



CIMFR designs First Highwall Mining in India

India's domestic energy requirement is met by coal combustion to the extent of about 60%. Currently the country produces about 500 MT of coal per year, 80% of which comes from opencast mines. There has been a great need to substantially increase the coal production in the coming decade to meet our growing economy.

Unfortunately, many of Indian opencast mines are reaching their pit limits. Existence of surface dwellings in many places limits the expansion of currently running opencast mines. Also, in many cases the overburden becomes so high that coal extraction becomes uneconomical. But with the use of highwall machines, a cutter is placed on the top of a continuous miner kind of material, and taken through a conveyor inside the seam, which is almost 500-600 m deep inside. That was not possible till now, and large amounts remained untapped owing to limited means and high cost of mining of that seam.

Highwall mining is a new technology which can extend the life of opencast mines without disturbing the surface dwellings, and maintaining economy and productivity. This technology is in use in United States and Australia but yet to be introduced in Indian coalfields. It is a remotely operated coal mining technology closely related to underground mining machinery. The method comprises extraction of coal from a series of parallel entries driven in the coal seam from the face of the highwall. These entries are unmanned, unsupported and unventilated.

The Central Institute of Mining and Fuel Research (CIMFR), Dhanbad, is instrumental in adapting this new technology for Indian geomining conditions by providing scientific extraction design for the first two Highwall Mining sites at Ramagundem Opencast Project-II of M/s Singareni Collieries Company Ltd (SCCL) and Quarry SEB and AB, West Bokaro of M/s Tata Steel Ltd (TSL).

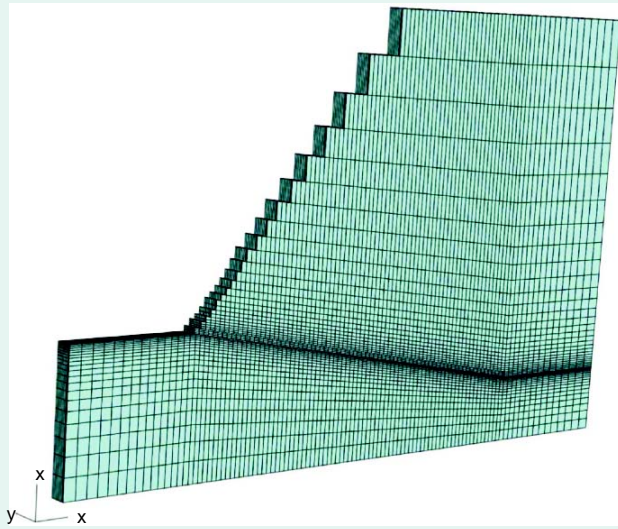


Fig. 1 : Elastic model geometry of OCP-II highwall mining of SCCL

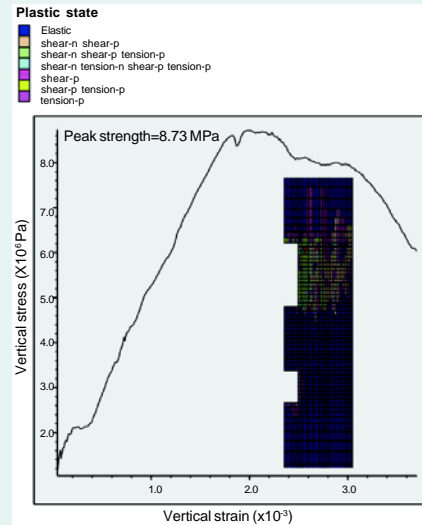


Fig. 2 : Stress-strain curve and plasticity states of a Model of OCP-II, SCCL



Fig. 3 : ADDCAR Highwall Mining in operation at Miller Brothers Coal LLC, Kentucky, USA



Fig. 4 : View of 15 working benches of both Coal and OB of Quarry-SEB of M/s Tata Steel Limited (TSL), West Bokaro where CIMFR-designed highwall mining would start shortly

Indian geomining conditions are found to be widely different from those existing in other parts of the world, with the existence of multiple seams and frequently varying geology. CIMFR had conducted a series of numerical modelling studies coupled with empirical approach and decades of experience in coal mine geomechanics to come up with optimum highwall mining extraction designs. The designs also consider safety during Highwall

Mining operations, maximum coal recovery and protection of surface and sub-surface properties. Coal recovery of up to 60% has been designed by CIMFR at the above mining sites. In the process, novel approaches for pillar designing have also been formulated specifically for long and slender web pillars formed during Highwall Mining operations.

Recently Dr John P. Loui, Scientist-‘EI’ and Dr P. Pal Roy, Scientist-‘G’ of CIMFR Highwall

Mining team visited USA to gather practical experience on Highwall Mining operation and meet renowned experts, so that in future, this type of work can be carried out at any complex rock-geologic condition with much ease and confidence, using formulations and base-data generated by CIMFR and other Indian organizations. They acquired reach experience, knowledge and understanding by visiting Colowayo mine, Denver

