conference on "Modern Methods of Chemical Analysis Future Trends" (MMCA-2013) (20 Nov - 22 Nov 2013)



4th Prof. P. Ramachandra Rao Memorial Science Quiz-2013 (25 Nov 2013)

Dr. T. Mukherjee, Independent Non Executive Director, Member of Audit Committee and Member of Remuneration & Compensation Committee, TIL Limited graced the occasion as the chief guest.

64th CSIR-NML Foundation Day Celebrations (27 Nov 2013)

The function was attended by 65 students of Nettur Technical Training Foundation (NTTF), Jamshedpur. Mr. Anand Sen, President (TQM and Tata Steel Business) of Tata Steel graced the occasion as chief guest.



International Conference on Science and Technology of Iron making and Steelmaking (STIS 2013) (16 Dec – 18 Dec 2013)



The Conference was jointly organized by CSIR-NML, TATA STEEL & IIM, Jamshedpur Chapter. Mr. A. M. Mishra, Former Vice President of Tata Steel was the chief guest and Prof. Roderich LL Guthrie, Director McGill Metals Processing Centre, McGill University, Canada was the guest of honour.

25th Annual Flower Show (27 Dec - 30 Dec 2013)



CSIR-NML Sports Day (12 Jan 2014)



Republic Day Celebrations 2014



65th Research Council Meeting (06 Feb 2014)



MoU Signed with CSIR-Tech (10 Feb 2014)



National Science Day Celebrations (28 Feb 2014)

Dr. Balbir Kumar Mathur, IIT Kharagpur
graced the occasion as the chief guest.



AcSIR Fest (Joyrush 2014)

AcSIR Fest (Joyrush 2014) was organized by the students of AcSIR, CSIR-NML in the month of February 2014. Quiz and cultural programs were organized during this fest.



Visit of Shri. Muthuraman and Dr. Sanjay Chandra, Chief (R&D) & Scientific Services, Tata Steel Ltd. (4 Mar 2014)



International Women's Day Celebrations (8 Mar 2014)

Mrs. Ruchi Narendran graced the occasion with her presence as the chief guest.



Project Review Committee Meetings (R&D Projects Funded by Ministry of Steel, Government of India) (21 Mar 2014)

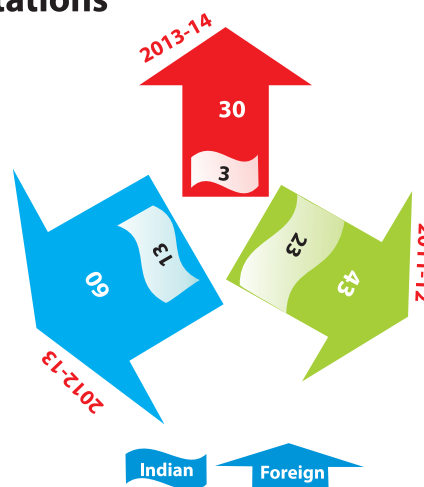
Third Metallurgical Seminar for Students- Behind the Teacher's Desk (27 Mar - 28 Mar 2014)



Deputations

Foreign Deputations

1. Dr. Sushanta Kumar Nath, Scientist was deputed to USA to participate in the conference on "World of Coal Ash (WOCA) 2013" at Lexington, USA during 22 Apr – 26 Apr 2013.
2. Dr. B Ravi Kumar, Principal Scientist was deputed to Sydney, Australia to attend the fifth international conference on "Recrystallisation & Grain Growth", during 05 May – 10 May 2013.
3. Dr. Arpita Ghosh, Scientist was deputed to Cornwall, UK, to attend the international conference on "Physical Separation", during 19 Jun – 21 Jun 2013.



Deputations in India

1. Shri. Saroj Kant Pradhan, Technical Assistant and Shri. Pankaj Kumar, Technical Assistant were deputed to CSIR-HRDC, Ghaziabad, to attend the "Orientation Training Program" for Gr. III personnel during 08 Apr – 12 Apr 2013.
2. Shri. Kanchan Kumar Paul, Chief Scientist and Shri. Nimai Halder, Technical Assistant were deputed to NTTF-R.D Tata Technical Education Centre, Jamshedpur to attend the seminar on "Rapid Prototyping" on 16 Apr 2013.
3. Dr. Kapil Deo Mehta, Sr. Scientist was deputed to CSIR-IMMT, Bhubaneswar to attend the refresher course on "Emerging Technology Trends in Indian Industries" during 29 Apr - 04 May 2013.
4. Mr. Jay Narayan Patel, Technical Assistant and Dr. Arvind Kumar Upadhyay, Sr. Technical Officer (2) were deputed to AMD Hyderabad to attend "Analytical Training at AMD" during 20 May - 25 May 2013.
5. Dr. Sanjay Agarwal, Scientist was deputed to LBS National Academy of Administration, Mussorie to participate in the program "Science & Technology for Rural Societies" during 20 May – 31 May 2013.
6. Mr. Sanatan Naiya, Sr. Technician was deputed to Ramakrishna Mission, Howrah to attend a program on "Horticultural Nursery Management" during 20 May - 07 Jun 2013.
7. Mr. Vinod Kumar, Administrative Officer and Dr. Manoj Kumar, Sr. Scientist were deputed to CSIR-HRDC, Ghaziabad to attend the "CSIR Leadership Development Program" during 29 May - 08 Jun 2013.
8. Dr. Ashit Kumar Pramanick, Sr. Scientist was deputed to LBS National Academy of Administration, Mussorie to attend a DST sponsored training program on "Ethics and Values" during 24 Jun - 28 Jun 2013.
9. Dr. Shyamal Kumar Maity, Sr. Scientist, Shri. Mallarouth Chandra Shekhar, Sr. Technical Officer (2), Dr. Gopi Kishor Mandal, Scientist and Dr. Durubadal Mandal, Scientist were deputed to RDCIS(SAIL) & MECON, Ranchi to attend an international conference on "Advances in Refractories and Clean Steel Making (ARCS13)" during 25 Jun 2013 to 28 Jun 2013.

