

## Development of Advanced Catalyst for Water-Gas Shift Reaction

Hydrogen is poised to be an ideal future fuel. Combine it with oxygen in a fuel cell, and it produces water and electricity, without producing any obnoxious pollutants that accompany the burning of fossil fuels. However, most of the hydrogen today is produced from fossil fuels, releasing vast quantities of carbon oxides. Dr Rajaram Bal and his group in Catalytic Conversion Processes Division of the Indian Institute of Petroleum (IIP), Dehra Dun, is working for the development of a technology for the production of CO-free hydrogen. In fact, the development of a technology for the production of pure hydrogen (with little or no CO) at a low cost is one of the major challenges in this field. Conventionally, water gas shift (WGS) reaction,  $\text{CO} + \text{H}_2\text{O} = \text{CO}_2 + \text{H}_2$  is applied in most hydrogen production facilities to decrease the concentration of CO and to increase simultaneously the production of  $\text{H}_2$ .

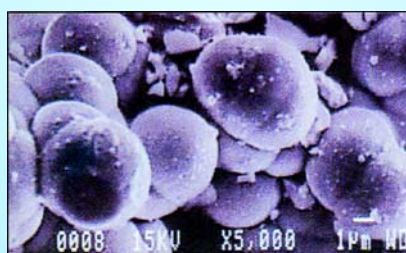


Fig. 1 : Scanning Electron Micrograph (SEM) of the prepared Cu-nanoclusters supported on CeO<sub>2</sub>.

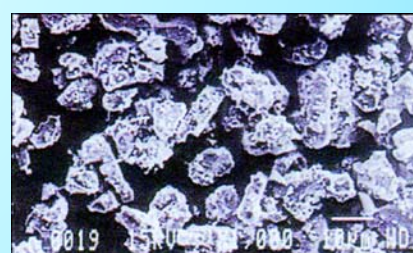


Fig. 2 : Scanning Electron Micrograph (SEM) of the conventional catalyst



Conventional low temperature (Cu/ZnO/Al<sub>2</sub>O<sub>3</sub>) WGS catalysts cannot be used in power generation systems for transportation and residential applications owing to restrictions related to their volume and weight and also owing to the requirements for reduced start-up times, durability under steady state

and transient conditions. In view of the demand for the development of advanced catalysts for the low temperature WGS reaction that will be useful for practical fuel cell application, Dr Bal and his group have developed small size Cu-nanoclusters supported on CeO<sub>2</sub>, ZnO and Al<sub>2</sub>O<sub>3</sub> by

means of hydrothermal synthesis method in the presence of surfactants.

The scientists are now planning to use the newly synthesized catalysts for the water-gas-shift reaction at low temperatures (-80°C), which can be used in Polymer Electrolyte Membrane Fuel Cell.

### Isomerizing C<sub>7+</sub> Hydrocarbons in Industrial feedstocks

Isomerization Group in Catalytic Conversion Processes Division of IIP, Dehra Dun, has made an exciting breakthrough in finding a solution to boost octane number in gasoline by converting n-paraffin to iso-paraffin by means of developing a highly-efficient zeolite-based catalyst for isomerization of C<sub>7+</sub> hydrocarbons. The main difficulty encountered in isomerization of hydrocarbons having more than, or equal to, seven carbon atoms is the cracking reaction leading to lower hydrocarbons which become

significant as the chain length increases.

Dr V.V. D. N. Prasad with his research team has screened out a novel zeolite material with optimum pore structure and appropriate Si/Al ratio, crystal size, extra frame work alumina, acid strength and density, to be used as one of the ingredients in preparing the desired catalyst. The team is optimistic about the behaviour of this catalyst in pilot plant, which is certainly going to maximize the selectivity of isomerization reaction towards highly branched isomers. In fact,

isomerization refers to converting straight chain C<sub>7+</sub> hydrocarbons preferably C<sub>7</sub> to C<sub>9</sub> hydrocarbons present in light naphtha feedstocks to its isomers. Branched isomers have high octane number as compared to their straight-chain counterparts and thus they can act as high-octane gasoline blending stocks with low aromatics. This reaction is aimed to take care of paraffins, naphthenes and olefins in C<sub>7+</sub> hydrocarbon feed to yield environment-friendly gasoline by minimizing aromatics and olefins.

