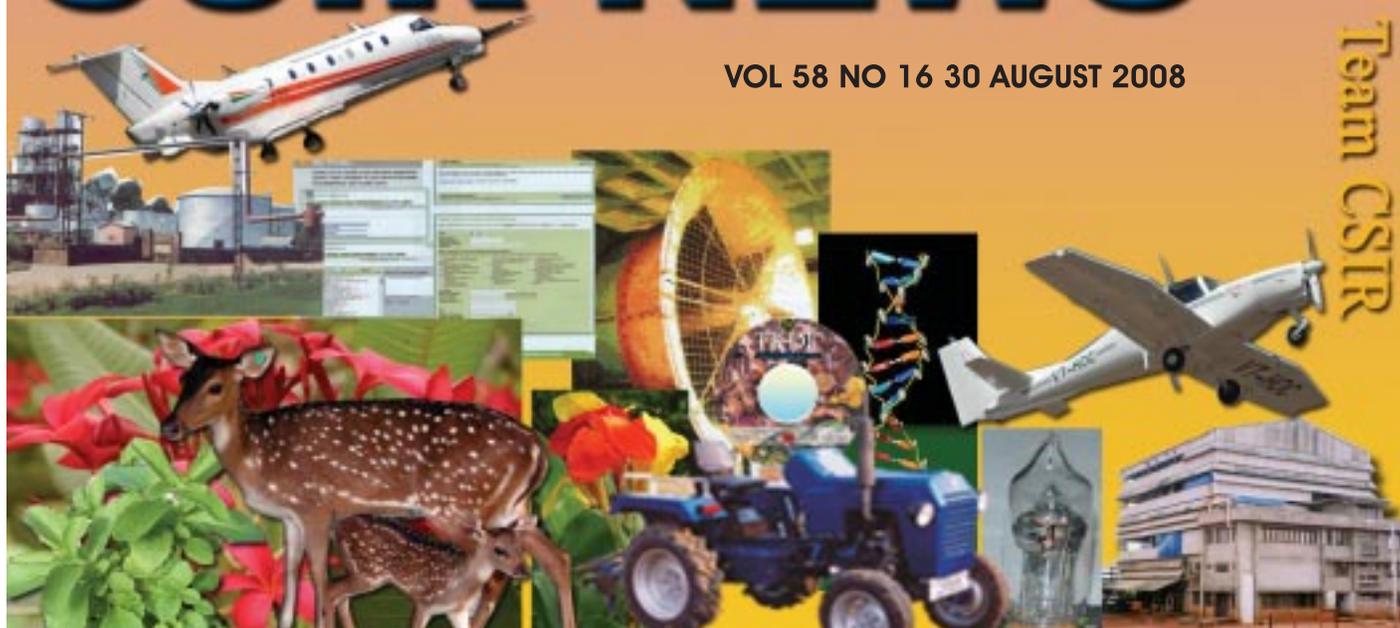


CSIR NEWS

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Team CSIR



CSIR/NCL signs Technology Transfer Agreement with GSML

An agreement for transfer of a technology for chemical fractionation of sugarcane bagasse to its constituent polymers and chemicals was signed on 16 July 2008 between CSIR/National Chemical Laboratory (NCL) (www.ncl-india.org), Pune and the Godavari Sugar Mills Ltd (GSML), Mumbai, at Pune.



Dr S. Sivaram, Director, NCL and Shri Samir Somaiya, Executive Director, GSML, exchanging the agreement document



Pre-fractionation Plant at GSML, Sameerwadi



R & D Highlights

This agreement will enable CSIR/NCL and GSML to jointly develop a commercially viable technology further based on the results of laboratory work and pilot plant demonstration. GSML was an industrial partner of the project beginning 2002 in a public-private partnership mode under NMITLI programme of CSIR. GSML is among the top ten sugar complexes in India. It operates two fully integrated sugar mills in Karnataka and Maharashtra. The Company is one of the largest producers of

industrial alcohol and a pioneer in manufacture of alcohol. GSML is planning to make substantial investments into scaling-up the process and validating the technology at a commercial level.

The process developed consists of a novel method to fractionate bagasse, a by-product of sugar production, into its constituent polymers, namely, cellulose, hemicellulose, and lignin. Each of these is a platform material used to produce, in turn, a variety of industrially useful materials and

chemicals. These materials can replace several synthetic materials made from petrochemical sources. The importance of the project also stems from the fact that about ninety million tonnes of sugarcane bagasse is produced every year and can provide a valuable source of raw material for obtaining pure value added materials.

A 100 kg/batch demonstration unit has been designed by NCL and installed at GSML, Sameerwadi, Karnataka.

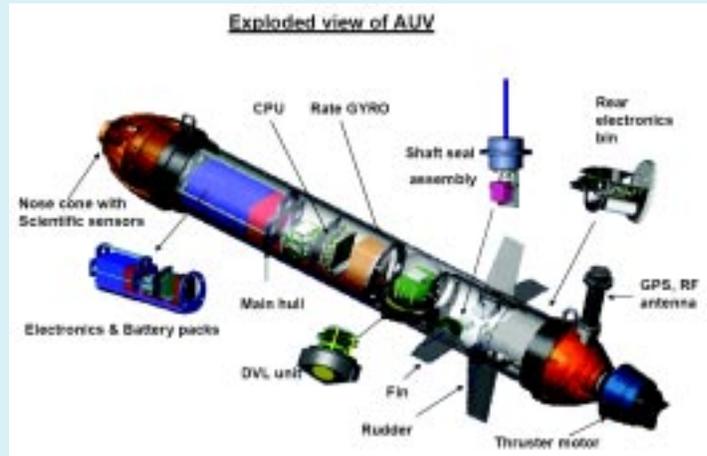


NIO-developed Technology for Autonomous Underwater Vehicle Ready for Transfer

National Institute of Oceanography (NIO), Goa, has developed a small autonomous underwater vehicle (AUV) 'Maya' as a tool for scientific and commercial applications. The development was funded by NIO and the Department of Information Technology, New Delhi.

Envisioned missions of the AUV include oceanographic studies, marine biology studies, water quality studies in fresh water reservoirs/dams and environmental monitoring of coastal waters and estuaries, to name a few.

The vehicle is made up of three parts. The first part is the free flooding nose cone of the vehicle which houses the scientific sensors. This nose cone is swappable and is application specific. The second part is the sealed aluminum hull which is called the Core Pressure Unit, which houses the batteries, electronics, vehicle sensors, actuators, communication systems and the electronics. The third part is called the tail cone and is used to house the propulsion device which is a brushless dc motor thruster.