10. Dr. Abhilash, Scientist was deputed to Andhra Pradesh to deliver an invited talk on "Microbial Synthesis of Nanomaterials from Industrial wastes" in the nanobiotechnology session of first international and third national conference on Biotechnology, Bioinformatics and Bioengineering during 28 Jun – 29 Jun 2013.
11. Dr. Sanchita Chakravarty, Principal Scientist was deputed to Indian Chamber of Commerce, New Delhi to attend the "Fifth India Coal Summit" during 01 Jul – 04 Jul 2013.
12. Dr. Banshi Dhar Pandey, Chief Scientist, Dr. Manoj Kumar, Sr. Scientist, and Ms. Swati Pramanik, PA-II were deputed to Corporate Monitor, MECON and AI Circle Ranchi to attend the 17th international conference on "Non-ferrous Minerals & Metals-2013" during 05 Jul- 06 Jul 2013.
13. Dr. Ranjan Kumar Sahu, Sr. Scientist and Shri. YN Singhbahu were deputed to CSIR India & Japan Society, New Delhi, to attend the international conference on "Frontiers in Energy, Environment, Health and Materials Research (EEMR-2013)" on 12 Aug 2013.
14. Dr. Vinod Kumar, Sr. Technical Officer (2) and Shri. Rachit Ghosh, Technical Officer were deputed to CSIR-HRDC, Ghaziabad to attend a conference on "Development of Managerial Efficiency for Technical Officers" during 22 Aug – 24 Aug 2013.
15. Shri. Parvesh Kumar, Sr. Principal Scientist and Shri. K Gopala Krishna, Principal Scientist, Madras Centre were deputed to ASCI, Hyderabad to attend the DST sponsored "General Management Program" during 26 Aug – 06 Sep 2013.
16. Dr. Soumitra Tarafder, Chief Scientist, Dr. Sarmistha Palit Sagar, Principal Scientist, Dr. Narayan Parida, Chief Scientist, Shri. Anindya Das, CSIR-SRF, Shri. Rajeev Kumar Gupta and Shri. Randhir Krumar Singh were deputed to TMDC Auditorium, Jamshedpur to attend a conference on "Failure Analysis Clinic", organized by IIM, ISNT, SFA (Jamshedpur Chapter) on 30 Aug 2013.
17. Dr. Rajendra Kumar Rath, Sr. Scientist was deputed to ISR Conferences & Services, Kolkata, at Raipur, Chhatisgarh to attend a national seminar on "Challenges and Innovations in Mining, Mineral & Metallurgical Processing and Technologies" on 30 Aug 2013.
18. Dr. Manoj Kumar, Sr. Scientist was deputed to CSIR-HRDC, Ghaziabad to attend the CSIR Leadership Development Program (Module IV) organized by CSIR-HRDC, Ghaziabad during 02 Sep – 05 Sep 2013.
19. Dr. Sanchita Chakravarty, Principal Scientist and Dr. Mamta Sharma, Scientist were deputed to The Mining, Geology & Metallurgical Institute of India, at Kolkata to attend a national seminar on "Business & Investment Opportunity in Mineral Industry 2013", organized by The Mining, Geology & Metallurgical Institute of India on 14 Sep 2013.
20. Shri. Vinod Kumar, Administrative Officer was deputed to CSIR-HRDC, Ghaziabad to attend a program on "Capacity Building" for Sr.COAs/COAs/AOs, organized by CSIR-HRDC during 16 Sep – 20 Sep 2013.
21. Dr. (Ms) Kakali Chatterjee, Sr. Principal Scientist was deputed to LABNAA, at Mussoorie to attend the DST sponsored training program on "Governance in Science and Technology" during 23 Sep – 27 Sep 2013.
22. Dr. Sabita Ghosh, Project Investigator was deputed to Centre for Geospatial Science, CEPT University at Ahmedabad to attend a training program for women scientists on "Geomatics: Technology and Application" during 21 Oct – 26 Oct 2013.
23. Dr. Vikas Chandra Srivastava, Principal Scientist, Dr. Sanjay Agarwal, Scientist, Dr. Pratima Meshram, Scientist, Dr. Sandip Ghosh Chowdhury, Sr. Principal Scientist, Dr. Abhilash, Scientist, Dr. B Ravi Kumar, Principal Scientist, Dr. Arvind Sinha, Sr. Principal Scientist, Dr. Swapan

- Kumar Das , Principal Scientist, Mr. Parikshit Mahato, CSIR-SRF, Mr. Navneet Singh Randhawa, Tech. Asst, Ms. Aarti Kumari , Trainee Sct, Dr. Amitava Mitra, Chief Scientist, Mr. Gautam Kumar, Trainee Scientist, Dr. Soumitra Tarafder, Chief Scientist, Dr. S Sivaprasad , Principal Scientist, Dr. Mita Tarafder, Sr. Principal Scientist, Dr. Sabita Ghosh , Principal Investigator, Dr. Swapna Dey , Principal Investigator, Dr. Rakesh Kumar, Chief Scientist, Dr. Banshi Dhar Pandey, Chief Scientist, Dr. Vinod Kumar, Sr. Technical Officer, Dr. Kanai Lal Sahoo, Principal Scientist, Mr. Soumya Bhattacharya, CSIR-SRF , Dr. Debajyoti Bandyopadhyay , Chief Scientist, Dr. Sanjay Kumar, Principal Scientist were deputed to IIT-BHU, Varanasi to attend IIM NMD-ATM 2013 during 12 Nov – 15 Nov 2013.
24. Dr. Sanchita Chakravarty, Principal Scientist and Dr. Rajneesh Kumar, Scientist were deputed to Ghaziabad to attend “IVth Module Leadership Development Program” organized by CSIR-HRDC, Ghaziabad during 03 Feb – 06 Feb 2014.
 25. Dr. Rajat Kumar Roy, Scientist and Dr. J Swaminathan, Sr. Principal Scientist were deputed to Kalpakkam to attend international conference on “Structural Integrity”(ICONS 2014) organized by IGCAR, Kalpakkam, IIM, IIW & SFA during 04 Feb – 07 Feb 2014.
 26. Shri. Ashish Kumar Upadhyay, Technical Officer was deputed to New Delhi to attend 4th Capacity Building Program for Technical Personnel, organized by IIPA, New Delhi during 10 Feb – 21 Feb 2014.
 27. Dr. Gopi Kishor Mandal, Scientist and Shri. Anuja Mohan Pradhan, FAO were deputed to Ghaziabad to attend 3rd CSIR-Leadership Development Program organized by CSIR-HRDC, Ghaziabad during 10 Feb – 20 Feb 2014.
 28. Dr. Ram Pravesh Bhagat, Chief Scientist was deputed to Varanasi to attend international symposium on “Environment Management & Current Practices in Mining & Allied Industries”(EMPM-2014), organized by BHU, Varanasi during 13 Feb – 15 Feb 2014.
 29. Dr. Deepak Chandra Sau, Scientist was deputed to Gwalior to attend training program on “Soft Computing Techniques for Optimization”, organized by IIITM, Gwalior during 17 Feb – 21 Feb 2014.
 30. Dr. Srinivasan Srikanth, Director, CSIR-NML was deputed to Kolkata to attend national seminar on “Science & Technology Policy: The Need for State Specific Appraisal” organized by Indian Science News Association, Kolkata during 26 Feb – 27 Feb 2014.

Audit Report

Excerpts From Audit Report and action required

Reference : Audit report for 2012-13, report received 16th April 2014

Item no. (as per Audit Report)	Item	Details	Action Required
Para- 1	Idling of assets at Marine Corrosion Research Station (MCRS), Digha	Governing Body of CSIR in its meeting held on 05.3.2002 decided to close MCRS, Digha. NML closed MCRS on 31.8.2002 and requested the secretary, Development and Planning Department, Government of West Bengal in December 2002 to take over the possession of land and building erected thereon by NML, but no action was taken. NML incurred an expenditure of Rs.36.71 lakh on security guards on idle assets at MCRS, Digha for the period September 2002 to March 2013. On being pointed out, NML stated in March 2014 that as per the decision conveyed by CSIR, this laboratory was bound to keep the position of the land stipulated at MCRS, Digha as CSIR was considering to utilize the land & building for Capacity Building & Training Complex.	Further development made in this regard may be communicated to Audit.
Para- 2	Non-realisation of cost of the project from sponsor	A sum of Rs.74.74 lakh had remained to be realized from the sponsors / clients till the dates of audit in respect of 10 numbers of sponsored/consultancy/grant-in-aid projects completed till March 2013	Necessary steps may be taken towards early realization of the outstanding dues NML clarification: For many of these projects invoice has been sent and payment is awaited

Item no. (as per Audit Report)	Item	Details	Action Required
Para- 3	Non-submission of final/completion reports of projects	Scrutiny of records and reply revealed that although 41 numbers of different categories of projects were completed between April 2010 and March 2013, the final/completion reports there – against had remained to be submitted till date.	Necessary steps may please be taken towards submission of the final/completion reports under intimation to Audit. NML Clarification: For most of these cases the project report has been sent to client. The reports are not archived which will be rectified.
Para- 4	Excess payment of pay and allowances	CSIR under its letter no. 3-33(113)/2004-E-I dated 12.05.2006 conveyed its approval to all its National Labs/institutes for introduction of NFS of Rs. 8000-275-13500 to all regular section officers (General/Finance & Accounting/Stores & Purchase) who have completed four years of approved service in that grade from 3 October 2003. The grant of Non-functional Scale to section officers (SOs)/Private Secretaries (PSs) of CSIR does not, however, have the approval of Ministry of Finance (MoF) CSIR-NML, however, irregularly allowed the Grade Pay of Rs. 4800/- instead of admissible Grade Pay of Rs. 4600/- to its five SOs and one PS. In view of above, the following Grade Pay of RS.4800/- to SOs and grant of NFS to 10 numbers of SOs and one PS after completion of their four years	While taking up the matters with CSIR, necessary action may be taken to recover overpayment made under intimation to Audit. Action in this regard falls within the purview of CSIR Headquarters.