### Predicting Localization of Subnuclear Protein

Scientists from National Chemical Laboratory (NCL), Pune ([www.ncl-india.org](http://www.ncl-india.org)) have developed a more accurate predictive model for nuclear protein localization in cells using nuclear protein primary sequence information. They have presented a novel method to mathematically represent a protein sequence. It is important to predict the protein

subnuclear localization as a mislocalized nuclear protein can lead to human genetic disease, cancer or virally infected cells.

The cell nucleus in eukaryotes is a highly complex organelle. Nucleus organizes an assembly of genes which are responsible for the regulation of other processes. Many proteins assist this regulatory activity and are localized very

specifically in the nucleus. Nuclear proteins operating in related pathways, or those that share a common functionality, tend to be localized in specific compartments within the nucleus.

Accurate knowledge of localization can lead to the better understanding of the mechanism of action and environment specificity of proteins. Recent advancements

in experimental techniques like protein microcharacterization and mass spectrometry have led to the identification of proteins in the nuclear complex. With the completion of the human genome project, huge volume of data is available with unknown functions. Thus, there is a need for an economical and faster bioinformatics tool that can take advantage of the existing information at hand to provide an *in-silico* annotation of the proteins with good reliability. Against this background, a team led by Dr B. D. Kulkarni, from the Chemical Engineering and Process Development Division of NCL used multiclass Support Vector Machines (SVM), one of the most powerful classifiers, for predicting protein subnuclear localization.

The NCL scientists used SVM with input features extracted by employing different methods. Five factor scores from a large number of amino acid indices, which reflects polarity, secondary structure, molecular volume, codon diversity and electrostatic charge. They employed these factors for extraction of the most informative features from protein sequences and used them as input feature vector for SVM-based classification of the nuclear protein families. Experiments with dipeptide composition and pseudo amino acid compositions were also performed for comparison. Further, evolutionary information like PSSM scores were used.

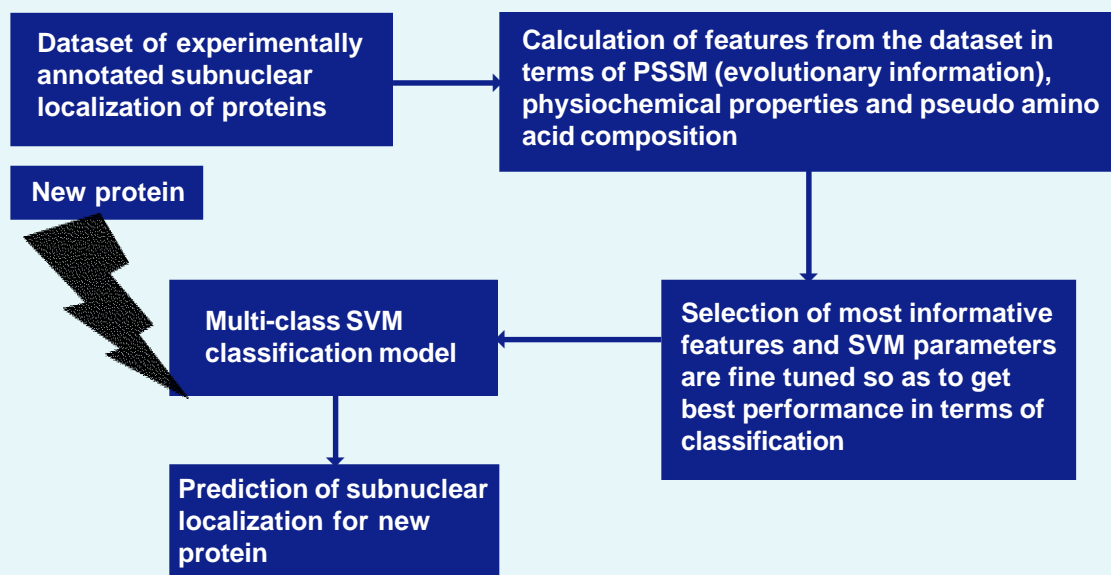
The performance of the SVM model was evaluated on the basis of a resubstitution and jack-knife (a.k.a.