Exploded view of AUV



View of AUV in water

Specifications of the AUV

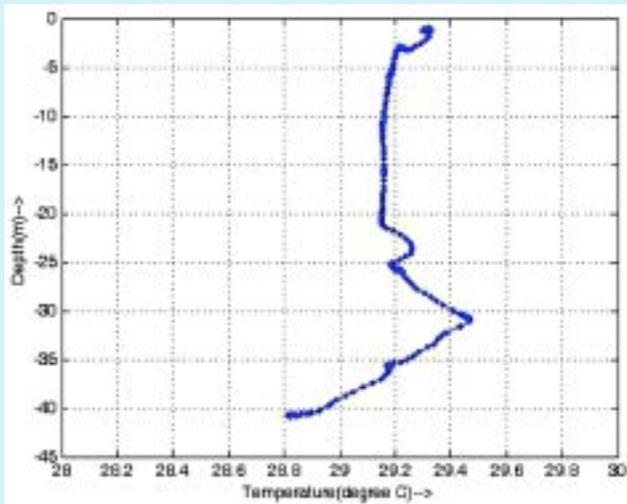
Vehicle Parameter	Value
Total length	1.742 m
Diameter	0.234 m
Total weight in air	~ 54 kg
Depth range	200 m
Hull material	Aluminium alloy
Nose and rear cones	GFRP/ Acetal
Nominal speed	1.5 m/s
Endurance	~ 7.2 hrs (propulsion)
Propulsion	DC brushless motor
Power source	Lithium polymer cells
RF communications	2.4 GHz, 115 kbaud
Scientific payloads	Conductivity, Temperature, Depth, Dissolved oxygen, Chlorophyll

The vehicle is rated for operations at 200 m depth and is capable of diving to different programmed depths and maintaining control of motion at those depths. It can follow mission paths that are pre-programmed. Safety features enable the vehicle to return to the surface in case of hardware failure. The missions for the vehicle are loaded through an RF link with the aid of a GUI on the shore.

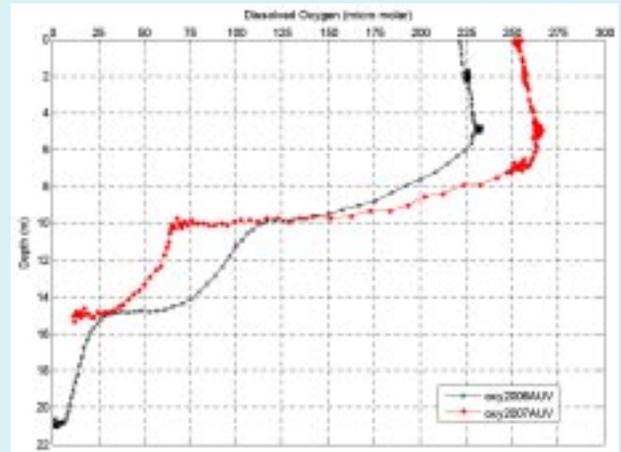


Data obtained from the AUV:

The AUV has been tested on numerous occasions for operations at sea and in freshwater reservoirs. Figures below show the data collected from the AUV missions.



Temperature Vs Depth obtained during the sea trials in the Arabian Sea



Dissolved oxygen Vs Depth obtained in the trials at the Idduki reservoir



AUV underwater performing a mission

Patents Granted to NAL

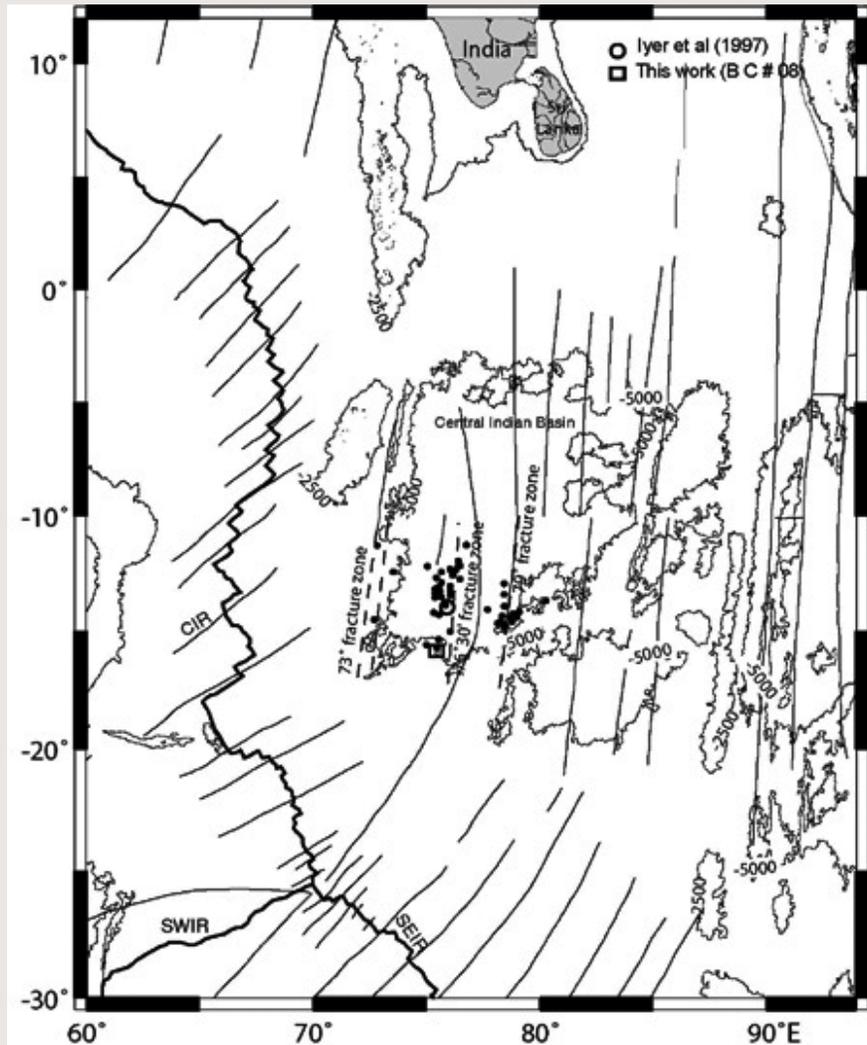
The patents granted to the National Aerospace Laboratories (NAL), Bangalore, in the recent past include:

- An Indian Patent No. 221407 dated 1 August 2008 was granted to 'A Process for the Preparation of Sub-denier Fibres' developed by Sridhar M. K. P. Kanaklatha, Ajay Chandra, Murli Mohan, Krishnaswamy Rangarajan, Scientists, IFRE, Material Science Division. Invention relates to a process for the preparation of sub-denier fibres of polymetaphenylene isophthalamide with denier per filament of less than 1, having high yield strength and high tensile modulus.
- An Australian Patent No. 2006201026 has been granted to 'An Improved Process for the Manufacture of Strontium Doped Lanthanum Manganite (LSM) Ceramic Powder suitable for Solid Oxide Fuel Cell Applications' developed by Mr A. Udayakumar, Scientist, Material Science Division. With this, NAL holds 14 foreign granted patents. The process developed by Mr Udayakumar provides procedure for fast synthesis of LSM powder using microwave energy while maintaining the purity and homogeneity of the product at lower processing temperatures.