Item no. (as per Audit Report)	Item	Details	Action Required
		of approved services in that cadre were not in order and in this connection the excess pay & allowances so paid stands inadmissible. NML stated in March 2014 that the Pay of SOs /Ps had been done in accordance with CSIR orders.	
Para- 5	Non-observance of DoPT order while granting promotion to scientists	Contravening the provision of DoPT orders NML, granted in-situ promotion to its scientists with retrospective effect and allowed them to draw arrear payments. In reply to an audit query NML stated in March 2014 that the Assessment Promotion of Scientists at CSIR-NML had been governed by the provisions of "CSIR Scientist Recruitment and Assessment Promotion rules, 2001" as amended from time to time but not by the provisions of aforesaid DoPT orders.	Action in this regard falls within the purview of CSIR Headquarters.
Para- 6	Non-disposal of unserviceable store items and non-regularisation of missing items	36 items out of a total inventory of 5109 items remained untraced. A total 1411 numbers of unserviceable items as of January 2014 valuing Rs. 500.53 lakh was awaiting disposal till dates of audit	Necessary action may be taken to conduct updated physical verification and trace out/obtain write off sanction for the missing items as well as early disposal of the unserviceable items.
Para- 7	Non-reconciliation of value of assets with the Register	As per Annual Accounts for 2012-13 value of fixed assets on March 2013 was Rs.9206.27 lakh. The breakup of these fixed assets was verified with the Annual Accounts figure for the	

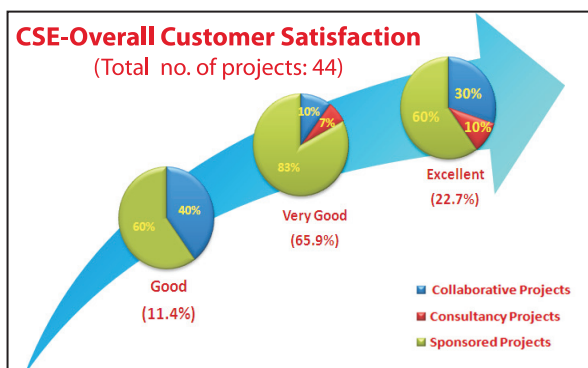
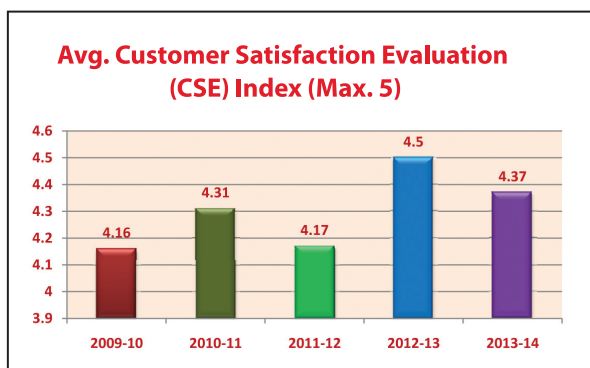
Item no. (as per Audit Report)	Item	Details	Action Required
		year 2012-13. However, the breakup of the said asset value could not be verified (except library books) with the asset registers maintained at different divisions of NML.	
Para- 8	Missing Library Books and Journals and delay in receipt of journals against which advance payment made	240 numbers of books and journals etc. valuing more than Rs. 12208.00 plus \$63.80 plus £3.09 plus 162 Sh were missing as on 31 March 2012. Further, advance payments made of Rs. 10850.00 to the publishers during November 2012 to April 2013 for seven different types of journals were also not received by the laboratory till dates of audit.	Necessary action may be taken towards early retrieval/tracing out of the aforesaid misplaced/missing library books/journals or towards recovery the value thereof. Action may also be taken towards getting back the journals for which advance payment had been made to the publishers immediately under intimation to Audit. NML Clarification: Search operations were still going on for tracing out the missing documents. Reminders were being sent to the publishers to get the issues of various overdue journals and NML had already received one of the due items.



Mae Jemison,
First African American woman in space (1956-present)

"Never be limited by other people's limited imaginations...If you adopt their attitudes, then the possibility won't exist because you'll have already shut it out ... You can hear other people's wisdom, but you've got to re-evaluate the world for yourself."

Customer Satisfaction Evaluation (CSE)



Comments from our collaborators & sponsors

Earthstone Iron ore resources, FZE, UAE, Indonesia

The satisfactory outcome from experts and well sorted team members/ group provoke us to have a long term business relationship with this laboratory. [SSP 0733 & SSP 0770]

Tata Steel, Jamshedpur

Willingness to make changes. [CLP 0083]

Good facilities & expertise available at reasonable cost. [CLP 0092]

Commitment, R&D Competence. [CLP 0097]

Gas Turbine Research Establishment, Bangalore

Technical interaction with project leader during the course of testing found useful and effective in making midcourse correction. [SSP 0448]

Good Infrastructure and knowledge base available at NML for testing. [SSP 0448]

Intellectual Assets and Infrastructure availability. [SSP 0582]

Ultra Tiles Pvt. Ltd., Chennai

Some more tests like solar reflective index and acoustic property can be included. [SSP 0586 & SSP 0737]

Hindustan Aeronautics Limited, Koraput, Orissa

Persons are competent and customer friendly. [SSP 0756]

Customer friendly people. [SSP 0757]

NML is a national laboratory with good facilities. [SSP 0764]

MOIL Limited, Nagpur

CSIR-NML is the only big laboratory in India, having very intelligent and well behaved scientists. Each and every type of facility is available in CSIR-NML in all fields like metal, non-metals, water treatment etc. Progress is a continuous process although CSIR-NML having all types of facilities but other instruments for rare metals may be required in future. We are proud to have such type of laboratory in India. [SSP 0793]

IFGL Refractories Limited, Kalunga (Orissa)

Doing research and development in the field of Bioceramic implant material applicable in Orthopaedic & Dental segment suitable for placing in the market as per the present scenario. [SSP 0657]

Neepco Ltd, Shillong

The R&D project was completed in scheduled time to the satisfaction of cooperation. The expert service may be availed by other agencies. [CNP 0155]

JSW Steel Limited, Pottaneri, Mecheri

Excellent domain knowledge. [SSP 0821]

ADV Metal Combine Pvt. Ltd., New Delhi

Expertise available with project leader is excellent and found useful for the project. Good Infrastructure and knowledge base available for such testing. [SSP-0828]

Central Mine Planning & Design Institute Ltd.