'leave-one-out' test). Results of the simulations done with different sets of features in order to improve the jack-knife test performance showed that the model based on the PSSM features gives the highest jack-knife test accuracy, indicating that using PSSM to represent the nuclear protein is an effective way to incorporate evolutionary information. The superior performance of SVM based classifier with PSSM suggests strong correlation between evolutionary information and subnuclear localization characteristics.

Co-investigator Dr Jayaraman elaborates, "This method gave comparable results with conventional dipeptide composition and statistical factor score based features. The jack-knife success rate thus obtained on the benchmark dataset is 71.23%, indicating that the

novel pseudo amino acid composition approach with PSSM and SVM classifier is very promising and may at least play a complimentary role to the existing methods." The major reasons for limited study in this field are that the nucleus is more compact and complicated as compared to other cell compartments; and protein complexes within the cell nucleus can alter their compartments

### Algorithm for the prediction of subnuclear localization





during different phases of the cell cycle.

To computationally predict the localization of nuclear proteins, NCL scientists have proposed a novel method to represent the protein sequence. “The results suggest that this work has the potential for developing a web-server which can help experimental biologists to identify the localization characteristics of a query protein from the primary sequence itself,” asserts Dr Kulkarni. This work published in *Pattern Recognition Letters* was chosen as ‘Fast Breaking Paper’ by Sciencewatch.com in the field of Engineering for the month of February 2009.

*For further reading:*

Atchley, W.R., Zhao, J., Fernandes, A.D., Druke, T., Solving the protein sequence metric problem. *Proc. Natl. Acad. Sci.*, 2005, 102, 6395-6400.

Kuo-Chen Chou, Prediction of protein cellular attributes using pseudo amino acid composition, *PROTEINS: Structure, Function, and Genetics 2001* (Erratum: *ibid.*, 2001, Vol. 44, 60) 43, 246-255.

Mundra, P.; Kumar, M.; Kumar, K. K.; Jayaraman, V. K.; Kulkarni, B. D., Using pseudo amino acid composition to predict protein subnuclear localization: Approached with PSSM. *Pattern Recognition Letters*, 2007, 28(13), 1610-1615.

Shen, H.B., Chou, K.C. Predicting protein subnuclear location with optimized evidence-theoretic K-nearest classifier and pseudo amino acid composition. *Biochem. Biophys. Res. Commun.*, 2005, 337, 752–756.

Fast Breaking Paper by Sciencewatch.com in the field of Engineering

For more information, please contact: Dr B.D. Kulkarni / Dr V.K. Jayaraman

## Functionalized Recycled Polymer-Bitumen Blends

Use of recycled polymers has been recognized for bitumen modification because of their favourable economics and environment friendly disposal. One of the issues addressed in the system is the incompatibility of recycled polymers and bitumen. Underlining this, Central Building Research Institute (CBRI), Roorkee, has been made an attempt to develop a polymer-linked-bitumen system by anchoring reactive species onto recycled polymers and also by using bitumen copolymer type system. The main aim is to obtain adequate rheological stability for satisfactory blend endurance in use conditions. A recoverable bituminous composition developed aimed at satisfying the minimum specified level of softening point (60°C) and elastic recovery (50% at 15°C).