Signatures of Degassing and Hydrothermal Alteration of Recent Origin in Central Indian Basin

Since the time of discovery of submarine hydrothermal vents in the Pacific Ocean in the late seventies, several deep-sea hydrothermal systems have been discovered along the divergent or convergent plate boundaries such as the mid-oceanic ridges and island arc-trench systems. East Pacific Rise, Mid-Atlantic Ridge and the subduction zones at Southwest Pacific are known to host the majority of hydrothermal systems. Hydrothermal mineralization sites are rarely found in the intra-plate regions basically because of lack of heat source.

Some of the seamounts which are located within a plate in the Pacific Ocean such as Macdonald, Loihi, Vailulu'u (Samoaan Hotspot related) were found to be hydrothermally active. Extensive bathymetric studies using both single and multi-beam echosounders have been made by the National Institute of Oceanography (NIO), Goa. These have revealed a number of seamounts and abyssal hills in the Central Indian Basin. Sampling in the vicinity of these topographic highs has yielded volcanogenic-hydrothermal material at one location (Iyer, Prasad and Gupta, 1997) in the past. Further, native aluminium of hydrothermal origin were reported from two locations in the Central Indian Basin (Iyer, Mascarenhas-Pereira and Nath,



Tectonic setting map. Dots represent seamounts and the sampled location is close to 76°30' fracture zone (*Ms. Maria Desa and Mr. T.C.Vineesh helped Ms. Mascarenhas-Pereira in drafting this figure*).

2007).

In a recent study, NIO scientists have identified signatures of recent hydrothermal fluid flow through the sediments at the base

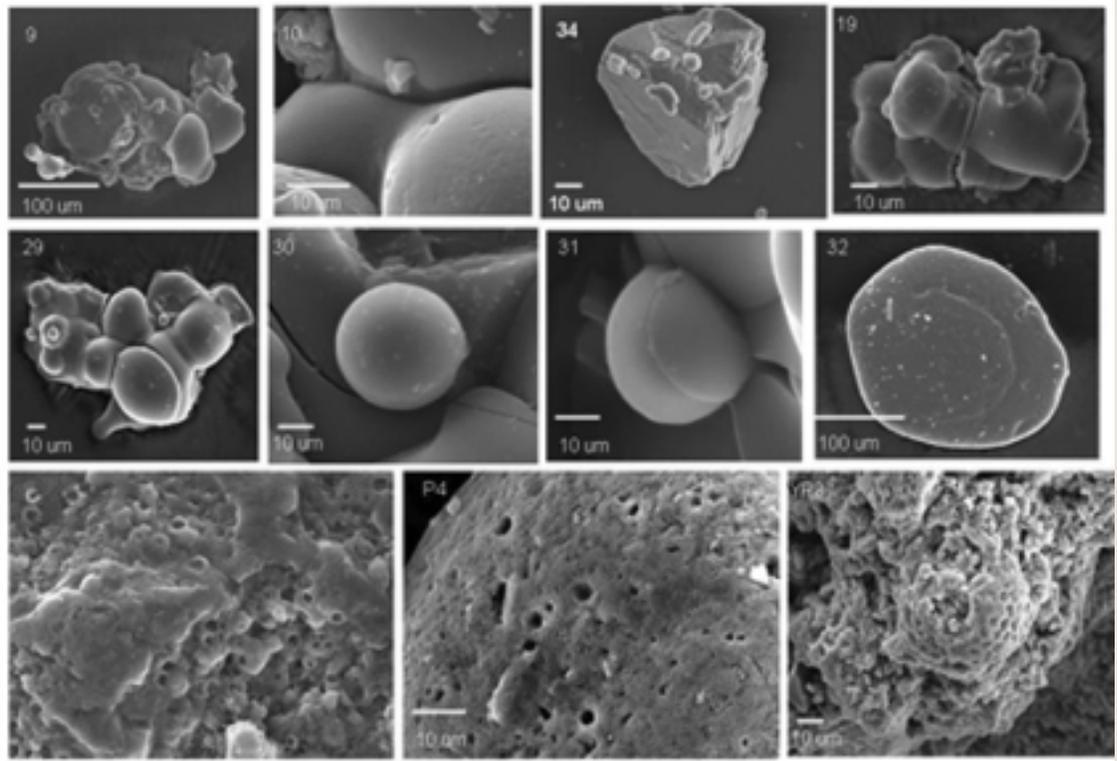
of a seamount in the Central Indian Basin through several geochemical and isotopic tracers in a core located close to the southern end of 75°30'E fracture zone, which defines the



trace of Indian Ocean triple junction movement. Isotopic (^{210}Pb , ^{238}U - ^{230}Th , ^{10}Be), major and trace elements, and micromorphological and microchemical data were used to identify recent (~ 100 yrs) hydrothermal alteration of a >200 kyr sedimentary record.

Collaboration with scientists from the Uppsala University, Sweden for AMS based ^{10}Be studies and Mossbauer spectroscopy and from Dr K.S. Krishnan Geomagnetic Research Laboratory,

Allahabad, for magnetic properties has yielded valuable supporting data. Although the earlier studies have reported the occurrence of hydrothermally derived sediments at intra-plate seamounts in the Central Indian Basin, degassing events of recent origin as reported in the present work were not known. Emanation of hydrothermal fluids and consequent alteration of the sediments may be a widely prevalent phenomenon in the Central Indian Ocean than that is known currently, in view of possible fluid ascent along



Scanning electron microphotographs of lithic grains rich in Al, Cu, Zn, S (top two panels) and the bottom panel shows intense dissolution features of radiolarian (siliceous microfossils) presumably due to the percolation of hydrothermal fluid flow through the host sediments (Assistance with SEM work: Mr. V.D.Khedekar, NIO)

the conduits in the faulted areas of the well defined fracture zones. Reactivation of tectonic activity at the fracture zones may be responsible for the hydrothermal activity. Systematic geochemical studies along the fracture zones may help identify more such areas.