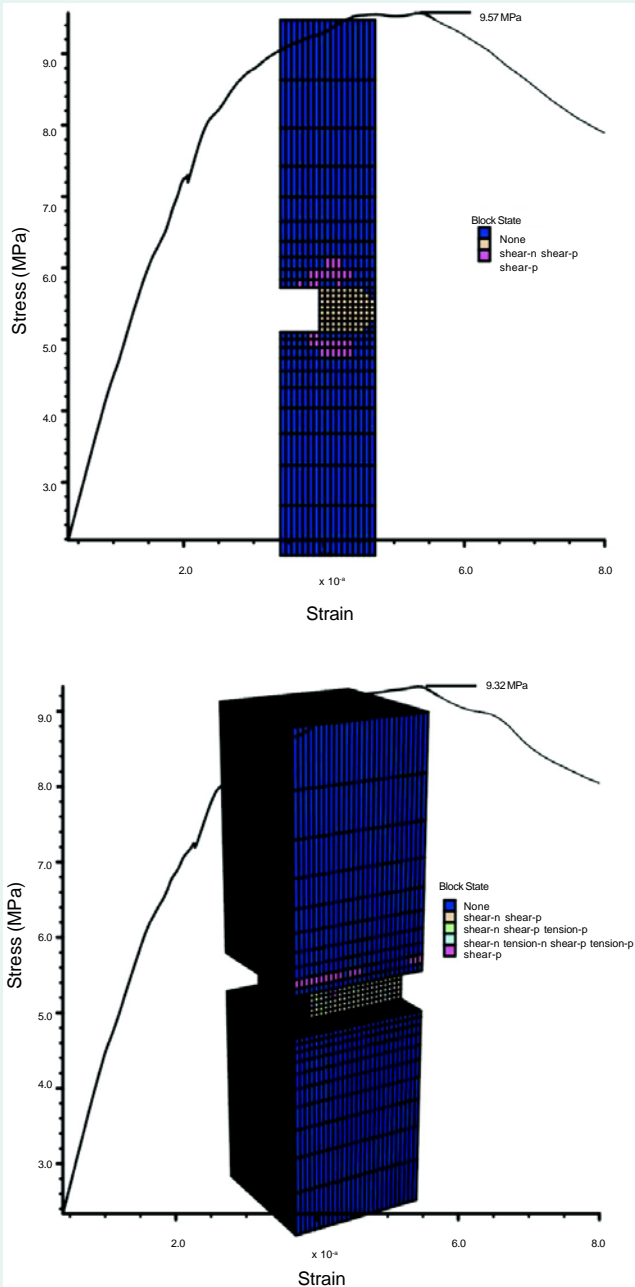


Fig. 5 : Stress-strain curves for width/height ratio of 2.5 in (a) long pillar (b) equivalent square pillar of Quarry SEB, TSL

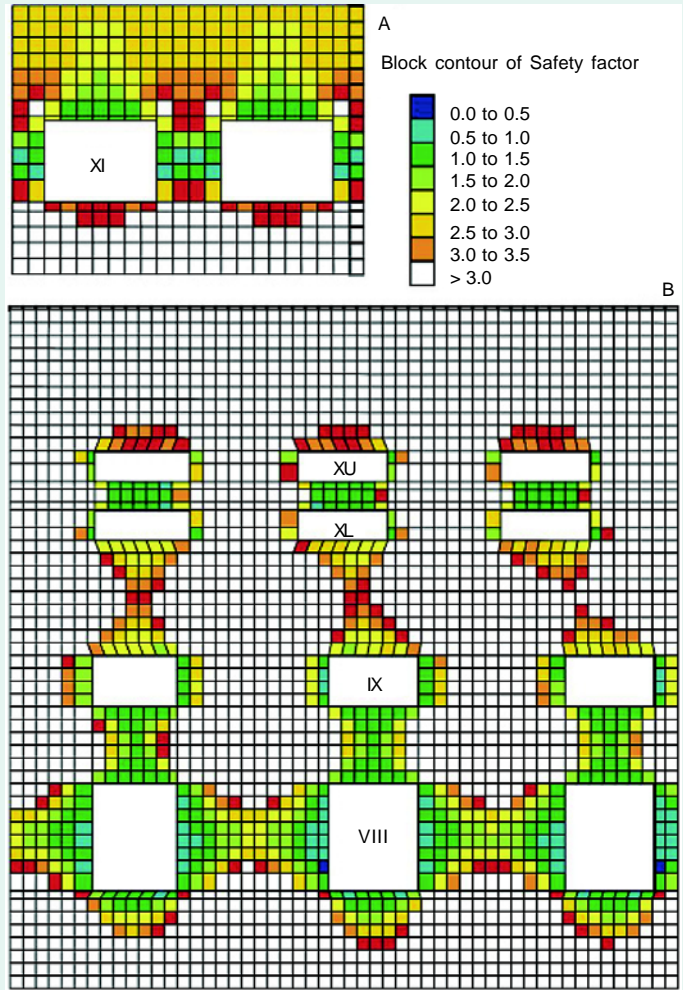


Fig. 6 : Closer view of safety factor contours in (A) Seam XI and (B) Seams XU, XL, IX and VIII of Quarry SEB of TSL

where multiple seam Highwall Mining is undertaken and also witnessing Highwall Mining operation at Miller Brothers Coal LLC, Kentucky and meeting Dr

David Newman, President, Appalachian Mining & Engineering, Inc., who is active in Highwall Mining design in eastern USA.

With the scientific design

capability developed by CIMFR, the coal mining companies in India and abroad can now procure the machinery and extract the locked up coal resource safely and economically. This noteworthy work has been possible as a result of dedicated involvement of a group of scientists among which Dr John P. Loui and Dr C. Sawmliana acted as Project Leaders at both the sites Dr P. Pal Roy acted as Coordinator while Dr Amalendu Sinha, Director, CIMFR provided his skilful advice and guidance.



Indo-German Open Ocean Experiment to Test Effects of Iron Fertilization on Ecology and Carbon Uptake Potential of Southern Ocean (LOHAFEX)



The Indo-German Iron Fertilization Experiment LOHAFEX (LOHA in Hindi for iron, FEX for Fertilization EXperiment), a collaborative venture between National Institute of Oceanography of CSIR and Alfred-Wegener Institute – Helm Boltz Association, Germany, was carried out from the German research vessel “Polarstern” in the southwest Atlantic from 7 January to 17 March 2009. The interdisciplinary team of 48 scientists from India (29), Germany (10), Italy (3), Spain (2), UK (2), France and Chile (1 each) on board “Polarstern” closely collaborated in monitoring the algal bloom expected to grow in the fertilized patch of ocean and studying its effects on the chemistry and biology for at least 45 days.

The results of LOHAFEX will be of great interest to both ocean ecologists and geochemists because the minute, unicellular algae suspended in the sunlit surface layer known as phytoplankton not only provide the food sustaining all oceanic life but also play a key role in regulating concentrations of the greenhouse gas CO₂ in the atmosphere.

The Southern Ocean encircling Antarctica is rich in the nutrients nitrate, phosphate and silicon but the phytoplankton growth is limited by the supply of iron which is a crucial ingredient of all organisms.

Iron is highly insoluble in sea water, so, unlike the other nutrients, is quickly lost in sinking particles. Addition of trace amounts of iron to these waters, whether from natural sources (contact with land masses and via settling dust blown of the continents) or by artificial iron fertilization (from a ship releasing dissolved iron sulfate to the surface layer), results in rapid algal growth leading to development of phytoplankton blooms.

Phytoplankton grow by taking up CO₂ dissolved in sea water and converting the carbon into biomass (organic matter). Because the CO₂ dissolved in the ocean’s surface layer is in equilibrium with the atmosphere, blooms cause a deficit, which is compensated by uptake from the atmosphere. The fate of the bloom biomass determines how long this CO₂ is retained in the ocean. If the organic matter is recycled by bacteria and zooplankton - unicellular protozoa and a variety of small animals that graze on phytoplankton - within the surface layer, and

the iron selectively lost, then the CO₂ taken up is returned to the atmosphere within months. However, the organic particles in the form of phytoplankton cells and zooplankton faecal material that settle out of the surface layer sequester CO₂ for longer time scales depending on how deep they sink. Carbon transported in particles that sink below 3,000 m is sequestered for centuries and the portion buried in the sediments for much longer.