The optimization of various constituents (plastomer/elastomer) in the maleinized bitumen is made with respect to its use in the actual conditions for roofing/sealing. As would be expected, the addition of polymer to the bitumen increases the softening point and elastic recovery while the penetration of the resulting blends decreases. However, this alone is not sufficient for such applications, as the blend also required an adequate elastic recovery at low temperatures. Various amounts of thermoplastic elastomer were added into polymer bitumen blend. Increasing the percentage of elastomer increases the elastic recovery of the resulting blends. About 105% increase in elastic recovery is noticed when the blend is modified with an optimum level (2-5 wt%). At low temperature, these blends retained their elastic recovery at a specified level (50%). This is attributed mainly to the changed characteristics of the modified bitumen to those of the elastomer type, which could be stressed and would recover. SEM micrographs of polymer – bitumen blends were shown in Fig.1. In order to reduce the viscosity, these bitumen blends were

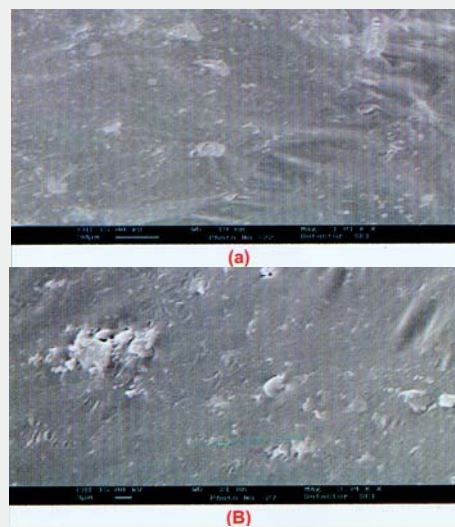


Fig. 1: Scanning electron micrographs of bituminous blends (a) Polymer Bitumen Blends (b) Elastomer Modified Polymer Bitumen Blends

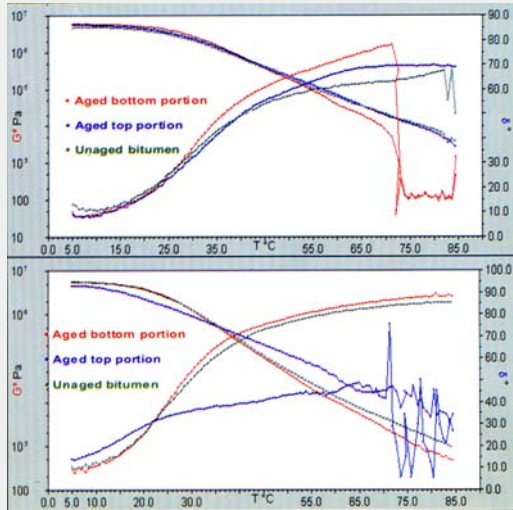


Fig. 2: Complex modulus and Phase angle Vs Temperature of unaged and aged bitumen (a) Control (b) Modified

diluted with plasticizer. It is observed that besides viscosity reduction, it also enhances the elastic recovery of resulting blends because of its interaction with the asphaltene fraction of the bitumen. To make it cost-effective, natural rubber is also tried in place of thermoplastic elastomer in the polymer-bitumen system.

The storage stability of these blends is studied by aging at 163°C for 48 hrs and then in a freezer at 6°C for 4 hrs. For base bitumen system, difference between softening point of the top and bottom portions is 60. The difference is further reduced to a level of 5 when maleinized bitumen is used in the blend. It is expected that maleinized bitumen provides adequate storage stability to the system by forming chemical interactions between the anhydride (maleic) functionality of bitumen and surface hydroxyl groups of recycled polymer. In another attempt, functionalized recycled polymer was used in making bituminous blends preparation. Storage stability test of these samples indicate that functionalization gives difference in softening point of the top and the bottom is -2. Rheological data also supported these findings (Fig. 2). For base bitumen system, the difference between phase angle of the top and the bottom portion is 6.8 at 25°C whereas for functionalized samples, the difference is 1.6. It is concluded that maleinized bitumen and/or functionalized recycled polymer possess superior properties over the base for satisfactory blend endurance in use conditions.