This was recovered while collecting the basin-wide benthic environmental data to help model the dispersal pattern of plume to be generated during deep-sea mining. Currently, an interdisciplinary study with biologists at NIO is being

carried out to look at the benthic and microbial community structures in these geologically special areas.

To consult original article, refer:
Nath, B. N., D. V. Borole, A. Aldahan, S. K. Patil, M. B. L. Mascarenhas-Pereira, G. Possnert, T. Ericsson, V. Ramaswamy, and S. M. Gupta (2008): " ^{210}Pb , ^{230}Th , and ^{10}Be in Central Indian Basin seamount sediments: Signatures of degassing and hydrothermal alteration of recent origin", *Geophys. Res. Lett.*, 35, L09603, doi:10.1029/2008GL033849

National Metallurgical Laboratory (NML), Jamshedpur

R&D Highlights: 2006-07

The National Metallurgical Laboratory (NML), Jamshedpur, has emerged as one of the global leaders in metallurgy and materials research riding on a substantial number of research publications in peer-reviewed journals and intellectual property products generated in metallurgical and materials science & technology. The laboratory aims at excellence in R&D in the development and delivery of right-sized technologies for use in the Indian metallurgical and materials science sector.

During 2006-07, the laboratory completed 17 Grant-in-aid projects, 33 sponsored projects, five consultancy projects, four collaborative projects, and 14 network projects. Forty six Grant-in-aid Projects, 49 sponsored projects, four Consultancy projects, four Collaborative projects, and three S&T service projects are ongoing.

The laboratory added to its growing Intellectual Property Assets, filing four National and 13 International patents, being granted 14 National and six International patents and registering two copyrights.

Regarding research publications, 133 papers were published in international journals and 33 papers in national journals. Fifty seven papers were published in international and seven papers in national Seminars/Symposia/Conference proceedings. Altogether, 231 papers were published during

2006-07, out of which 133 papers were in SCI Journals—the highest ever published in a single year.

Further, with its effective marketing drive NML mobilized extra budgetary sources above Rs 6.46 crores.

During 2006-07, the laboratory signed 14 MoUs with 11 parties, namely: (i) Korea Institute of Geoscience and Mineral Resources of the Republic of Korea; (ii) Caribbean Industrial Research Characterization and Corrosion Studies of Metal Samples Institute, Trinidad & Tobago; (iii) Samro International, New Delhi; (iv) Institute for Steel Development & Growth, Kolkata; (v) Test Metal Corporation, Kolkata; (vi) Silcarb Heating Elements Pvt Limited, Bangalore; (vii) Nav Bharat Ventures Ltd, Hyderabad; (viii) Indian Rare Earths, Kerala; (ix) Somu Organo Chem (P) Ltd, Bangalore; (x) Department of Engineering, Metallurgical and Mining, IIT-Kharagpur, and (xi) Jomo Kenyatta University of Agriculture and Technology, Dept of Mechanical Engg, Nairobi, Kenya.

NML also bagged the ISO 9001:2000 certification having successfully undergone upgradation audit. The surveillance audit was conducted by Certifying Body TUV Suddeutschland India Pvt Ltd bringing all the Divisions under the ambit of ISO 9001:2000.

Highlights of Significant R&D Achievements During 2006-07

CSIR Network Project

Under the CSIR Network Programme initiated during the Tenth Five Year Plan, NML participated and contributed towards 63 ongoing activities, within the 14 major Network projects relevant to the laboratory. These Projects include: (1) Technology for Engineering Critical Assessment (TECA); (2) Bioprocessing of lean grade ores/concentrates/wastes and bioremediation of effluents and acid mine drainage; (3) New building construction materials and technologies for sustainable development; (4) Computational mechanics for modeling analysis and design of high performance structures, materials and process applications; (5) Developing capabilities in advanced manufacturing technologies; (6) Catering to development of specialized aerospace materials; (7) Custom-tailored special materials; (8) Coal resource quality assessment for specific end users; (9) Quality enhancement of coal for its efficient utilization; (10) Capacity building for coastal placer mineral mining; (11) Environment friendly leather processing technology; (12) Upgradation of SI base units, National standards of measurement and Apex calibration facilities and creation of high quality network of



testing and calibration laboratories and preparation and dissemination of certified reference materials; (13) Industrial waste minimization and clean up, and (14) Design analysis and health assessment of special structures including bridges. All these network projects were completed as per schedule.

Further, NML has also been participating in two projects in which NISCAIR is the nodal agency and NML is one of the participating members viz. e-Journal Consortium and National Science Digital Library.

In the network project on Technology for Engineering Critical Assessment (TECA), NML has served as the Nodal Agency. Seven sister CSIR laboratories, namely, CRRRI, New Delhi; AMPRI, Bhopal; NAL, Bangalore; SERC, Chennai; CGCRI, Kolkata; CBRI, Roorkee; CMERI, Durgapur along with IIT, Kharagpur and IGCAR, Kalpakkam, in consultative capacities have participated in the project. The three year project with a total expenditure outlay of Rs 14.98 crores has resulted in several important outcomes: (i) Experimental quantification of high temperature fatigue behaviour of thermal barrier coated materials for gas turbine applications; (ii) Creation of database on fatigue crack growth and fracture behaviour of primary heat transport piping materials of nuclear power plants; (iii) Design and fabrication of a portable automated ball indentation apparatus for *in situ* determination of mechanical properties of in-service equipment; (iv) Development of magnetic non-destructive evaluation system for

microstructural degradation of components at elevated temperatures; (v) Development of rejuvenation protocols for nickel base superalloys GTD-11 and Hastelloy-X, and cobalt base superalloy FSX-414 used in aero- and gas-turbines; (vi) Development of a stochastic model-based software for the prediction of erosion rate in boiler components; (vii) Fractal based characterization of fracture toughness of engineering materials; (viii) Development of a Non-linear Ultrasonic Technique for Damage Assessment; (ix) Enhancement of material performance by grain boundary character determination; (x) Software-based life assessment and life management of critical components; (xi) Thermodynamics-based predictions of high temperature oxidation and corrosion, and (xii) Use of acoustic emission monitoring for identification of fracture processes.

The R&D work carried out under TECA led to 65 technical papers in refereed journals, 63 presentations in conferences, seminars and symposia, and filing of six copyrights and three patents.

NML has significantly contributed in 13 other CSIR network projects. Some of these where NML scientists have contributed as major partners are mentioned here:

In the project on 'Advanced Manufacturing Technology', NML scientists have developed a technology for preparing about 30 mm wide and 30 micron thick continuous metallic glass ribbon through melt-spinning technique. The prepared materials have

excellent soft magnetic properties in their nanostructured state and are suitable for transformer cores and as sensor elements. Attempts were being made to develop brazing alloys suitable for space application using the same technology.