Five iron fertilization experiments in the Southern Ocean have created phytoplankton blooms but only in the previous experiment EIFEX carried out from *Polarstern*, was it possible to actually follow the rain of particles sinking through the underlying deep water column because the experiment was carried out in the closed core of a stationary, rotating eddy. LOHAFEX was also



German research vessel *Polarstern*.

conducted in a pre-selected eddy but the size of the patch was twice as large – 300 km² fertilized with 20 tonnes of iron sulfate. EIFEX had to be terminated after 35 days while the bloom was still growing and sinking but LOHAFEX last 10 days longer and quantified the amount sinking to depth more accurately.

Another goal of LOHAFEX was to study the effects of iron fertilization on the zooplankton, in particular the shrimp-like krill, which is the main food of Antarctic penguins, seals and whales. Stocks of krill have declined by over 80% during the past decades and their response to the iron-fertilized bloom will indicate whether the decline is due to declining productivity of the region for which there is evidence. Thus, large-scale iron fertilization of the krill habitat could well help in boosting their stocks to their former high densities and facilitate long-term recovery of the decimated great whale populations.

2-Tonne Force Generating Shape Memory Alloy Actuator Bank

As part of the project titled “Deployment of Mousche Using Shape Memory Alloy” awarded by Aeronautical Development Agency (ADA) under the DISMAS programme a 2000 kg (2Tonne) force generating smart Shape Memory Alloy (SMA) actuator bank has been developed at

Advanced Composites Division of the National Aerospace Laboratories (NAL), Bangalore. The SMA actuator bank moves a distance of 15mm while generating a net actuator force of over 2000 kg. This force is used to deploy the additional aerodynamic surface (referred to as ‘Mousche’) measuring

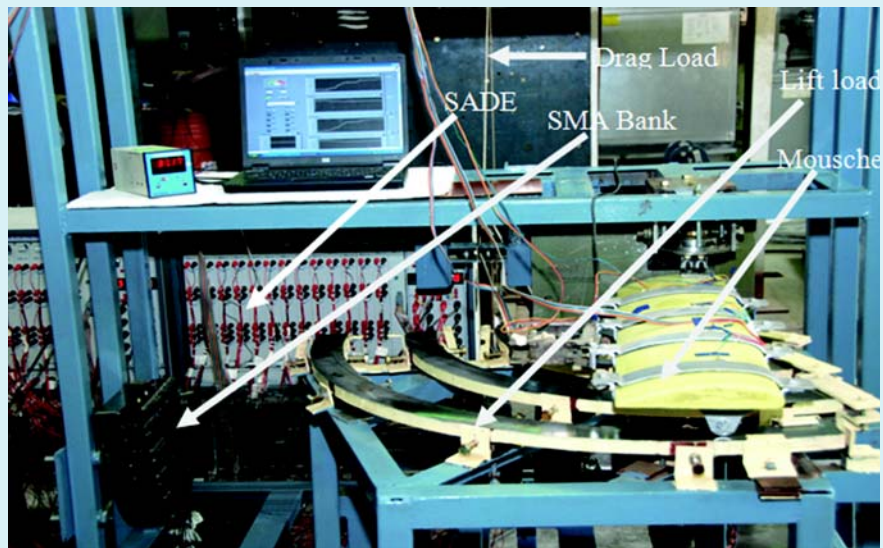


Fig. 1 : Pictorial view of experimental setup

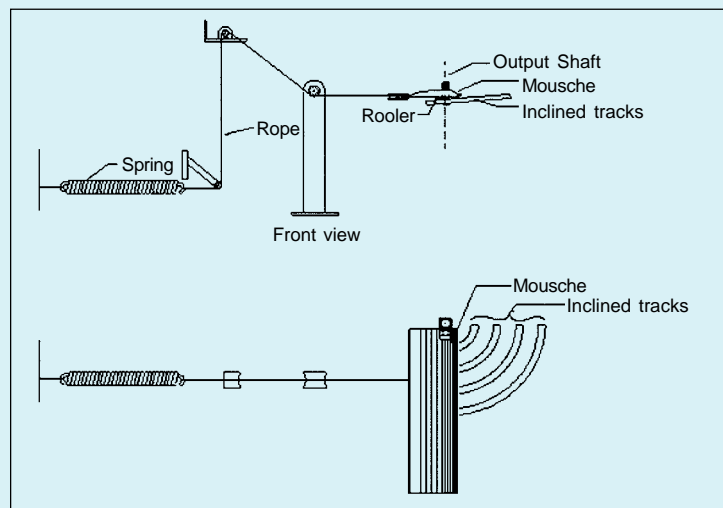


Fig. 2 : Schematic of lift & drag load mechanism

790 x 215 x 32mm against a simulated lift and drag load acting simultaneously. i.e. resultant lift load of 331.6 kg and drag load of 33.16 kg acting at the C.G of the Mousche. The SMA bank consists of 130



wires of about 1mm in diameter and 650mm in length. The actuation of these 130 wires is electronically and mechanically synchronized. The Mousche has been analyzed using standard FEM codes for the combined lift and drag load. Experimental and analysis values have matched well. The electronics circuit assembly of Smart Actuator Driver Electronics (SADE) that powers the SMA actuator bank has been designed and developed in the form of Mother and Daughter boards. Each Daughter board is having six miniaturized DC-DC converters and the required power and control signals are routed to the Motherboard. The SADE has been integrated to carry out the full load test. NI 6009 DAQ card along with GUI software LabVIEW is used to conduct the experiments.

The assembly of the SMA bank along with Mousche is shown in figure 1. The schematic diagram of the drag load and lift load mechanism is shown in figure 2.

The NAL team responsible for development of this AMA actuator bank consists of : G.N. Dayananda, P.Senthilkumar, S. Jayasankar, Byji Varughese, B. Ramanaiah, Satisha and H.V. Ramachandra.

Seminar on Safeguarding of Intellectual Property Rights

Give a man a fish and you have fed him for a day, teach him fishing and you have fed him for a lifetime. This was exactly the message of the one-day seminar on 'Safeguarding of Intellectual Property Rights' organized at National Aerospace Laboratories (NAL), Bangalore, on 1 May 2009 by NAL's Knowledge and Technology Management Division (KTMD). It was the concluding seminar of the series of conferences held as part of the Golden Jubilee celebrations of NAL.

The objective of the seminar was to spread awareness, motivate and educate the scientists about the importance of intellectual property through an array of expert lectures.