## Plate Rolling Mill commissioned in AMPRI

The Advanced Materials and Processes Research Institute (AMPRI), Bhopal, has procured a two high, one stand Plate Rolling Mill for rolling Al, Mg, Zn alloys and metal matrix composites in hot and cold conditions. This unit can roll a maximum billet thickness of 60 mm and maximum billet width of 150 mm. The mill is equipped with a set of H13 hot worked die steel rolls of 165 mm diameter and 250 mm width. It is interfaced with a remote diagnostic fault finding system through a modem. The machine is designed for a maximum separating force of 75,000 kg at a roll speed of 7.6 m/min. Electrical cartridge heaters are provided within the rolls and are capable of heating the rolls upto 400°C. The rolling mill has been procured under CSIR, Network Project on the Development of Advanced Light Weight Metallic Materials for Engineering Applications (NWP-0028).

Dr Navin Chandra, Acting Director, AMPRI, inaugurated the machine which was commissioned on 2 April 2009. In his inaugural address Dr Chandra, said that the facility will be used to study deformation behaviour of rolled light alloys and composites. It is also expected to enable to clad the sheets/foils on metallic substrates like foams through roll bonding, realization of property improvement in materials through deformation and establish microstructure property co-relations in the deformed/pressed materials.





## National Conference on Wind Tunnel Testing (NCWT-02)

The National Aerospace Laboratories (NAL), and the Indian Institute of Science (IISc), Bangalore, jointly organized National Conference on Wind Tunnel Testing (NCWT-02) during 12-14 March 2009, to commemorate the Golden Jubilee Year and Centenary Year of the respective institutions. The Chief Guest Dr K Radhakrishnan, Director, Vikram Sarabhai Space Center, Trivandrum, released the Souvenir and delivered the inaugural address. Recalling the contributions of Dr Satish Dhawan and Dr P Neelakantan to wind

tunnel testing in India, he acknowledged the support given by NAL to the space vehicle development of ISRO, from the SLV to GSLV. He remarked that the data from the NAL 1.2 m wind tunnel was world class, as experienced by VSSC through testing of their models in wind tunnels at TsAGI (Russia), AEDC (USA), Boeing (USA) and ONERA (France). Complimenting NAL on the excellent results obtained on the PSLV Chandrayaan mission, he mentioned that the flight data and the wind tunnel data compared well.

Briefing the audience on the future aerospace programmes of ISRO, viz., the GSLV with indigenous cryogenic engine in 2009, Dr Radhakrishnan stated that the Reusable Launch Vehicle and airbreathing propulsion programmes would usher in a new era in space transportation. Dwelling at length on the technological challenges posed in the 'Human in Space' programme, interplanetary explorations and landing on Mars in 2030, he highlighted that safety and reliability in the case of human missions would



National Conference on Wind Tunnel Testing in progress

have to be 0.99, demanding very high accuracies and reduced dispersion levels of measurements in wind tunnels. Referring to the new hypersonic wind tunnel being developed at VSSC, Trivandrum, he mentioned that it would soon be commissioned and invited the wind tunnel community to hold the next NCWT at Trivandrum.

Prof. Balaram, Director, IISc released a Directory of Wind Tunnel Test Facilities in India and recalled that the Open Circuit Wind Tunnel (OCWT) at IISc, which also completed 50 years this year, is synonymous with HAL and Indian Aerospace. Dr A. R. Upadhya, Director, NAL, presiding over the function, recalled that some of the technologies developed around the 1.2 m wind tunnel in NTAF were unique to blowdown type wind tunnels and pointed out that the

challenges posed by the future aerospace programmes of the country have necessitated further development of advanced test techniques.

The 3-day Conference featured 11 invited speakers and 19 contributed papers. The invited speakers stressed the importance of wind tunnel testing and relevance to flight. Comparing data from the 1.2 m wind tunnel to the flight data on the LCA, Dr K P Singh, Outstanding Scientist, ADA, Bangalore, stated that the tunnel data compared well with data from other wind tunnels as well as flight data.