Under the network project on 'custom-tailored Specialty Materials', NML scientists have developed amorphous wire through in-water quenching technique which has high strength and is suitable for development of giant magnetoimpedance (GMI) materials. This material can be used for GMI-based sensor for NDE applications.

Under the programme on 'Superhard Materials', nano-carbon nitride and silicon carbonitride coatings, with 273 Gpa and 44 Gpa modulus and hardness, respectively, have been developed. Nano composites of boride, carbide and oxide based *in-situ* composites of 99% density have been successfully developed with SHS processing.

Similarly, through bio-mimetic processing, high strength polymer hydroxyapatite composites have been developed, which have a good potential for application in tissue engineering and biological valves.

Under the network project on 'Aerospace Materials', nano crystalline powders of TiB₂ were sprayed on graphite, and super alloy substrates by plasma spray to prepare coatings having improved adhesion strength, excellent wear resistance, and oxidation resistance at more than 700°C. Under the same programme, Ni-based high temperature brazing alloys have been successfully developed to join various ceramic materials, such as

SiC , $\text{SiC-SiC-Al}_2\text{O}_3$, $\text{Al}_2\text{O}_3\text{-Al}_2\text{O}_3$. The joints have shown good strength with stability up to SiC-SiC .

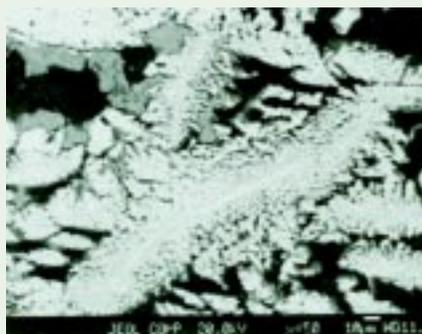
135°C R&D work on bioleaching of uranium is poised to open a new vista for exploiting low grade Indian ores/dumps/tailings, which are otherwise not very attractive due to poor metal recovery and high energy consumption. Under the CSIR network project on bio-processing of lean grade ores/concentrates/wastes, NML has made good strides in the bio-processing of low-index silicate ore of Turamdih mines containing 0.03% U_3O_8 . The process optimized on bench level successfully scaled up to 2.0 tonne column. A project proposal for further scale-up up to 100 tonne column was under consideration of BNRS.

In the project on quality enhancement of coal for its efficient utilization, it is established that for Munidih and oxidized Munidih coal fines (particles less than 75 micron), excellent yield values can be obtained at low target ash levels in clean coal using advance flotation techniques. Under the coal resource quality assessment for specific end uses, the washability studies, proximate analysis with special emphasis on the valuable and noble metals were investigated on the coal samples collected from the North Eastern Region of India. Meghalaya samples are most promising with respect to valuable trace metals like Ga, Ge and Au.

Under industrial waste minimization and clean-up project, NML's work revealed that alkali treated *A. niger* was suitable for removing chromium from a model training solution, and for alkali



Coal specimen showing alternate bands of coal and iron sulfides



Pyrite in NE coal showing dendritic structure

pretreated biomass. Bio-sorption is 52% Cr (III) for 2000 ppm feed as against metal removal of 65% from a diluted feed of 1000 ppm solution in 24 hours. NML has also established one NABL accredited Calibration Centre and for the first time in the country developed a set of Spectroscopic Standard for Plain Carbon Steel.

NMITLI Project

The New Millennium Indian Technology Leadership Initiative (NMITLI) project on 'Development of fuel cells based on hydrogen' being pursued at NML Madras Centre has been progressing well. Pure and Sr-doped LaGaO_3 , LaFeO_3 and LaCoO_3 were synthesized by various chemical routes namely, combustion, co-precipitation and Pechiney methods. The effect of various process parameters on the phase purity, particle size and

surface area and morphology of the synthesized powders are determined by XRD, laser light scattering, BET and scanning electron microscopy. The electrophoretic deposition process for the electrolyte on Ni-LSGM anode substrate was standardized in terms of electrodes, solvent, current density etc. Studies on the electrical conductivity of these perovskite oxides as a function of temperature and the assembly of a single cell have been in progress.

The progress of the two NML Mega Projects – (1) Maximising blast furnace productivity with Indian iron ore with financial support of the Ministry of Steel, Government of India, under the Steel Development Fund scheme, and (2) Processing of polymetallic sea nodules of Indian ocean following Reduction Roast-Ammoniacal Leaching-Solvent Extraction-Electrowinning route to recover Copper, Nickel and Cobalt, sponsored by Department of Ocean Development, Government of India – has been quite encouraging.

NML has successfully designed and developed a Real-Time Process Simulator (RTPS) for Indian iron making blast furnace under the Blast Furnace Project. The RTPS has been installed at Bokaro Steel Plant for BF-5. Encouraged by the successful installation and satisfactory performance, the Bhilai Steel Plant also approached NML to design and install RTPS for some of their blast furnaces. The Ministry of Steel had given its formal approval to this proposal and a new project entitled 'Reduction of Coke Rate Using Probing and Modeling Techniques in BF No 6 and BF No



7 of Bhilai Steel Plant', had been approved by the Ministry under the Steel Development Fund scheme. This project was conceptualized jointly by NML and RDCIS/Bhilai Steel Plant to utilize the technology as a part of their modernization programme.

The contract value for the NML-led activities under the project was Rs 247 lakh. The major objective of this project has been to exploit the knowledge base generated in the concluded project (in the form of comprehensive process models as well as a real-time process simulator), towards reduction of coke rate by increased auxiliary fuel injection and thus lowering the cost of hot metal production.

In the project on processing of polymetallic sea nodules, the process has been scaled up to 100 kg per day and the recoveries of metals are 95% Cu, 95% Ni and 80% Co. The leach residue generated after ammoniacal leaching of sea nodules contains considerable amount of Mn. NML has developed a process on pilot scale for the treatment of leached residue to recover Mn in the form of ferro-silico-manganese, which is used as deoxidiser in the steel industry. Leached residue has also been utilized for adsorption of arsenic from ground water and removal of heavy metals from various effluents.

Thrust Area Project

During the year, the laboratory continued to work on its thrust area—the Component Integrity Evaluation Programme (CIEP). The emphasis has been to solve

industrial problems through failure analysis, remaining life assessment, non-destructive evaluation and stress analysis.