Symposium on Healthy Life in Platinum Years and Thereafter

A national symposium on 'Healthy Life in Platinum Years and Thereafter' was held at the North-East Institute of Science & Technology (NEIST), Jorhat, on 19 March 2009. NEIST organized this event in collaboration with the CSIR Pensioners Welfare Association (CPWA), NER Branch, Jorhat and All India CSIR Pensioners Welfare Association. It was attended by Prof Samir K Brahmachari, Director General, CSIR; Dr G. Thyagarajan, former Director of NEIST (then called Regional Research Laboratory, RRL-Jorhat); Dr P.G. Rao, Director, NEIST; Dr B.N. Dhawan, former Director, CDRI; Dr V.P. Kamboj, President, CPWA; renowned scientists and doctors from all over India, invited dignitaries, media personnel and NEIST fraternity and CPWA members. Dr P.G. Rao extended a warm welcome to the distinguished gathering and mentioned about CPWA's activities and its role in the society.

The symposium was inaugurated by Prof Brahmachari, Dr Thyagarajan, and other dignitaries. Prof Brahmachari also released a souvenir, symposium brochure and launched a new website of CPWA. Speaking on the occasion, he remarked that unconditional love and happiness were the key to healthy life and advised the retired people to take part in societal development. The keynote address was delivered by Dr B.N. Dhawan. Dr V.P. Kamboj on behalf of All India CPWA, Lucknow, also delivered a lecture on the occasion. Lectures on 'Management of age related degenerative disorders', 'Heart related disorders in old age', 'Role of indigenous systems of medicine', 'Health foods for healthy aging' and 'Financial Planning and Management' were delivered by the experts. The technical session was followed by a panel discussion and several recommendations were made.

Annual General Meeting of Indian Society for Advancement of Materials and Process Engineering

The Indian Society for Advancement of Materials and Process Engineering (ISAMPE), dedicated to the promotion of Materials and Process Technology in this country was founded in September 1985, with the aim of bringing together scientists, engineers, academicians, industrialists and private entrepreneurs of the Materials and Processing community to a common platform to promote the materials and process technology in this country. The 23rd Annual General Meeting (AGM), of ISAMPE was held at the National Aerospace Laboratories (NAL), Bangalore, on 12 June 2009

Shri P.S. Subramanyam, Director, ADA, Bangalore, who was the Chief Guest on the occasion, delivered the keynote address, 'On Role of Composites in the Light Combat Aircraft (*Tejas*) Programme of ADA'. Expressing his happiness over the composites development for the TEJAS programme he opined that the country needs to continue to forge ahead with newer innovations.

The Vijay Zaveri Memorial Lecture was delivered by Shri Pramod Rastogi, Chief Manager, CMD, HAL, Bangalore, on 'Trends in Composite Manufacturing'. He gave a bird's eye view on the low cost manufacturing techniques.

Presiding over the meeting, Dr A. R. Upadhya Director complemented ISAMPE for successfully carrying forward the vision of its founder President, late Prof A.K. Rao. He opined that composites was on firm grounds and ISAMPE should try and foster other newer areas like nano technology, smart composites and the like.

Dr S. Sridhara Murthy chaired the technical session with the theme on Advances in processing technologies. Dr Satish V Kailas, Associate Professor, Department of Mechanical Engineering Indian Institute of Science, gave a talk on 'Friction Stir Welding'; Shri A. Udayakumar, Scientist, Materials Science Division, NAL, on 'Monolithic and Composite-based Ceramic Products for Aerospace Applications' and Mr M.S. Velpari, Chief Manager (Development), F&F Division, Hindustan Aeronautics Limited, Bangalore, on 'An Overview of Advanced Manufacturing Processes in Forging, Casting and Powder Metallurgy Components'. All the talks were followed by fruitful deliberations.

Workshop on IPR Awareness

Intellectual Property Rights (IPRs) play an important role in the development of Innovation-driven sectors like Drugs & Pharmaceuticals. There has been a recent spurt in promoting various aspects of IPRs during the last decade, and efforts continue to adequately expose the scientific community to the complex issues involved.

The S&T knowledge Resource Centre of Central Drug Research Institute (CDRI), Lucknow, organized an IPR Awareness General Workshop on 26 April 2009—the World Intellectual Property Day declared by WIPO.

The workshop was meant not only for S&T staff of CDRI but also for all the other CSIR Labs of Lucknow, besides other S&T as well as academic institutions in town. In keeping with WIPO's focus this year on promoting Green Innovation as the key to a secure future, the focal theme was covered in 'IPRs for Traditional Health Systems'.

Dr Sheela Tandon, Scientist-in-Charge, S&T Knowledge Resource Centre, CDRI, in her welcome address gave a brief introduction about the purpose of workshop. Dr T.K. Chakraborty, Director, CDRI, delivered the inaugural address and Dr R. Rajashekharan, Director, CIMAP, as well as Dr K.C. Gupta, Director, IITR, presented views on the importance of commercially viable and important patents.

Dr V.K. Gupta, Scientist G from NISTADS, delivered his lecture on IPR protection for technological development. Dr S.B. Katti, Scientist G from CDRI, in his lecture, highlighted the importance of Green Innovations. In the context of Green Innovations, Dr N.N. Mehrotra of CDRI described the importance of innovations in Traditional Medicines and Medicinal Plants and an alternative framework for their IPR protection. Dr Shashi Rana of CST-UP gave an overview of IPR status in UP. Dr S.R.



Foundation Day Celebrations

Kulkarni of CDRI described various methodologies for patent searches and information sources in patents. Mr Aditya Kant, an Attorney on Patents from Delhi, explained in details the importance of the clause 3 (d) in the context of non-patentable inventions.

Besides these lectures a panel discussion on the theme was organized and a special supplement of 'Drugs & Pharmaceuticals - Industry Highlights' was also published on this occasion. The issue has some articles from the experts, besides the lists of patents filed and granted to the four CSIR Labs in Lucknow. Some basic facts on various aspects of IPR have also been provided for awareness generation.

More than 150 scientists, research fellows and postgraduate students of pharmacy colleges and law faculty attended the workshop. Mr W.F. Rahman summed up the function and proposed the vote of thanks on behalf of the organizing committee.

NEIST celebrates Foundation Day

The North-East Institute of Science & Technology (NEIST), Jorhat, celebrated its 48th Foundation Day on 18 March 2009. Prof. Samir K. Brahmachari, Director General, CSIR, graced the occasion as Chief Guest and delivered the Foundation Day lecture. Dr G. Thyagarajan, a former Director of NEIST [then called Regional Research Laboratory (RRL-Jorhat)], Indian Institute of Chemical Technology,



Prof Samir K Brahmachari, Director General, CSIR, delivering the NEIST Foundation Day lecture

Hyderabad and Central Leather Research Institute, Chennai, presided over the function. The function was attended by scientists, invited dignitaries, prominent citizens of the town, students, teachers and members of NEIST fraternity, CSIR Pensioners Welfare Association members coming from all over the country and media.