About 120 delegates from various R & D establishments, Academia and undergraduate students participated. The topics covered aeroelasticity, industrial aerodynamics, unsteady and steady

flows from subsonic to hypersonic Mach numbers, balance and support system design, controls development, concepts for aerodynamic database management, etc. Panel discussions were held at IISc on 14<sup>th</sup> March on three topics. First, the formation of a Wind Tunnel Association of India (WTAI) to provide a national forum for wind tunnel owners, users, academia, the AR&DB and the Aeronautical Society of India. Secondly, A Standard Model for Tests in All Wind Tunnels in India and the third topic on The Need for a Large Size Low Speed Wind Tunnel to study the performance of full scale aircraft prototypes. Lively discussions were held on these topics, with inputs from all the major facility owners, users and academia. The community overwhelmingly supported all the three ideas proposed.

## Conference on Scholarly Communication in India in the Age of Commons (Open Access) at NAL

Open Access (OA) to the scientific literature means the removal of all barriers including copyright restrictions of publishers for providing free access to research output to wider populations accessing scholarly work. In today's knowledge based society, the advent of Internet with a widespread and easy access to scientific information are facilitating research and innovation. Open Access is not only changing the nature of scholarly communication but even the way research is carried out. Indeed open

access is becoming the bedrock on which the emerging global research is being built. OA has now reached the common mass to make research more visible, open and productive.

The Information Center at the National Aerospace Laboratories (NAL), Bangalore, hosted one-day conference on 'Scholarly communication in India in the Age of Commons (Open Access)' in collaboration with Indian Academy of Sciences (IASc) and Center for Internet and Society (CIS) on 26 March 2009 to address the issues

and problems facing this movement especially in the Indian context and find suitable solutions and steps to be taken at various levels. More than 250 delegates from academic/research community, librarians, IT professionals from corporate sector and publishing industry participated in the conference.

The programme commenced with a welcome address by Dr I. R. N. Goudar, Head of Information Center at NAL. After giving a brief background about the event he introduced the Chief Guest of the