During the year 2006-07, several sponsored projects were completed. Some of the notable beneficiaries include—M/s Tata Tube, Jamshedpur; M/s BHEL, Tiruchirapalli; M/s Fine Manufacturing Industries; M/s Advanced System Laboratory, Hyderabad; M/s Indira Gandhi Centre for Atomic Research; M/s Bhabha Atomic Research Centre; M/s Jindal Steel and Power Limited, Hisar; M/s Kolhapur Steel Limited, Kolhapur; M/s Mott MacDonald, Noida; M/s CESC Limited; M/s Tata Steel, Jamshedpur; M/s Central Power Research Institute, and M/s Gala Precision Technology, Thane.

Under CIEP also several projects have been going on as per schedule. Mention may be made of a few: Evaluation of fatigue and fracture behaviour of narrow gap pipe weldments of similar and dissimilar metals; Study on ductile fracture of SA333 Gr 6 PHT piping materials for M/s Bhabha Atomic Research Centre, Mumbai; RLA study of cooling water heater at power plant for M/s SAIL, Durgapur; Creep rupture and LCF testing for M/s Indira Gandhi Centre for Atomic Research, Kalpakkam; Creep fracture properties evaluation of steel as per specification HY 18573 for M/s Kolhapur Steel Limited, Kolhapur; Residual life assessment of two primary reformer tubes for M/s Indo Gulf Fertiliser, Lucknow; Stress rupture test of boiler tube for M/s Central Power Research Institute, Koradi; Metallurgical

investigation on aircraft components, Failure analysis of aircraft components, and Failure analysis of bolts of wheel hub assembly of aircraft for M/s Indian Air Force; Assessment of creep rupture and elevated temperature tensile strength of steel for ISTM Limited, Pune and so on.

Supportive R&D

The project on Non-destructive Evaluation (NDE) Facility for Infrastructure Asset Management has made significant progress.

NML exploited its expertise in the areas of damage assessment and imaging using ultrasonic and non-linear ultrasonic (NLU) methodologies to study pitting corrosion in alloys, especially aluminium alloys. NLU has been successfully used for the first time for damage quantification owing to pitting in 7075 Al alloys. This work particularly relates to the spectral analysis of received ultrasonic signals to quantify the localized damage due to corrosion pitting in airframe materials.

Besides applying NLU, NML has also been involved in high frequency ultrasonic imaging of pitted samples and correlating the results with pitting distributions obtained through image analysis. The pitting phenomenon is analyzed statistically and the kinetics of pitting assessed through a change in the statistical distribution parameter of pits rather than deterministic equations relating pit dimensions to time. The results of image analysis and ultrasonic imaging were being correlated with the NLU results to establish the potential of this new

technique to quantify the localized damage due to corrosion pitting.

Indian Space and Research Organization (ISRO) successfully performed its first and most prestigious Space Capsule Recovery Experiment (SRE-1) in January 2007, bringing India into the select club of space capable nations, namely, USA, Russia, the European Union and China. It has been an equally glorious event for the NML



Experimental setup of NLU and scanning image of corrosion pitting in AL-alloy using NLU parameter

family as SRE-1 carried on-board a Biomimetic Payload reactor, conceptualized and designed by NML, to study the effect of microgravity on the biomimetic synthesis of hydroxyapatite nanoparticles. Successful on-board experimentation has made NML perhaps the first Indian laboratory to carry out *in situ* synthesis of nanoparticles in space. Structural characterization of the nanoparticles synthesized in space



Recovered biomimetic payload

manifested the formation of highly ordered bulk structure made from ordered assembly of hydroxyapatite nanoparticles having dimensions in the range of 2 nm–4 nm. Biocompatibility of the samples was being studied in collaboration with the Centre for Cellular and Molecular Biology, Hyderabad.

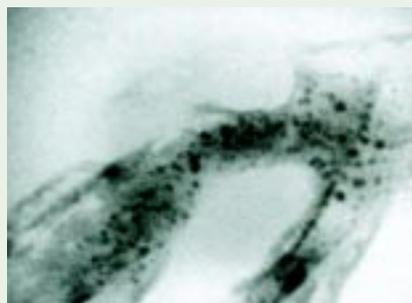
The Department of Information Technology (DIT) had sponsored a project on Process Simulation for Optimisation of Ferroalloy Production in Submerged Arc Furnace valued at Rs 62.2 lakh. The project aimed at developing a simulation package that helps in optimizing the ferroalloy production processes through reduction in specific power and raw material consumption. The process simulator was to be installed at the Angul Ferroalloy plant (Orissa) of Nava Bharat Ventures Limited (NBVL).

Collaborative Research

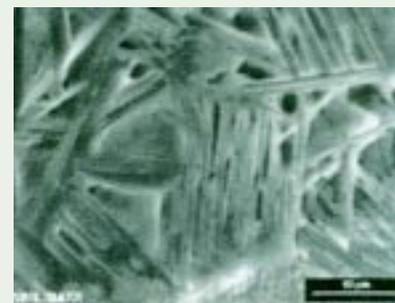
Globalisation has brought about joining of hands to establish alliances that would help create a universal knowledge pool. Realising the need and mutual benefit of international S&T co-operation, NML signed bilateral programmes with several countries through DST, DSIR and DBT. Under the

International Collaborative Programme, several projects with South Korea, the European Commission, Russia, US and Bulgaria are going on. The collaborative R&D areas include: Process flow-sheet development for recovery of heavy minerals; Removal of hazardous metal elements from leach liquor of electronic scrap; Low cost technology development for *in-situ* ground water treatment; Nanowire technology; Dense ceramic composites; Fatigue damage and deformation evaluation; Paints and coating on HSLA steel and so on.

A large number of equipment have been purchased and installed during the period to facilitate the ongoing R&D activities of the laboratory. Some of the major ones are: Portable XRF, Carbon Coater with accessories, Low Pressure Autoclave, Table-top Microscope, UHV Analysis System, Inductively Coupled Plasma-Mass Spectrometer, Computer Controlled Emission Analyser, Universal Hardness Tester, Ultrasonic Immersion Scanning System, Vibrating Sample Magnetometer, Tension-Torsion Testing System with internal pressurisation, Creep Testing Machines, Air-jet Hot Erosion Tester etc.



Biomimetic scaffold synthesised under microgravity



Hydroxyapatite nanoparticles (2nm-5nm) synthesised under microgravity



Workshop-cum-Discussion Meeting on Metrology in Chemistry (MiC)

The National Physical Laboratory, (NPL), Metrology Society of India (MSI) and National Accreditation Board for Testing & Calibration Laboratories (NABL) organized a one-day workshop-cum-discussion meeting on Metrology in Chemistry (MiC) on 30 May 2008 at NPL. Metrology in Chemistry (MiC) plays a key role in accurate and precise traceable measurements, which are very important in the field of environment, healthcare, food safety, energy as well as forensic sciences. They have far-reaching consequences for trade and industry and tremendous societal impact.