Knowledge & experience of people and equipment availability. [SSP 0796]

Indian Oil Corporation Ltd., Asansol, Burdwan

More specific recommendation would have helped a lot. [SSP 0815]

Kalyani Carpenter Special Steels Ltd., Pune

Prompt service, world class facility. [SSP 0715]

Aditya Birla Science and Technology, Maharashtra

Good facilities & expertise available at reasonable cost. [SSP 0814]

RSB Transmission (I) Pvt. Ltd., Jamshedpur

Customer satisfaction, dedicated effort. [CNP 0159]

Bhabha Atomic Research Centre, Mumbai

Commitment towards work, very good facility and expertise, accessibility of member. [SSP 0211]

Intellectual Property Created

PATENT APPLICATIONS FILED BY CSIR-NML

A Device for the measurement of magnetostriction of ferromagnetic materials (0094NF2013)

A process for the recovery of rare earth metals Yttrium, Lanthanum, Terbium & Europium from scrap fluorescence tube (0140NF2013, 0280DEL2014)

A sensor based on amorphous or nanostructured magnetostrictive ribbons and a process for non-destructive evaluation of defects in pipelines using the same device

An improved process to produce refractory bricks from ferrochrome slag

A process for the production of graphene oxide and functionalized graphene oxide by thermal reduction

A process for the production of graphene oxide based anti-corrosion coating of metals by solution method

An improved suction casting assembly for the preparation of bulk metallic glass

A Process for recovery of potash from feldspar with simultaneous recovery of ferro-Silicon

Development of biomimetic novel three dimensional metal fibre reinforced polymer hydroxyapatite nanocomposite for different load bearing bone graft application

An improved process for the pyrolysis of depopulated printed circuit boards (PCBs) of e-waste

A process for the recovery of neodymium as a value added product from waste hard disk of personal computers (0086NF2012/IN, 1660DEL2013)

An improved process for the preparation of load bearing biphasic calcium phosphate nanocomposite blocks useful as bone grafts and scaffolds (0078NF2013/IN, 2009DEL2013)

A device based on higher harmonic analysis of ultrasound waves for structural damage evaluation of in-service components (0144NF2012/IN, 2618DEL2013)

A process for preparation of Cu-based brazing alloys for joining steel components (0084NF2012/IN, 3051DEL2013)

A single pot biomimetic process for the synthesis of colloidal collagen-graphite composite (0183NF2013/IN, 3566DEL2013)

A process for the recovery of rare earth metals from scrap fluorescent tubes (0140NF2013/IN, 0280DEL2014)

PATENT APPLICATIONS FILED BY CSIR-NML AND COLLABORATOR

An equipment for the production of titanium oxide from ilmenite ore

An improved process for preparation of briquettes for iron making using iron ore slime and jhama coal (0217NF2013)

An improved annealing simulator device (0218NF2013)

A process for production of highly metallised directly reduced iron (0227nf2013)

Process for production of highly metallised low sulphur directly (0228nf2013)

A process for synthesizing reduced graphene oxide on a substrate (0229nf2013)

A process for synthesizing reduced graphene oxide on a substrate from seed lac

An improved Rayleigh wave ultrasound based technique for detection of cause of residual stress on HSS rolls

An improved method to produce paving blocks from AOD Slag using geopolymerisation

An improved process for the conversion of hematite powder into magnetite using CNG (compressed natural gas)

A method of generating recyclable products from primary steelmaking slag

An improved process for the conversion of hematite powder into magnetite using COG (coke oven gas)

PATENT GRANTED IN INDIA

Novel chromium and manganese mixed oxide pillared clay and a process for the preparation thereof (257386)

COMPLETE SPECIFICATIONS FILED AFTER PROVISIONAL FILING

A process for preparation of polymeric n-acrylamido triazole compounds and the use thereof as anti tarnishing agents and corrosion inhibitors of copper and copper alloys (3445DEL2012)

A process for production of various shapes and sizes of high purity monodispersed iron oxide from waste chloride pickle liquor (0251DEL2013)

An improved coke based energy efficient non-ferrous melting furnace (0596DEL2013)

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A web based e-reporting system (Inquest)

Software for online detection of alumina in Iron ore

NEURO-MECH - An adaptive neuro-fuzzy simulation code for predicting mechanical properties of hot rolled steel

On line equipment and business information (OLEINFO)

Research Publications

- 1 Abhilash; Mehta, K. D.; Pandey, B. D.(2013) Bacterial leaching kinetics for copper dissolution from a low-grade Indian chalcopyrite ore *REM-REVISTA ESCOLA DE MINAS*, **66**(2), pp. 245-250
- 2 Abhilash; Pandey, B. D.(2013) Bioreactor leaching of uranium from a low grade Indian silicate ore *BIOCHEMICAL ENGINEERING JOURNAL*, **71**, pp.111-117
- 3 Abhilash; Pandey, B. D.(2013) Microbial processing of apatite rich low grade Indian uranium ore in bioreactor *BIORESOURCE TECHNOLOGY*, **128**, pp.619-623
- 4 Abhilash; Pandey, B. D.(2013) MICROBIALY ASSISTED LEACHING OF URANIUM-A REVIEW MINERAL PROCESSING AND EXTRACTIVE METALLURGY REVIEW, **342**, pp.81-113
- 5 Alex, T. C.; Kalinkin, A. M.; Nath, S. K.; Gurevich, B. I.; Kalinkina, E. V.; Tyukavkina, V. V.; Kumar, Sanjay(2013) Utilization of zinc slag through geopolymerization: Influence of milling atmosphere *INTERNATIONAL JOURNAL OF MINERAL PROCESSING*, **123**, pp.102-107
- 6 Alex, T. C.; Kumar, Rakesh; Roy, S. K.; Mehrotra, S. P.(2013) Leaching behaviour of high surface area synthetic boehmite in NaOH solution *HYDROMETALLURGY*, **137**, pp.23-32
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- 10 Balusamy, T.; Narayanan, T. S. N. Sankara; Ravichandran, K.; Park, Il Song; Lee, Min Ho (2013) Influence of surface mechanical attrition treatment (SMAT) on the corrosion behaviour of AISI 304 stainless steel *CORROSION SCIENCE*, **74**, pp.332-344
- 11 Balusamy, T.; Narayanan, T. S. N. Sankara; Ravichandran, K.; Park, Il Song; Lee, Min Ho (2013) Plasma nitriding of AISI 304 stainless steel: Role of surface mechanical attrition treatment *MATERIALS CHARACTERIZATION*, **85**, pp.38-47
- 12 Balusamy, T.; Narayanan, T. S. N. Sankara; Ravichandran, K.; Park, Il Song; Lee, Min Ho (2013) Effect of surface mechanical attrition treatment (SMAT) on pack boronizing of AISI 304 stainless steel *SURFACE & COATINGS TECHNOLOGY*, **232**, pp.60-67
- 13 Balusamy, T.; Narayanan, T. S. N. Sankara; Ravichandran, K.; Park, Il Song; Lee, Min Ho (2013) Pack boronizing of AISI H11 tool steel: Role of surface mechanical attrition treatment *VACUUM*, **97**, pp.36-43

- 14 Bar, H. N.; Sivaprasad, S.; Narasaiah, N.; Paul, Surajit K.; Sen, B. N.; Chandra, Sanjay(2013)Low Cycle and Ratchetting Fatigue Behavior of High UTS/YS Ratio Reinforcing Steel BarsJOURNAL OF MATERIALS ENGINEERING AND PERFORMANCE, **226**, pp.1701-1707
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Ongoing & Completed R&D Projects