Welcoming the gathering, Dr P.G. Rao, Director, NEIST, briefly spoke about the activities of the institute in the NE region.

In the Foundation Day lecture, Prof. Brahmachari mentioned about the performance of CSIR in the past and present and projections for the future. He pointed out that the CSIR's future technology development programmes would have emphasis on improving the quality of life of 800 million people of India, particularly the poorest of the poor. He said that there is no parallel competitor of CSIR in India in matters of filing of patents or in the number of



Students visiting NEIST during 'Open Day'



patents granted as well as publication of research papers with high impact factors. He also said that producing Ph. D. students still has a long way to go to set its own standards. He also mentioned about the immense scope of NEIST in scientific research in NE region. He advised retired CSIR staff to take the responsibility of educating at least one child of a poor family and thus be a part of societal development.

Prof Brahmachari also released the newly published NEIST Annual Report for 2007-08 and *NEIST Highlights 2008-09*. He also felicitated the 16 NEIST personnel who had retired during 2008-09 for their services rendered towards the growth and development of the institute, and also the staff members who had achieved excellence and rendered exemplary performances in their respective fields, by presenting them silver plaques. Certificates of appreciation were awarded to staff members for high impact factor research papers, patents granted in India and abroad, developing novel technology, generating highest external cash flow, exemplary R&D support, to the best SRF, JRF and women scientist and for best performance in sports, etc.

In the Presidential remark, Dr Thyagarajan talked about the scope and role of retired person in societal development and said that Foundation Day provides an opportunity to assess the performances and plan for the future.

On this occasion, four new infra facilities were also inaugurated by Prof Brahmachari, namely the *Param Gem High Performance Computing Center* in Geoscience, *Single Crystal X-ray Diffractometry* in Analytical Chemistry Division, *Polymer Laboratory* in Petroleum & Natural Gas Division and *North East Exploration of Pharmaceuticals* in Natural Products Chemistry Division. The laboratory also observed 'Open Day' for the students, teachers and others in the morning hours between 10.00 am to 12.00 noon. Nearly 200 students visited and interacted with NEIST scientists. The celebration concluded with a brief cultural programme in the evening.

Energy R&D for Rural Development Prof. Tilak Memorial Lecture by Dr A.K. Rajvanshi



Dr Anil K. Rajvanshi delivering Prof. Tilak Memorial Lecture

Dr Anil K. Rajvanshi, Director, Nimbkar Agricultural Research Institute (NARI), Phaltan near Pune, delivered the National Technology Day Lecture and the sixth Professor B.D. Tilak Memorial Lecture at National Chemical Laboratory (NCL), Pune, on 22 May 2009. A pioneer in establishing a close relationship between NCL and chemical industries, Prof. Tilak was Director of NCL from 1966 to 1978. Prof. Tilak contributed significantly to the country's march towards self-reliance in chemical technology. Under his dynamic leadership NCL contributed to the establishment of several industries based on NCL know-how. He also contributed immensely to the preparation of science and technology plan of chemical industry.

Dr Rajvanshi spoke on 'Energy R&D for Rural Development'. Dr Rajvanshi remembered his association with Prof. Tilak, informing that Prof. Tilak was on Advisory Board of NARI from 1981 till his death. In his talk, Dr Rajvanshi focused on rural energy scenario and problems, possible high tech solutions, energy from agriculture, and how laboratories like NCL and NARI can collaborate in solving some of them.



Regarding rural scenario, Dr Rajvanshi said that even in 21st century and sixty year after independence nearly 20,000 villages have not seen electricity and about 60% of rural population has nearly non-existent electricity. Most of our villagers use kerosene for lighting and consume 180-200 million tonnes/yr of biomass per annum for cooking in inefficient and smoky stoves. Because of indoor pollution from these ineffective devices around 300,000 deaths take place every year.

Energy is the basis of life. Human Development Index is directly linked to electricity consumption, but energy situation in India is alarmingly low. Our average per capita consumption is 5%(18 GJ/annum) compared to US (350 GJ/yr.) and our rural per capita electricity consumption is just 60 kWh/annum, the lowest in the world.

Energy from agriculture can solve the twin problem of electricity and liquid fuel shortage and will provide rural wealth and create employment. Adequate liquid or gaseous fuels which are environment friendly and locally produced can solve the cooking and lighting problems. Dr Rajvanshi recommended the development of high technology for rural development as it will allow maximum extraction of materials and energy from dilute distributed resources available.

In any agriculture, 25-40% of produce is food and rest is residue since there is no remunerations from residues, farming is uneconomical. No industry can

survive on such norms. He informed that India produces approx. 600 million tonnes of agricultural residues every year. The agricultural residue is mostly burnt in fields creating environmental pollution and loss of energy. Dr Rajvanshi said that the residue can be used to produce three types of fuel such as liquid fuels like ethanol, gaseous fuel like methane (biogas) and electricity via biomass-based power plants. Residues can give an extra income of Rs 2000-4000 per acre per year to the farmers and can work as insurance against distress sale. Increased agriculture will result in increased residues. Farms and farmers are the backbone of any nation since they can produce food, fuel and wealth from the land. High tech innovations are needed for them. Dr Rajvanshi emphasized on the need of R&D in the areas such as, cellulosic conversion of residues into ethanol, conversion of plant saps into useful fuel, chemical additives for biodiesel and ethanol, increasing stability of pyrolysis oil, high tech biogas reactor to run on residues, and residues into fertilizer.

Dr Rajvanshi said that size reduction, sustainability, increased efficiency, equilibrium with surroundings and robustness are hallmark of evolution. Most of the research and development in agriculture, renewable energy, and sustainable development that are being carried out at NARI follow these routes. He also listed few examples of NARI's contribution to energy production, lighting and cooking.

Dr Rajvanshi also recommended the need of decentralized energy production at Taluka level in the form of biomass or coal based plants (10-20 MW capacity), small scale plants (10-500 kWe range), and micro scale power units that can produce 40-50 W power.

Dr Rajvanshi said that nearly half of India's population is below the age of twenty-five and mass communication has raised their level of expectations. Scientists, technologists, corporate world and GOI should work together in solving the rural energy problems. To make India superpower, the rural poor should be brought into mainstream of development.

Earlier, Dr S. Sivaram, Director, NCL, in his welcome remarks described Prof. Tilak as a strong proponent of technology for development and self-reliance. Prof. Tilak, after his retirement, was active in many forums that dealt with rural development. Introducing Dr Rajvanshi to the audience, Dr Sivaram said that he is a true social entrepreneur who after education from IIT-Kanpur and a doctoral degree from USA in chemical engineering, chose to direct his energy to applying appropriate S&T to the needy of the rural population. He further said that Dr Rajvanshi has a passion for delivering energy to rural areas based on two abundantly available resources, sunlight and biomass. People like him can open-up our eyes to new opportunities to apply S&T to those at the bottom of the economic pyramid.