Certified Reference Materials (CRMs) are vital to enhance quality of chemical measurements in the country. In the absence of MiC and related CRMs, Indian stakeholders, laboratories and industries in various areas of MiC will have to get

this service done outside India which will not only be costlier but also extremely inconvenient and time consuming. In addition, if the country has to face technical barriers to trade, the loss to the country will go up manifold.

It is planned to introduce MiC in India in a network mode with partner laboratories for areas such as organic/inorganic/gas/electrochemical/surface and bioanalysis etc. The National Physical Laboratory (NPL), New Delhi, being the National Metrology Institute (NMI) of India, will play a catalytic role in making the Indian community aware about MiC in different fields of chemical measurements, help produce reference materials needed and thus provide national and international traceability through participation in key-comparisons.

It was to share the above

concerns, update participants with the latest happenings around the world, help in identification of areas in which MiC could help and to plan the future roadmap that the workshop-cum-discussion meeting on Metrology in Chemistry was organised.

Some key resource persons and participants who attended the workshop were Dr Robert Kaarls, Secretary, Comite International des Poids et Mesures (CIPM) and Chair, Consultative Committee on Quantity of Matter (CCQM) of Bureau International des Poids et Mesures (BIPM); Dr Laurance M. Baseley, Chief Metrologist, National Measurement Institute, Australia (NMIA); Dr Chainarong Cherdchu and Dr Pian Totarong, National Institute of Metrology, Thailand (NIMT); Dr Kam Tat Ting from Government Laboratory, Hong Kong; Dr Uwe Miesner from



Group photo of participants



Physikalisch-Technischen Bundesanstalt (PTB), Germany.

Thirty four scientists of partner labs like CFTRI Mysore; IIP Dehra Dun; CDRI Lucknow; IICT Hyderabad; NGRI Hyderabad; CIMFR Dhanbad; IITR Lucknow; IMMT Bhubaneswar; IHBT Palampur; CSMCRI Bhavnagar; CBRI Roorkee; CRRI New Delhi; IARI New Delhi; IGIB New Delhi; IIIM Jammu; IOC R&D Faridabad; NEIST Jorhat; representatives from RDPD CSIR New Delhi and NABL New Delhi, apart from 30 participants from NPL participated in the workshop.

Welcoming the delegates and resource persons, Dr Vikram Kumar, Director, NPL, gave an overview of the MiC/CRM programme of NPL and talked about its importance in improving the quality of life in India and NPL's initiative during the 11th five year plan. It was followed by a keynote address by Dr Robert Kaarls who talked about the latest happenings internationally and dwelt upon the Metre-Treaty, MRA and Traceability in chemical measurements for improving quality of life and removing technical barriers to trade. Dr B.R. Chakraborty, Head Materials Characterization Division, in his remarks mentioned about materials metrology activities of NPL. The highlight of the inaugural session was the release of six CRMs of mono-elemental and multi-elemental solutions in water by Dr Robert Kaarls.

Dr Besely of NMI, Australia, talked about 'MiC models and role of NMIs and designated institutes in developed and developing

economies'.

'Metrology in chemistry and CRMs in the area of food and food safety, NMI role in traceability', was the topic of Hong Kong's Dr Kam Tat T i n g ' s presentation. It was followed by MiC activities and progress in Thailand by Dr Chainarong Cherdchu, of NIM Thailand. Dr P.S. Ahuja, Director, IHBT, Palampur, highlighted the measurement scope, need and possibilities in various areas like biosensors-based pesticide, heavy metals, microorganism, toxin and virus analyzers including the need for free air carbon dioxide enrichment (FACE) and flux-tower based measurement needs to address climate change and carbon/nutrient flow needs.

Shri Anil Relia from NABL talked about the status of accreditation for environmental measurement laboratories in India. 'Indian MiC and CRMs activities: NPL-I partnership model and strategy for national traceability dissemination', was dealt by Head, Chemical Metrology, NPL. The partner laboratories briefly mentioned the progress made by them and discussed their roadmaps for MiC and CRM activities.

Dr V. Balaram, NGRI,



Release of Certified Reference Material (from left): Mr Prabhat K. Gupta, Head Chemical Metrology; Dr B.R. Chakraborty, Head Materials Characterization; Dr Robert Kaarls, Secretary CIPM & Chair CCQM, Netherlands and Dr Vikram Kumar, Director, NPL New Delhi

Hyderabad, discussed about Geochemicals; Dr V.D. Sattigeri, CFTRI, Mysore food and food safety; Dr K.K. Gupta, NML, Jamshedpur, metal and metal alloys; Dr(Smt.) Prem Dureja, IARI, New Delhi, agrochemicals and pesticide residues; Dr R.S. Shukla, CSMCRI, Bhavnagar, porous reference materials; Dr Rajeev and Shri Manish, IMMT, Bhubaneswar, ores; Dr J.N. Behari, IITR, Lucknow, toxic species; Dr A.K. Bandopadhyay, CIMFR, Dhanbad, coal and related CRMs; Dr A.K. Minocha, CBRI, Roorkee, CRM need for building materials; Dr N.C. Dey, NEIST, Jorhat, medicinal plants; Dr J.K. Dhar, IIIM, Jammu, herbal and pesticides issues; Dr A.S. Sarpal, IOC R&D Faridabad MiC/CRM need in petroleum and natural gas; and Dr Anuradha Shukla and Dr Sippy Chauhan, CRRI, New Delhi, about the need of CRMs for road transport environment studies.



Training Programmes at HRDC

Developing Leadership Pipeline

The Human Resource Development Centre (HRDC), Ghaziabad, has been conducting training programmes for CSIR personnel on developing/upgrading skills of organizational relevance. The leadership skill development was identified as one of the needs in a study of training needs conducted by HRDC. The study highlighted the need to build a strong leadership pipeline for CSIR to create leaders of future. HRDC has thus launched a major training initiative in the form of a series of programmes on development of leadership skills amongst middle and senior level scientists.

The programmes are being conducted by an international faculty Mr Ian Dean, CEO, Groman Consulting, South Africa, who has been associated as a trainer for developing leadership skills with leading organizations and corporates of the world. These programmes not only comprise knowledge delivery through class room lectures/presentation but also involve intensive hands on/field trainings on different aspects of leadership.