Project No.	Project Title	Project No.	Project Title
CLP0079	Studies on the beneficiation of coal fines by column flotation	CLP0107	Development of an online IR-thermography based non-invasive technique to detect and estimate iron in galvanized coatings
CLP0089	Optimization of strength in V/N induced micro alloyed steel by varying vanadium content with fixed nitrogen level	CLP0108	Study of scale formation and optimization of pickling process parameters for different hot rolled steels to improve efficiency
CLP0096	Development of aluminium Reflectors protective coating for thermal solar applications	CLP0109	Graphene coated steel
CLP0098	Studies on the effect of process parameters on properties of iron ore pellets	CLP0110	Production of ferrite and pigment grade monodispersed nano iron oxide
CLP0099	Study of the sintering with reference to Tata Steel using ferruginous materials: pre-balled Iron ore concentrates and beneficiated sinter grade feed	CLP0111	Study the suitability of ferro-chrome slag for refractory bricks
CLP0100	Study of the factors influencing the sintering rate and cooling of super-fluxed sinter (CaO/SiO ₂ : 1.8- 2.5) on the sintering indices : Structure-Properties correlation	CLP0112	Evaluation of rebars for cryogenic application
CLP0101	Process mineralogical and energy characteristics of low grade iron ore from Tata Steel	CLP0113	High strain rate deformation behaviour of automotive grade sheet steels
CLP0102	Energy assessment in the comminution of heat- treated BHQ from Tata Steel	CLP0114	Process Development for Production of Titanium Oxide from Ilmenite with Jhama Coal and Separation of Iron from Titanium Oxide
CLP0103	Process for Production of DRI using iron ore slime with middling and rejected coal	CLP0115	Feasibility study of iron production utilizing iron ore slime and Jhama coal in low shaft furnace
CLP0104	Mold powder characterization for low carbon high manganese steel	CLP0116	Scale-up of process for production of DRI using from Iron Ore Slime and Jhama coal in Tunnel Kiln furnace
CLP0105	Development of API X80 linepipe steel (2nd Phase)	CLP0117	Creep damage assessment of high temperature headers and pipeline using multi parameter non-destructive examinations.
CLP0106	Development of advanced sensor-based technique for raw materials beneficiation	CLP0118	Optimisation of annealing parameters in IF HS Steel Sheet

Project No.	Project Title	Project No.	Project Title
CLP0119	Optimisation of Annealing Parameters in full hard CRC IF Steel Sheet	CNP0158	Thorough investigation of anchor grillage and girder of Rabindra Setu
CLP0120	Effect of combination of synthesis slag and carry over slag of LF to control the inclusions in high carbon steel wire rod	CNP0160	Consultancy on precipitation & characterization of various zinc salts
CLP0121	Scale-up studies for fluidized bed conversion of hematite powder into magnetite suitable for application in heavy media separation	CNP0161	Enhancement of NDT Facility for Quality Assessment of Grooved Rolls used in New Bar Mill (NBM): Phase II
CLP0122	Technology Development for Iron Ore Slime Briquettes	CNP0162	Patent Research Analytics Services
CLP0123	Study on Crumbling of LF Slag during Cooling and Development of Suitable Method to avoid powdering	CNP0163	Consultancy on marketable grade iron oxide production from waste iron sludge.
CLP0124	Development of delivery standard of Hot rolled sheets based on Ultrasonic velocity mapping	CSC0132	Design and development of novel solvent extraction/ hydro-metallurgical process for separation and recovery of individual rare earth from selected resources/rare earth and other values from wastes
CLP0125	Torsion properties of cold drawn pearlitic steel: role of residual stress, microstructure and crystallographic texture	ESC0103	Development of novel CSIR Technologies for manufacturing tailored and patient-specific Bio-Ceramic implants and biomedical devices at affordable cost (Bioceram)
CLP0126	Utilisation of LD slag as flux	ESC0104	Advanced ceramic materials and composites for energy and structural applications (CERMESA)
CLP0127	Recovery of Chrome Value from Chromite ore.	ESC0109	Development of zero waste technology for processing and utilization of thermal coal.
CNP0154	Providing Technical Expertise to CARIRI to Study Corrosion Failure Problems of Industries in Trinidad & Tobago	ESC0503	Development of Magnesium Metal Production Technology (MPT)
CNP0155	Severity, cause and possible remedial measures for corrosion problems faced by metallic components of Kopili plant of Neepeco, Assam	GAP0154	Development of Slit Erosion Resistant Material for Turbines of Hydrogenerator
		GAP0220	Technology Development for Geopolymer Pavement Tiles from Fly Ash.

Project No.	Project Title	Project No.	Project Title
GAP 0223	Autoclave processing/ pressure metallurgy for metal extraction and materials synthesis Activity I: Selective hydrothermal production of metal powder /oxides from waste sources Activity II: Hydrothermal precipitation of nano size oxides of aluminium and titanium	GAP 0244	Inventorization of Lead, cadmium, Mercury and Arsenic in Paints, Distempers and Pigments
GAP 0225	Electrothermal processing for light metal extraction	GAP 0245	Beneficiation of Iron ore Slime from Barsua and other mines
GAP 0228	Improvement in Sinter Productivity through Deep Beneficiation and Agglomeration for rational Utilisation of Low Grade Iron ore and Fines.	GAP 0246	Development of pilot scale pelletisation technology for Indian Goethitic/Hematite ore with varying degree of fineness
GAP 0235	Use of slag from Non-Ferrous Industries in Geopolymeric Material	GAP 0247	Effect of welding heat inputs on low temperature sensitization and thermal ageing on embrittlement of austenitic steel
GAP 0236	Biosynthesis of iron oxide based magnetic nanoparticles from industrial wastes	GAP 0248	Evaluation of mechanical properties of structural materials using miniature test technique
GAP 0240	Effect of pileup-sink-in on mechanical properties characterization of bulk and UFG/nano material using indentation simulation and its experimental validation	GAP 0249	Quality Evaluation of Coal-Cores explored from different regions of India
GAP 0241	Determination of Metal Fractionation Deposited on the Sediments of River Subarnarekha System: A Voltammetric study.	GAP 0250	Hydrogen Induced fatigue in high Strength Aluminium Alloy
GAP 0242	Development of geopolymer building materials through mechanical activation of Construction & Demolition Waste	GAP 0251	Tailoring of geopolymer properties by mechanical activation of fly ash
GAP 0243	Development of technology to produce clean coal from high ash and high sulphur Indian coal	GAP 0252	Microstructure measurement in un-irradiated Zr-2.5% Nb pressure tube material
		GAP 0253	Study on the interface layer formation during hot dip galvanizing of advanced high strength steels for automotive applications
		OLP 0141	Monte Carlo simulation of grain growth and recrystallization kinetics during thermomechanical rolling of high strength steel A mathematical model to predict mechanical properties of hot rolled high strength steel strip using an Adaptive Neuro-Fuzzy Inference System (ANFIS) architecture

Project No.	Project Title	Project No.	Project Title
OLP0142	Development of sensor using nanostructured magnetic materials and studies on their performance evaluation in SHM. Module 1: Development of high sensitive GMI based magnetic sensing devices using low magneto-restrictive rapidly quenched wire (Module – III: Study on the performances of the GMI sensing device and its applications in structural health monitoring (SHM) of engineering components)	OLP0184	Improvement of magnetic energy product of hexaferrite permanent magnet (Young Scientist)
OLP0144	Development of Suitable Sinter from Chromite Ore Fines for Ferro-Chrome Production in Arc Furnace	OLP0188	Study of leaching properties of Al-Si-Zr alloys at different conditions
OLP0149	Development of NiMnGa based ferromagnetic shape memory alloys by melt spinning route	OLP0190	High strain rate deformation of automobile grade steels (Module I)
OLP0171	Construction of new Creep Bay	OLP0191	Creep-Fatigue Interaction Behaviour of Advanced Ultra Super Critical Boiler Grade Materials: Module I
OLP0174	Corrosion and Tribological behavior of surface modified titanium alloys	OLP0192	Extraction of valuable metals from Lithium ion batteries.
OLP0179	Assessment of Creep Damage by Guided Wave Ultrasonic Technique (Module I)	OLP0193	Synthesis and characterization of water based graphene- ferrofluids (G-FF).
OLP0180	Design of novel hard & tough amorphous metallic coatings	OLP0194	Process for production of high purity ammonium paratungstate (APT) from tungsten bearing sludge with high content of impurities.
OLP0181	Optimizing strength and conductivity properties of an electrical conductor grade aluminum alloy wire through microstructural engineering	OLP0195	Multilayer Polymeric Self-Healing Coating for Corrosion Protection of Al & Mg alloys
OLP0182	Friction stir welding of carbon steel	OLP0196	Upgradation of the material database software for Industrial application
OLP0183	Chemical Fractionation on some Indian coal to obtain “mineral species”- specific information and their correlation on ash fusion temperature	OLP0197	Alloy Design & Casting of CRGO Steels
		OLP0198	Hot rolling, cold rolling and annealing of grain oriented silicon steel
		OLP0199	Immobilization of toxic wastes through geopolymerisation
		OLP0200	Design of an improved suction casting attachment for the preparation of bulk metallic glasses