Liquid Transportation Fuel Options

Dr L. K. Doraiswamy Honour Lecture by Prof. J. R. Katzer

Prof. J. R. Katzer, Department of Chemical and Biological Engineering, Iowa State University, USA, brought out the common dependability factor of liquid fuels between the United States and India while delivering a lecture on 5 June 2009 at the National Chemical Laboratory (NCL), Pune, as part of the Dr L. K. Doraiswamy Honour Lecture series. This lecture was held as a part of the symposium organized by NCL on 'Advances in Chemical Engineering and Process Technology' (ACEPT'09). While delivering the lecture on "Liquid Transportation Fuel Options", he pointed out that the world is almost entirely dependent on petroleum for transportation fuels. Stressing that over 90% of U.S. transportation fuel comes from petroleum, he said that out of it two-third is imported. A high dependence on petroleum therefore engenders security, stability, risks availability, and increasing demand growth resulting in supply restriction. Prof. Katzer said unfortunately there was still no real substitute for crude oil in fueling the transportation sector.

Prof. Katzer highlighted the available options and technologies involved with product costs and their environmental impacts with regard to particularly carbon



Prof. Katzer delivering his lecture on 'Liquid Transportation Fuel Options'

dioxide. He discussed in detail the conversion of coal and biomass to liquid fuels by gasification followed by Fischer-Tropsch synthesis. He also gave optional processes of methanol synthesis and methanol to gasoline and presented an analysis of the cost and performance. Biomass conversion by biochemical routes focused on cellulosic ethanol. He said, coal to liquids can produce liquid transportation fuels with life-cycle greenhouse gas emissions equivalent to those of crude oil-derived fuels. Prof. Katzer gave the benefits of geological storage of plant CO_2 emissions over venting plant CO_2 and said that geological storage of plant CO_2 emissions, combining coal and biomass (60%/40%) can produce simultaneously carbon-free transportation fuels and carbon-free

electricity sold to the grid at a cost of avoided CO_2 that is about one-half that for a power plant. Prof. Katzer said, almost all routes involve many chemical and biochemical engineering challenges at both, the fundamental science and the engineering levels. The potential offered by advances in both conventional and new power trains to impact fuel consumption was considered.

Dr S. Sivaram, Director, NCL, welcomed the audience and invited them to participate in the ACEPT'09 symposium. Dr Sivaram summarized the series of national symposia held earlier this year that focussed on catalysis, national meeting of the Chemical Research Society (CRSI) of India and announcement of an upcoming symposium in September on Advances in Newer Materials. Dr Sivaram then briefed the audience on the objectives of ACEPT and stated that it aimed at exploring recent developments and trends in chemical engineering science and process technology. Dr Sivaram said it would also provide an excellent opportunity for post-graduate students and young researchers to interact with eminent scholars working in this area. In his welcome remarks he stated that ACEPT was coinciding with L. K. Doraiswamy



Honour Lectureship series and the felicitation ceremony of Dr B.D. Kulkarni, Deputy Director, NCL.

Dr Sivaram briefly spoke about of Dr Doraiswamy in whose honour the lecture was organized. Dr Doraiswamy, he stated, was the first non-chemist Director at NCL who is presently the Anson Marston Distinguished Professor Emeritus at Iowa State University. During his long service in CSIR he established an internationally reputed research group in chemical engineering science which has continued the tradition of scholarships reputation till date. He then welcomed Prof. James Katzer. Once a year, representatives from Iowa State University's Chemical and Biological Engineering Department, the National Chemical Laboratory in Pune, India, and the Department of Chemical Technology at the University of Bombay (UDCT) select an internationally recognized scientist or engineer to present lectures at Iowa State and NCL.

Dr Amol Kulkarni, Scientist, Chemical Engineering and Process Development introduced Prof. Katzer to the audience with details on his academic and professional career and ended the function with a vote of thanks.

The lecture was attended by a galaxy of distinguished persons including Prof. M. M. Sharma, Prof. Rajendra Kumar, Dr Paul Ratnasamy, Dr B. D. Kulkarni, Dr Ajit Sapre, (President, Technology Reliance Industries Ltd.), Prof. K. S. Gandhi and Dr V. M. Naik, (former Head (R&D), Hindustan Unilever). In addition, about 150 delegates from ACEPT symposium including several distinguished chemical engineering faculties from various institutions in India were present.

National Technology Day Celebrations at NAL

The National Aerospace Laboratories (NAL), Bangalore, celebrated National Technology Day on 11 May 2009. The programme started with a welcome address by NAL Director Dr A. R. Upadhya. Dr Upadhya stated that Technology Day symbolizes India's technology prowess - conducting a nuclear test at Pokhran, the successful test firing of the Trishul Missile and the maiden flight of the indigenous two-seater *Hansa-3*. These achievements in Science and Technology have given our country enviable strength and self-confidence to stand on our own. He introduced the Chief Guest Shri H. N. L. N. Simha, Vice President (Strategic Electronics Center), Larsen & Toubro Limited, Bangalore, as a young, dynamic, next generation leader.

Shri H. N. L. N. Simha, in his address shared his thoughts on *Technology Innovation: Keystone to Self-reliance*. At L&T Mr Simha is involved in Defense Electronics- Warfare, Avionics, UAVs and Military Communications and design and manufacture of AVIONICS Subsystems. He spoke about why self-reliance is important, what is innovation, why is innovation important, why is it important in India, journey in innovation, innovation to cash tool, hurdles to innovation in India and barriers to successful innovation. He gave a detailed account of innovation at L&T adding that Technology innovation is all about Imagineering. He said L&T harbours and fosters innovation environment. He also mentioned that L&T has filed over 100 patents for electrical & electronic products in successive years. Stating he expressed that we need to build a powerful India not necessarily rich India, there are huge opportunities for innovation at NAL, DRDO and other such organizations. He concluded his lecture saying he is proud of being part of L&T - a self reliant company founded on innovation.

The programme coordinated by Knowledge and Technology Management Division, ended with a vote of thanks proposed by Dr M. R. Nayak, Adviser, (M&A).

Dr Anil K. Gupta takes over as Director, AMPRI

Dr Anil K Gupta has taken over as Director of Advanced Materials and Processes Research Institute (AMPRI), Bhopal, with effect from 9 April 2009.