Each programme runs into four modules staggered over a period and comprise on-job assignments and a two-week residential workshop at HRDC. The design of the entire programme is such that the learning process begins at the participants' work places with a pre-



The training programme on Developing Leadership Pipeline

work assignment even before they set-out for HRDC. This requires them to identify performance challenges at individual and organizational level and the important skills and behaviour they would like to develop.

Module 1 dwells on developing teamwork skills across boundaries (with participants from different laboratories of different disciplines) as the first learning step of leadership development. The residential workshop (Module 2) takes the participants through an intensive learning of leadership competencies and proficiency standards for CSIR with the help of pedagogics and simulation exercises in the class rooms and field. Module

3 carried out by the participants back at their work place is basically to implement and execute the performance improvement initiatives identified at the workshop. Module 4 is the delivery and competence phase to present major insights, learning and conclusion to Director General, CSIR. The completion of the four modules is followed by a graduation ceremony presided over by Director General, CSIR.

The first three programmes in the series concluded on 6 March 2008, 9 May 2008 and 11 July 2008 respectively. Around 40 participants participated from the CSIR laboratories in each programme. The format of the programme is such

that it induces competition amongst the participants and 'Merit Awards' are given for outstanding performances during the training. The Certificate of Participation and Merit awards are given away by Director General, CSIR at the

graduation ceremonies held at the end of the programmes.

In his message to the graduating trainees, he has been emphasizing the importance of building a strong leadership pipeline in CSIR to secure the future of the

organization. He feels that CSIR should create a stock of 'Leaders' who become a national asset and can be tapped not only by CSIR but by the entire country. HRDC plans to carry out 10 such programmes in the next two years.

R&D Valorization

The Human Resource Development Centre (HRDC), Ghaziabad, recently joined hands with the Asian Pacific Centre for Transfer of Technology (APCTT), New Delhi, to organize a training programme on 'Valorization of R&D' for the senior scientists of CSIR laboratories from 12 to 14 March 2008. APCTT is the Regional Institute of the United Nations Economic & Social Commission for Asia and the Pacific (UNESCAP) serving the Asia-Pacific region with the objective of facilitating technology transfer. The programme focused on apprising the participants about the emerging global trends and practices in valorization of R&D to maximize value addition to the organization.

The faculty comprised Dr Chachanat T. of the National Science & Technology Development Agency (NSTDA), Thailand; Dr Zong-Tae Bae of Korea Advanced Institute of Science & Technology (KAIST), Korea; Dr Richard Woolley of University of Western Sydney, besides experts from APCTT, CSIR and other leading institutions like IITs. The participants in the programme were senior scientists from CSIR



A view of the dais at the training programme on R&D Valorization

laboratories and from South Asian countries like Sri Lanka, Nepal, Malaysia, Mongolia and Thailand.

The programme was inaugurated by Dr K.V. Raghavan, Chairman, RAC, DRDO and former Director of two CSIR laboratories. In his key-note address, he highlighted the world trends in valorization of R&D, especially in USA, Japan, Korea and China. He also dwelt on the networks in these countries for taking R&D from mind to market.

Dr K. Ramanathan, Head, APCTT, in his opening remarks emphasized the need for promotion and collaboration in science &

technology at national, regional and international levels as cooperation between industry, academia and R&D institutions was important to effectively utilize the limited resources.

The participants were apprised about the recent advances in R&D management practices, re-positioning of public funded R&D institutes, use of public-private partnership to enhance R&D commercialization and valuation of technology.

HRDC and APCTT propose to work together in future to hold more such training programmes of value addition to both the organizations.



Two NGRI Scientists Bag APCOST Awards

Two senior scientists of the National Geophysical Research Institute (NGRI), Hyderabad,—Dr Tirumalachetty Harinarayana and Dr(Mrs) Chakravadhanula Manikyamba have been selected for the Andhra Pradesh Scientist Award for the year 2008 in the field of Earth Sciences for their outstanding contributions, by the A.P. State Council of Science & Technology (APCOST), Government of Andhra Pradesh. This field has been newly introduced this year by APCOST in recognition of the International Year of the Planet Earth. The two NGRI scientists thus become the first recipients of this award.

Earlier, Dr Harinarayana had won the National Mineral Award (1991) and was recently elected to the prestigious Russian Academy of Natural Sciences (RANS) and also as the Bureau Member of Electromagnetic Studies for Earthquakes and Volcanoes (EMSEV). He has also been elected recently (2007) as an executive member of International Association of Geomagnetism and Aeronomy (IAGA). Dr Harinarayana received Hogg award by IAGA Working Group 1.2. He has successfully handled and completed mega projects at NGRI related to oil exploration, geothermal exploration, deep crustal studies and earthquake

studies. The concerted efforts made by him in geophysics have opened up new areas for oil exploration in Saurashtra, Kutch, Narmada-Cambay regions, Manabhum area and Arunachal Pradesh. Application of innovative techniques have paved the way to delineate the unknown deep geothermal resources in Puga region, Himalayas, Tattapani region in Chattisgarh and Ganeshpuri-Kokenere regions in the west coast of India. He recently introduced a new geophysical technique in India, namely marine magnetotellurics and applied it in the Gulf-of-Kutch region for oil exploration. He is presently the Head of the Magnetotellurics Group at NGRI.

Dr Manikyamba's significant contributions are in wide ranging areas of Geology and Geochemistry. She has contributed immensely towards the understanding of the formation and evolution, Archean crustal growth and related mineralization by studying various types of rocks of different greenstone belts of Dharwar craton, India. This has created lot of geochemical data on greenstone belt lithologies, Proterozoic Cuddapah basin and documentation of several new rock types like boninites, Nb-enriched basalts, high Mg andesites and adakites for the first time from

Dr R A Mashelkar

Dr R A Mashelkar, former Director General, CSIR, has been honoured with the prestigious Australian Academy of Technological Sciences & Engineering Foreign Fellowship. He received this honour on 28 April 2008 during a special ceremony held at Canberra, Australia.

With this, Dr Mashelkar joins 13 other distinguished scientists and technologists as Foreign Fellows and the first Indian to receive this honour.

Gadwal greenstone belt of Dharwar craton of A.P. She has identified the Phanerozoic type of subduction zone processes in different greenstone belts like Sandur, Penakacherl, Kushtagi, Hutti, Gadwal, Narayanpet and reported many new rock types which are published and widely cited.

Dr Manikyamba is also a recipient of the CSIR-Young Scientist Award (1995), Dr B.P. Radhakrishna Prize (1999) of Geological Society of India and the prestigious National Mineral Award (2002) from the Ministry of Coal and Mines, Government of India, in recognition of her scientific achievements in the field of Geochemistry.

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