Project No.	Project Title	Project No.	Project Title
OLP0201	Recovery of tellurium from deselenized copper refinery anode slime	OLP0215	Melting and Processing of advance high strength micro alloyed steel
OLP0202	Studies on geopolymerisation behaviour of construction and demolition waste (CDW)	OLP0216	Effect of alkali concentration on the reaction kinetics of fly ash geopolymer
OLP0203	Design of an improved suction casting attachment for the preparation of bulk metallic glasses	OLP0217	Localization techniques in Underwater Acoustic Sensor Network- survey and a new thought
OLP0206	Recycling and recovery of rare earth metals from primary/ secondary resources.	OLP0218	Development of nanocomposite TiSiBC hard & tough coatings by magnetron sputtering and structure property correlation
OLP0207	Hydrometallurgical extraction of rare metals from the e-waste and related effluents.	OLP0219	Life prediction model for creep-fatigue interaction in P92 grade advanced creep resistant steel
OLP0209	Preparation of high pure tungsten powder of desired grade from HAPP alloys scraps	OLP0220	Leaching of mechanically activated boehmite synthesized by hydrothermal transformation of gibbsite
OLP0210	Development of rapidly solidified high induction alloys for transformer core	OLP0221	Improving the high temperature compressive strength of hematite pellet without bentonite using slag bonding agent
OLP0211	Biomimetic Metal fiber reinforced hydroxyapatite nanocomposite: A novel three dimensional load bearing bone grafts	OLP0222	Green separation of rare earth metals using Ionic Liquid as extractant
OLP0212	Development, demonstration and training of coke/coal based brass melting furnace for rural artisans	OLP0223	Theoretical and Experimental Investigation of Deoxidation Phenomena During Liquid Steel Treatment of Electrical Steel
OLP0213	Development of a web based online job sheet submission system for Civil, Electrical & Air conditioning unit of Engineering Division	OLP0224	Preparation of Magnesium Aluminum alloy through electrochemical co-deposition
OLP0214	Correlation of stereological parameters with mechanical properties of micro alloyed steels: Module I -Micro structural processing and quantification	OLP0225	Study of particle in centrifugal and pulsating force field
		OLP0226	Study on the formation of intermetallics during annealing treatment of galvanized steel

Project No.	Project Title	Project No.	Project Title
OLP0227	Defect evaluation in Pipes using Magnetostrictive sensors made from nanostructured soft magnetic materials	SSP0718	Assessment of creep stress rupture and elevated temperature tensile properties of ASTM T11 Grade Steel
PSC0101	Very high power Microwave Tubes: Design and development capabilities (MTDDC)- i) Development of ultrathin TiN coatings on alumina for rf window and ii) Thermal and mechanical characterization of materials for gyrotron.	SSP0727	Recovery of rare metals from effluent and leach liquor of WEEE using SX/IX.
PSC0111	Measurement Innovation in Science and Technology (MIST)	SSP0730	Studies on creep behavior of Zr-2.5Nb alloy
SSP0524	Studies on low temperature sensitization and low temperature thermal embrittlement of narrow gap weld joints of austenitic stainless steel	SSP0735	Evaluation of Creep behavior of SA335/P91 Grade of Steel
SSP0525	Fatigue and fracture behaviour of dissimilar metal weld	SSP0743	Characterisation studies on Rubber Tiles
SSP0527	Fatigue Ratchetting Behaviour of SA333 Gr. 6 Carbon Steel and 304LN stainless steel under multiaxial, non-proportional loading	SSP0744	Characterization of Cement Tiles
SSP0640	Studies on impact of air pollution on corrosion of metallic and non-metallic materials	SSP0745	Studies on cement concrete roof tiles
SSP0648	Predicting service life of commercial G-I wires and suggest methods to improve it.	SSP0746	Flotation Studies on Limestone Sample of M/s ACC, Madhukari
SSP0665	Creep Rupture Properties of E9015-B9 (Modified 9Cr-1Mo) electrode material	SSP0747	Failure analysis of boiler water wall tubes.
SSP0708	Rare earth separation and recovery from Korean Monazite/REOs.	SSP0748	Evaluation of Reagents for Flotation
SSP0712	Development and popularization of AL-alloy conductors.	SSP0749	Estimation of failure of drier in the paper mill at M/s Sevenhills paper mills, Samalkot, Andhra Pradesh
		SSP0750	Characterization of Cement Tiles
		SSP0751	Development of a process for Extration of Potash(K ₂ O) from Potash Feldspar
		SSP0768	Optimization of ABI test parameters with conventional test result of 9 different grade of steel.
		SSP0773	Development of load bearing polymer hydroxyapatite composite
		SSP0778	Development of a process of making fiber reinforced hydroxyapatite nano composite three dimensional structure.

Project No.	Project Title	Project No.	Project Title
SSP0787	Training Programme for VSP Officials towards R&D Orientation	SSP0817	Metallurgical Analysis of Boiler Tube
SSP0799	Metallographic studies and ACRT properties of service exposed tube of SA 213 (P91) grade of Steel	SSP0818	Studies on Corrosion Characteristics of coated and uncoated rebars by impedance and cyclic polarization
SSP0801	Physical & Hydrometallurgical Beneficiation of poly cracker ash to enrich the metal concentrate	SSP0819	Dynamic response studies in cryogenic rebars at room and subzero temperatures
SSP0804	Ash fusion temperature analysis of coal samples from Tata Steel	SSP0820	Residual life assessment (RLA) of Hydrogen Reformer and Pig Tail Tube
SSP0805	Root Cause analysis of failure of clinker hopper & clinker circuit of Binani Cement Plant	SSP0821	Accelerated creep/stress rupture testing and evaluation elevated temperature strength of T11 Steel for IBR certification.
SSP0808	Failure investigation of Boiler Bed Coil	SSP0822	Rolling and heat treatment process optimization of various alloy steels
SSP0809	Arriving at a threshold value of Electro-magnetic Stirring parameters for casting of high carbon billets	SSP0823	Coated steel products performance evaluation
SSP0810	Studies on role of chemistry on corrosion behaviour of steel rebars	SSP0824	Evaluation of Coal Core Characteristics of different region of Orissa
SSP0811	Development of GMI based Portable non-destructive magnetic Sensing device for detection of carburization quantitatively for health monitoring of carburised structure at Petrochemical / Refinery Industry (GPS)	SSP0825	Processing of spent Lithium ion batteries
SSP0812	Failure investigation of ID Fan Shaft	SSP0826	Development of processes for making biphasic (Hydroxyapatite + betaTCP) nanocomposite blocks & transfer of technology
SSP0813	RLA of Crude Distillation and Visbreaker Unit Heater	SSP0827	Material evaluation of center buffer couplers
SSP0814	Smelting reduction study of copper smelting slag	SSP0828	Recovery of gold from the waste printed circuit boards (PCBs) of used and discarded mobile
SSP0816	Environmental friendly aluminium coating to replace cadmium phase-III	SSP0829	Analytical Advice for coal samples collected from Moher-Moher Amlohri extn. Coal Block, Sasan Power Ltd.