Dr Gupta (born on 2 April 1951) obtained his Bachelor's Degree in Engineering in 1973 from National Institute of Technology (NIT), Warangal, (A.P.) in First Division with Distinction. He did his Ph.D (Engg) in 1987 from Delhi College of Engineering, University of Delhi. He started his career as Management Trainee with M/s J.K. Industries Ltd, and rose to Development Engineer. After nearly four years of industrial experience, he moved to National Physical laboratory (NPL), New Delhi, in February 1977 as Scientist B. He was Scientist G and Head, Division of Engineering Materials since 1999. During his 32 years of tenure at NPL, he was actively engaged in the R&D and R&D management. Dr Gupta also served as Acting Director, NPL on a number of occasions.

Dr Gupta established an excellent Metals and Materials Science lab in NPL and built-up an excellent team of scientists in the field working on a variety of metals, alloys and composite materials for materials development, fabrication technology, study of structure and properties, metal deformation etc. and developed deformation procedures for various materials for



industrial applications.

Dr Gupta has interacted effectively with Indian industries and provided an important link between CSIR Laboratories and industry. His collaborations with industry extended from those in India to overseas, such as Hero Honda and General Motors. He was responsible for setting up a cold and warm forging plant for transmission components of two-wheelers for Hero Group of Industries in 1998. This unit has since been expanded to two separate plants as M/s Shivam Autotech Ltd, amounting to Rs 100 crore each at Hardwar and Gurgaon. Under a General Motors sponsored project, an important development using Mg alloy resulted in improvement of ductility from 9% to 30%. This innovation would play an important role in the replacement of conventional aluminium alloys with novel magnesium alloys in near future.

Dr Gupta has been AICTE-INAE Distinguished Visiting

Professor at Department of Material Science & Metallurgy, IIT, Kharagpur (2005-08) and AICTE-INAE Distinguished Visiting Professor at Institute of Technology, Banaras Hindu University, Varanasi (2007-2008), Dr Gupta is currently Research Council Member of Central Glass & Ceramic Research Institute (CGCRI), Kolkata and Management Council Member at NPL and NISCAIR, New Delhi; AMPRI, Bhopal, CEERI, Pilani; and NIIST, Thiruvananthapuram. Dr Gupta is on the Editorial Advisory Board of Indian Institute of Metals (IIM-Universities Press) book series in Metallurgy and Materials Science. He is also reviewer for various international and national journals. Dr Gupta is Chairman, Alloy Steel & Forging Sectional Committee (MTDC-16) – BIS. He is also Member, Metallurgical Engineering Divisional Council (MTDC) – BIS, Member, Mechanical & Production Engineering Divisional Council (MPDC)- BIS.

Dr Gupta's collaborative efforts have taken him to both National and International partners. On the International Scene, he collaborated with MITI, Japan in the area of multi-axes forging; Fraunhofer's Institute, Germany; University of Milwaukee, Wisconsin, USA in the area of Metal Matrix Composites; University of California, Davis, USA, in the area of Spray



Forming; University of Sheffield, UK, in the area of Metal Deformation by Extrusion. Dr Gupta has extensively travelled abroad. He has visited USA, Canada, UK, France, Belgium, Germany, Austria, Singapore, South Korea, Japan etc. On the National Scene, he has collaborated with DMRL, Hyderabad; IISc, and HAL, Bangalore; NIIST and VSSC, Thiruvananthapuram.

Dr Gupta is a Fellow of the Indian National Academy of Engineering, (FNAE), Fellow of Institution of Engineers (India), (FIE), and Fellow of Metrology Society of India (FMSI). He is currently on the Board of Directors, M/s Shivam Autotech Ltd (A Hero Group of Company), at Gurgaon and Hardwar. He is Hony. Joint Secretary and Council Member of Indian Institute of Metals, and was Chairman, Materials Research Society of India, MRSI, Chapter Delhi (2004-2009). He is also Life Members of Aeronautical Society of India (MAeSI), Indian Society for Advancement of Metals & Process Engineering (ISAMPE), Materials Research Society of India (MRSI), and Metrology Society of India (MSI).

Dr Gupta has authored/presented large number of scientific and technical papers, and has delivered more than 50 invited talks at national and international forums. Dr Gupta has supervised Ph.D. (Engg.) and M.Tech. students and was External Examiner for more than 10 Ph.D. (Engg.) thesis from IISc, IITs etc and M.Tech thesis. He was awarded British Colombo Plan Fellowship in 1978, Indo-US Fellowship in 1992 and MRSI Medal was conferred in 1995.

Dr S. Gangopadhyay takes over as Director of CRRI

Dr Subhamay Gangopadhyay, Scientist G, has taken over as Director of Central Road Research Institute (CRRI), New Delhi, with effect from 29 May 2009. Prior to the present assignment, he had been serving as Acting Director of the Institute since 2 September 2008.



Dr Gangopadhyay is a B.E. in Civil Engineering from University of Calcutta and M.Tech. in Transportation System Engineering from IIT, Kanpur. He obtained his M.Sc. and Ph.D from the University of New Brunswick, Canada, under Commonwealth Scholarship Plan.

Dr Gangopadhyay joined CRRI as Scientist B in 1979 and rose to become Scientist G and Head of Traffic & Transportation Planning at CRRI. He has more than 29 years of experience in the area of Traffic Engineering & Transport Planning, Traffic Engineering & Safety, Regional and Urban Travel Demand Modeling Traffic Flow Theory and Capacity Analysis, Road Traffic Safety, Urban Traffic Congestion and Environmental Impact of Road Transport. He has coordinated a wide range of traffic and transportation studies covering many cities in India.

Dr Gangopadhyay has successfully carried out a number of significant projects, i.e. Comprehensive Traffic and Transportation Study for Mumbai, Surat, Amaravati, Nagpur and Aizwal; Urban Road Traffic and Air Pollution in Major Metropolitan Cities in India; Evaluation of Benefits after Implementation of Delhi Metro and Application of Intelligent Transport System in Delhi.

Dr Gangopadhyay is a member of Traffic Safety and Management Committee of the Government of India; member of Technical Advisory Group - Sky Bus Metro of Konkan Railway; member of the Technical sub-group of Delhi Development Authority and of several other committees of Delhi and Central Government. He is also a life member of Institute of Urban Transport (India), Indian Roads Congress (IRC) and Institution of Engineers (India). Dr Gangopadhyay has published more than 55 research papers and about 50 technical reports. He has guided a number of Ph.D and M.E. students and has visited Canada, USA, Australia and Italy.



Dr G. Parthasarathy elected FRSC- 2009

Dr G. Parthasarathy, Scientist, National Geophysical Research Institute (NGRI), Hyderabad, has been elected Fellow of the Royal Society of Chemistry, Cambridge, UK, for 2009.



Dr Gopalakrishna Rao Parthasarathy, a Ph.D. from Indian Institute of Science (IISc), Bangalore, has been working in the domain of physics and chemistry of materials for the last two and a half decades. He joined NGRI in 1990 and started Mineral Physics research, studying high-pressure and -temperature behaviour of minerals at mantle pressure and temperature conditions. He has also contributed to the understanding of origin of natural fullerenes, and mineralogy of several Indian meteorites. His current interests include thermodynamic and spectroscopic properties of Lunar minerals.

He has published about 160 papers in peer-reviewed SCI journals of high-impact factor, and presented about 150 papers in international and national conferences. He has seven international patents and one Indian patent to his credit. He is a recipient of National Mineral Award, PRL Award, MRSI Medal, AP Scientist Award of APCOST, M.R. Srinivasa Rao Award of Geological Society of India. He is Life Fellow of Geological Society of India, Andhra Pradesh Academy of Sciences, Indian Geophysical Union, Indian Society of Applied Geochemists, Mineralogical Society of India, and Lunar Exploration and Utilization Group (India).

Indo-US Research Fellowship to CSIR Scientists

The Indo-US Science & Technology Forum (IUSSTF) has awarded the Indo-US Research Fellowship to seven CSIR scientists (below 40 years) for the year 2009 for conducting advanced research in their prospective fields. The awardees include:

Dr Satyajit Shukla, Scientist C, National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram and CSIR Young Scientist Award-winner in Engineering Sciences (2008), has been awarded for out advanced research in the area of Engineering Sciences for a duration of 12 months at the Argonne National Laboratory, Illinois, USA.

Dr Shashank K. Singh, Scientist C, Indian Institute of Integrative Medicine (IIIM), Jammu, has been awarded the Fellowship for the year 2009, for conducting advanced research in the area of Life Sciences for a duration of 12 months at the Ohio State University, USA. Dr Singh will be working with Prof. Altaf Wani at Ohio State University, Columbus, OH USA.

Dr Rajkumar Banerjee, Scientist, Division of Lipid Science & Technology, Indian Institute of Chemical Technology (IICT), Hyderabad, to perform research work in the area of development of targeted cancer therapeutics under the mentorship of Prof. Debabrata Mukhopadhyay, Director, Angiogenesis and Vascular Biology Center & Nanotechnology and Nano Science Center, Mayo Clinic, Rochester, Minnesota, USA.

Dr M. Ghosh, Scientist, National Metallurgical Laboratory (NML), Jamshedpur, Jharkhand and Dr Nirmalya Karar, Scientist C, National Physical Laboratory (NPL), New Delhi, also figure among the awardees of this fellowship.

The fellowship should commence within FY 2009-10.

Fossil Economy to Biomass Economy: Opportunities & Challenges

In the series of events during its Golden Jubilee Year, the Indian Institute of Petroleum (IIP), Dehra Dun, will be holding a Symposium on “**Fossil Economy to Biomass Economy: Opportunities & Challenges**” during 19-21 August 2009. The symposium will have seven technical sessions covering: Energy scenario, Biomass resources, Conversion technologies to gaseous and liquid fuels, Lubricants, additives and other value-added products, Analytical procedures, and Compatibility for engines.

Further information regarding the symposium is available on symposium URL <http://www.iip.res.in/iipnew/febccoc>



Prof. Ajit Ram Verma

CSI*R News* records with profound sorrow the sad demise of Prof. Ajit Ram Verma, on 4 March 2009. An internationally renowned Physicist in Crystallography and an excellent S&T Administrator, Prof. Verma served as Director of the National Physical Laboratory (NPL), New Delhi, from 1964 to 1982.

Born on 20 September 1921 at Dalmau near Lucknow, Prof. Verma had done his B.Sc. (1940) and M.Sc. (1942, Gold Medalist) in Physics from Allahabad University. After a short stint as Research Scholar at Allahabad, he became a Lecturer in Physics at University of Delhi in 1947. During 1950-55, he worked at University of London and made well-known contributions to the observation and study of unimolecular growth spirals on the surfaces of silicon carbide crystals. He was awarded Ph.D. in 1952, and D.Sc. in 1969 by the University of London. After serving as Reader in Physics for four years (1955-1959) at University of Delhi, he moved to BHU, Varanasi, as Professor and Head of Department in 1959. He was appointed Director of NPL in 1964 and served as the leader of this prestigious CSIR establishment till 1982. Thereafter he served as Visiting Professor, IIT, Delhi; Jawaharlal Nehru Fellow and as Emeritus Scientist of CSIR and INSA Senior Scientist at NPL.

Among the major scientific contribution of Prof. Verma was the establishment of three very active Schools of research in Crystallography,

one each at University of Delhi, BHU, and NPL. In 1951, using Phase Contrast Microscopy, Dr Verma provided the first unequivocal experimental evidence in support of screw dislocation theory of crystal growth of millimetre sizes.

Prof. Verma also made valuable contributions to the pioneering work on direct measurement of metric thicknesses of Blodgett-Langmuir molecular films. At NPL, in collaboration with Dr Krishan Lal, since 1966, he made several original contributions to the field of crystal growth and study of lattice imperfections.

As NPL Director, Dr Verma's efforts were focused on bringing Indian National Standards of Physical Measurement to International level. Also, in place of artefact standards, work was taken up on quantum standards. Dr Verma laid the foundation of several new areas which include: Quantum Metrology; Materials Science including work on electronic materials like silicon and advanced materials like carbon fibers; high pressure and high temperature synthesis of materials, phosphorous and piezoelectric materials and consolidation of advanced materials characterization activities. Under his leadership, NPL made strong impact at the national and international level.

Prof. Verma authored six Books/



Volumes, published more than 100 research papers in refereed journals and contributed numerous invited papers and book chapters. His two books on Crystal Growth have been translated into Russian.

Prof. Verma was recipient of several honours and awards. Notable among these are: British Council Scholar (University of London) 1950-52; I.C.I. Fellow (University of London) 1952-1955; Fellow of Indian Academy of Sciences, Bangalore; Fellow, National Academy of Sciences' India, Allahabad; Member, Board of Editors – Solid State Comm., Pergamomg Press (Charter Member since inception, Retd in 1990); Elected Member of International Committee on Weights and Measures (CIPM) Paris 1966-1982; Member of Commission on Symbols, Units and Nomenclature of International Union of Pure & Applied Physics (IUPAP); Shanti Swarup Bhatnagar Prize-winner in Physics 1964; *Padma Bhushan* 1982, and *Atma Ram Puraskar* in Hindi by Kendriya Sansthan Agra 1984.

Prof. Verma was a person with many extraordinary qualities. He tried to practice what he preached. A most remarkable manifestation of this was the superb mental balance he exhibited during the last phase of his life, while battling the dreadful pancreatic cancer. He established strong human bonds with numerous persons, from the highest to the modest. As a result he headed a very big family of persons from diverse fields.

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