Project No.	Project Title	Project No.	Project Title
SSP0830	Residual stress evaluation in as cast and forged rolls using magnetic techniques.	SSP0844	Evaluation of creep properties of X22CRMOV12-1 20 CRMOVTIB4-10 and X20CR13 grade steel
SSP0831	Seam overall characteristics of coal core samaleswari and projapara, IB River coalfield, Orissa	SSP0846	Technology Development for making paving blocks through geopolymerisation of AOD slag
SSP0832	Failure analysis boiler tube tubes of unit #2, 4, 5 & 6 MTPS, DVC	SSP0847	Development of a process to produce flexible fast setting/curing Geopolymer for addition to cement/gypsum system.
SSP0833	High strain rate deformation behavior of polymer and steel	SSP0848	Development of NDT Facility for Quality Assessment of Grooved Rolls used in New Bar Mill (NBM)
SSP0834	Development of suitable chemical cleaning solvent and suitable inhibitors for RH and SH chemical cleaning	SSP0849	Evaluation of creep and stress rupture properties of T-91 material
SSP0835	Failure analysis of damaged LPTR and HPTR blades	SSP0851	Enhancement of in process efficiency in tech production of FERC and FEMN through Rational Charges Distribution
SSP0836	Remaining Life Prediction of various kinds of service exposed boiler components	SSP0852	Transfer of Technology for Removal and Recovery of lead from CINKOM Zinc plant residue
SSP0837	Failure analysis of refractory anchor	SSP0853	Short Term Creep property evaluation of G-X 12 Cr Mo WV NB N 10-1-1 and K-12F54B grade Steel
SSP0838	Investigation on slurry samples of Sarda Mines	SSP0854	Corrosion and corrosion fatigue behavior of strategic Aluminium alloys.
SSP0839	Study on Smelting Reduction of chromite ore in 50 kVA EAF	SSP0855	Dry Separation of cenosphere from fly ash
SSP0840	Studies on characterization and beneficiation of low grade Iron ore sample from shire - Mentebteb, Ethiopia	SSP0856	Remaining life assessment of service exposed main steam pipe of Ammonia plant.
SSP0841	Stress Rupture Property Evaluation of Service Exposed Heater Tubes	SSP0857	Studies on recovery of chromite values from Tailings of COB Plant of OMCLtd.
SSP0842	Characterization of coal, coke and manganese ore from Shyam Ferro Alloys Ltd.		
SSP0843	Development of Beneficiation strategy for Low grade copper ore from Zambia		

Project No.	Project Title	Project No.	Project Title
SSP0858	Stress Rupture property evaluation and microstructural studies of SS304H steel of coastal Gujarat Power Limited.	SSP0872	Failure analysis of boiler reheater tubes at Essar Power M.P.Ltd.,
SSP0859	Potash recovery from feldspar with Simultaneous recovery of Ferro Silicon	SSP0873	Failure analysis of boiler tubes of unit #1 &4, MTPS, DVC
SSP0860	Failure Investigation of Lp Turbine Blade Root Crack	SSP0874	Creep and stress relaxation test of 1 CrMoV Steel
SSP0861	Rolling of spray formed steel+ Copper bi- layered materials for bearing applications.	SSP0875	Consultancy services towards providing scientific /technical expertise to M/s. JSW Steel Ltd., by CSIR-NML
SSP0862	Delivery of PABI (Portable Automated bell Indentation) software and its support.	SSP0876	Failure investigation of Water Wall Tube
SSP0863	Failure Analysis of damaged LPCR Blades	SSP0877	Training program for Sterlite Copper personnel at CSIR- NML
SSP0864	Failure Analysis of economiser Tube	SSP0878	Environmental Friendly Coatings: Corrosion and Erosion Resistance
SSP0865	Failure investigation of Roller Tire Hub of Lafarge Cement Pvt. Ltd., Jojobera	SSP0879	Know -How Transfer for Production of high pure tungsten powder from W Bearing scraps
SSP0866	Study on stress rupture behaviour of Alloy 690 material.	SSP0881	Characterization and Analysis of supplied magnetite sample
SSP0867	Development of processes for recovery of cobalt from discarded Li- ion batteries of mobile phone.	SSP0882	Creep fatigue interaction behaviour of Nickel Based Super Alloys SU-718
SSP0868	Development of low cost online defect detection system for high end drawn wires	SSP0883	Creep behaviour of ASTM T-12 materials
SSP0869	Microstructural Characterization of Fusion Boundary of Ferrite- Nickel based Alloy in Dissimilar metal Weld	SSP0884	Failure Analysis of Kneader Components
SSP0870	Recovery of Gold from the scrap parts of telecommunications and Medical Equipments	SSP0885	Assessment of central quality of high carbon cast billets using ultrasonic imaging
SSP0871	creep strain behaviour of 12% Cr Ferritic Steel	SSP0886	Development of compositionally modulated multilayered alloy (CMMA) of Zn-Mn and Zn-fe Coatings by Electropalting technique.
		SSP0887	Short term creep and stress rupture property evaluation of ASTM A 387 GR. 11 Steel

Project No.	Project Title	Project No.	Project Title
SSP 0888	Creep Testing Charges for 100 hrs for steel Grade X19CrMoNbVn11-1	TMP 0208	Optimization of Annealing Parameters for High R Bar In IF
SSP 0889	synthesis of biometric electrospun collagen - Graphene Nanocomposites with varying Graphene content	TMP 0209	Optimization of Annealing Parameters in IFHS
SSP 0890	Failure Investigation of cooling coils in zinc plant from HZL, Rajasthan	TMP 0210	Blade root crack failure analysis NSPCL 250MW power through award no. 12214059 dated 05.07.2013
SSP 0907	Metallurgical opinion on analysis and evaluation of off grade copper cathode	TMP 0211	Failure Analysis of Door Nose wheel LH (Pt No. KB 322 L0115-000)
SSP 0910	Failure analysis of thimble of 20/90 Bajrang Dragline of Nigahi project.	TMP 0213	Microstructural analysis of LPTR Blades of R- 29 Aero Engine apropos of failure investigation process of accident aero engine no 262581700022.
TMP 0199	Failure analysis of seven(7) Nos. Boiler Tubes of Unit #1,3,4,6&7, MTPS DVC.	TMP 0215	Microstructural investigation of LPTR Blades of R-25 Aero engine
TMP 0203	Development of CRGO Steel	TMP 0217	Failure analysis of damaged 1st stage NGV (nozzle guide vane) of R-25 Aero Engine.
TMP 0205	Failure investigation of Roller Tire Hub of Lafarge Cement Pvt. Ltd., Jojobera	TMP 0218	Failure analysis of damaged 1st stage Fan Rotor blade of RD -33 Aero Engine
TMP 0206	Localised corrosion and corrosion fatigue of strategic Aluminium alloys		
TMP 0207	Metallurgical analysis flying incident to MIG-21(T-77)C-1155 on 16 Apr 13		

Targets Planned for 2014 - 2015

Performance Targets

Sl. No.	Objectives	Planned
1.	ECF	20
2.	Industrial ECF (a part of ECF)	14
3.	International ECF (a part of ECF)	2
4.	Lab Reserves to generated	10.5 Crores
5.	Expenditure(other than salary & pension & allowances)	18.30 Crores
6.	Customer Satisfaction Index	4.4
7.	Publications	125
8.	Patents	15
9.	Copyrights	5
10.	Technologies to be Developed	5
11.	Technologies to be Transferred	4
12.	M.Tech/Ph.D students for AcSIR	15

Organizational Targets for 2014 - 2015

Major Technological & Scientific targets Planned for 2014-2015

Activity	Targets for 2014-15
Development of zero waste technology for processing and utilization of thermal coal	- Flowsheet development for dry beneficiation of fine coal. - Large scale demonstration of bulk utilization of fly ash. - Bench scale processing for dry separation of cenosphere.
Development of Magnesium Metal Production Technology	- Process modeling of the electrothermal process of magnesium production. - Magnesium production process at the scale of 300 kg raw material (~40 kg Mg)/batch- minimum of 6 pilot scale campaigns to produce 500 kg Mg.

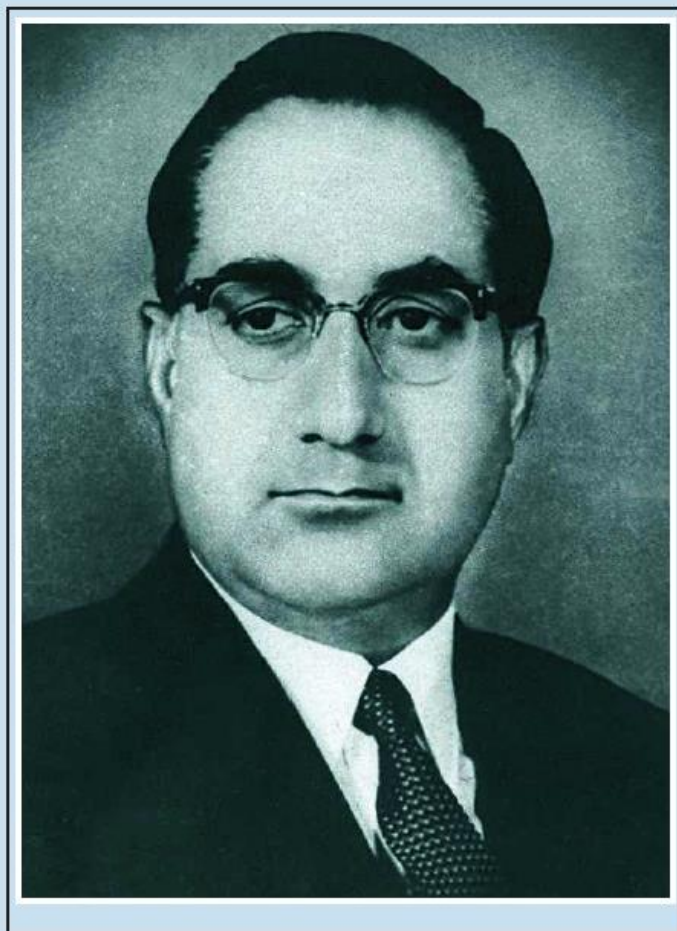
Activity	Targets for 2014-15
	- Final specification for the 1 ton raw material (~125 kg Mg) capacity pilot plant working in semi-continuous mode. - Order placement to the Engineering Consultant, fabrication, erection, installation and commissioning of 1 ton raw material (~125 kg Mg) capacity pilot plant working in semi-continuous mode at CSIR-NML site and conducting of campaigns.
Development of a process and design of a closed cell for production of sodium metal by fused salt electrolysis of sodium chloride	Industrial plant to be set up by Heavy Water Board, Mumbai at Baroda. CSIR-NML shall provide technical assistance as and when required. A separate project proposal with new terms and conditions to be finalized.
Non-destructive assessment of Creep	Preparation of simulated creep damaged specimen of P22 grade steel and initiation of creep experiment for P91 steel. Fabrication of device MagStar which will be used for magnetic measurement for creep damaged sample and will be handed over to NTPC for field activity. Initiation of generating NDE parameters using magnetic and non-linear ultrasonic techniques.
Remaining Life assessment and failure analysis of strategic components	RLA and root cause failure analysis of strategic components like aero engines, buffer couplers, power plant components, etc. will be continued for the strategic sector in the current year also
Coal core analysis	In collaboration with CIMFR, Dhanbad & CMPDIL, this programme will provide coal core analysis of at least 5000m of coal core samples
High strain rate deformation of automobile grade steels	- Determination of tensile properties of IFHS, DP 600 and 800 and C-Mn-440 steels at different strain rates (0.001 to 800 /s) - Study the deformation mechanisms of these materials undergoing tensile deformation at different strain rates.
Development of GMI-based Portable Magnetic Sensing Device for Detection of Carburization of Structural component of petrochemical / Refinery Industry	Development of GMI-based portable magnetic sensing device and measurements using carburised samples to be developed in the laboratory.

Activity	Targets for 2014-15
Development of Gas based Brass Melting Furnace for Rural Artisans	Transfer of technology of energy efficient coke based brass melting furnace to the brass cluster of Balasore district in Odisha
Tailoring of geopolymers properties by mechanical activation of fly ash	Building material using mechanically activated flyash will be developed, tested and evaluated.
Potash recovery from feldspar with Simultaneous recovery of Ferro Silicon	Installation and commissioning of the arc furnace with suitable fume condensation unit. Experiments to be initiated for the production of potash
Microstructural characterization of fusion boundary of ferrite - nickel based alloy in dissimilar metal weld	- Study effect of welding nature, filler alloy and electrode on the characteristics of HAZ, martensite layer, Type-I and II boundary near fusion zone - Study effect of re-distribution of alloying elements adjacent to fusion boundary on the development of Type-II boundary and martensitic layer These two will be applicable for dissimilar welds consisting of LAS and 304LN SS using 309L SS and IN182 butter layers.
Graphene coated steel	Evaluate the feasibility of replacing galvanized coating with graphene coating on steel

Business, Administration & other targets Planned for 2014-2015

Business	- Create and disseminate Technologies and Facilities brochures - Enable instrumental, infrastructure and facilities usage by industries and other clients - Attain online project monitoring in-toto - Strategize public private partnerships
Human Resources	Induct core manpower to the mission projects (Mg Technology, CRGO Technology & Coal dry beneficiation technology)
Administration	- Complete switchover to all online ERP processes - Integrate the biometric time attendance to online leave records - Implementation of RF-ID tracking on all PIR items - Improvement in overall speed & efficiency

A TRIBUTE



Dr. B.R. Nijhawan, Director, CSIR-NML (1956-1966)

Dr. Bal Raj Nijhawan, the first Indian Director of CSIR-National Metallurgical Laboratory (NML), Jamshedpur, passed away at an age of 98 on 6th April, 2014 in Florida (USA).

Dr. Balraj Nijhawan was a legend, a visionary and an inspirational leader who laid the foundation of R&D at NML. In an occasion during his last visit to NML, Jamshedpur, Dr. Nijhawan said, "I have been privileged and honored to have lived long enough to be a small part of the history of India, and to have been one of the members of this leading and prestigious international institution. To say that I am proud of my association is an understatement....I am humbled to have had the opportunity as a young man to have experienced the joy and inspiration of the founding fathers of India, and the founding visionaries of the laboratory. NML has been my life and joy".

Dr. Nijhawan was known for his vision, especially pilot scale research, for example on mineral processing, low shaft iron making furnace, ferro-alloys, manganese, aluminizing, etc., which helped towards establishing of new plants and/or industrial problem solving in India. His efforts fostered the Indian foundry industry. He developed alloys with the use of indigenously available metals including nickel free austenitic stainless steels based on Cr, Mn and N systems. He had been internationally recognized for his work on armour plate development and armour failure and related fields and on control of austenitic grain size of steel. Several research publications, technical reports, patents, books, etc. will always remain to his credit. Many Honours and Awards including Padma Shri (1958) and Bhatnagar Prize (1964) had been conferred upon him.

Director and all the staff of CSIR-NML condole the sad demise of their beloved guide and philosopher Dr. Nijhawan. May his soul rest in peace.



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