## Conferences

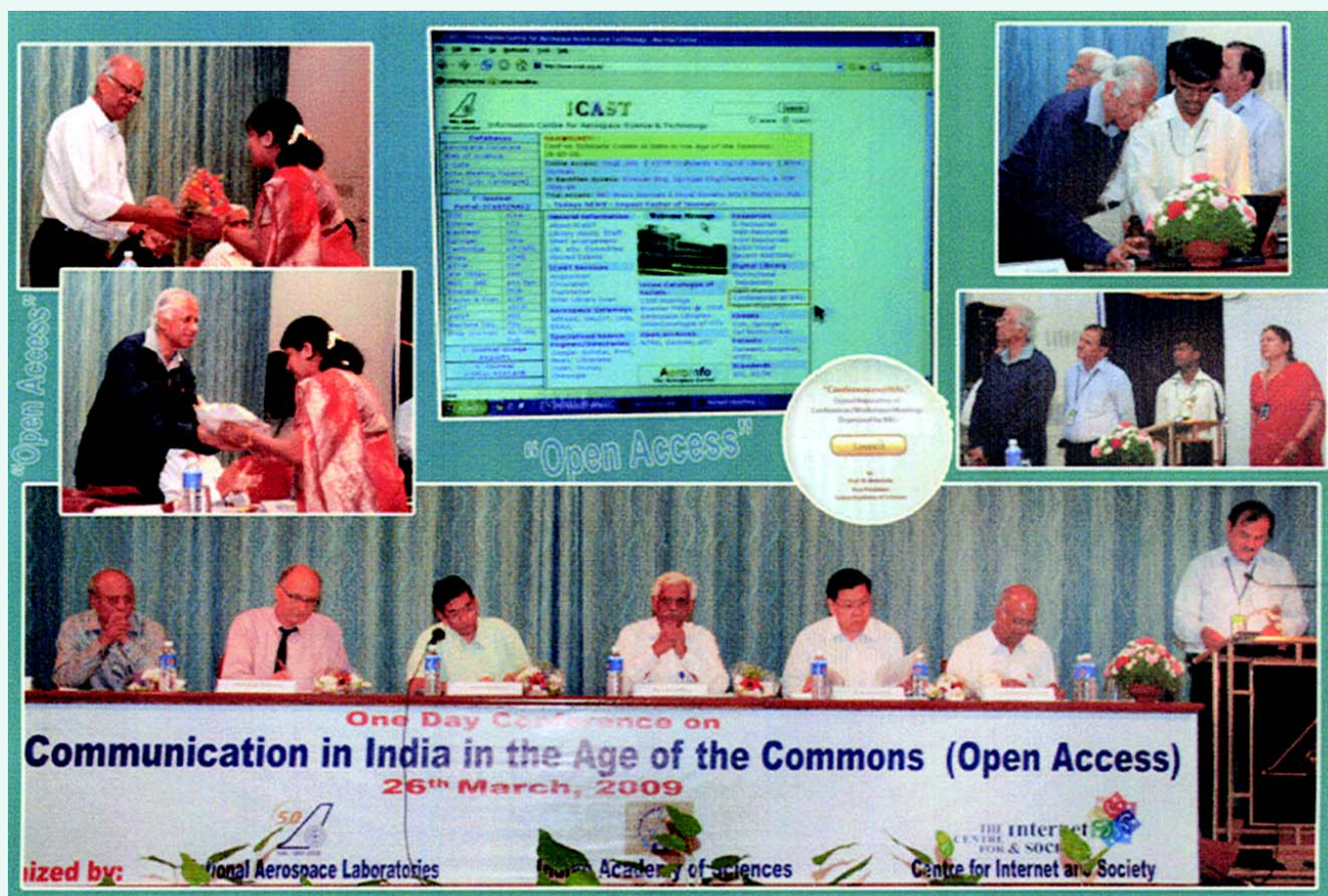
Inaugural function, Prof. N. Mukunda, Vice President, IASc. Prof. Subbaiah Arunachalam, the main person for initiating this conference, briefed the audience about the theme and the programme details.

Dr A. R. Upadhyya, Director, NAL, in his presidential remarks stressed on the point that information should be made available to anyone, anywhere and at anytime. The open access is transforming scholarly communication and has brought new opportunities and challenges for scholars, researchers, publishers and the funding agencies. He opined

that it has been an established fact that the open access apart from increasing citations to publications, increases the visibility, enhances the institution's prestige, usage and the impact of researcher's own findings. In this regard, he made a mention about the Institutional Repository, the second biggest in the country already set up at NAL few years back with nearly 3000 scholarly publications by its scientists. While appreciating NISCAIR's efforts, one of NAL's sister laboratories, for making its publications OA, he called upon the other CSIR labs to follow suit. His advice to the professionals was 'must chalk out a

road map, action plan and move on'.

The next item was the inauguration of the Digital Repository of conferences/seminars etc. set up at ICAST. Dr Poornima Narayana made a brief presentation about the repository's salient features, its contents and the status. The repository covers all events held in the conferences/seminars/symposia, workshops, meetings, lectures, etc., hosted/organized by NAL. The Chief Guest, Prof. Mukunda inaugurated the repository by clicking a mouse resulting in show-off important screen shots of the repository run through a Flash program.



A view of different sessions of the conference

Prof. Mukunda delivered the Keynote Address on 'Journals, Open Access, Copyright and Repositories: Some Viewpoints from an Academy'. He gave a brief background about IASc's efforts in making their in house publication *Pramana*, the first journal to become Open way back in 1998 and at present all the ten journals have been made Open on the Internet. He also mentioned that the Academy had signed the Berlin Agreement. He cited the renowned scientist Charles Darwin (whose draft proposal on origin of Species was kept for nearly two decades). He raised certain issues regarding the current journal crisis, like 'Who pays the cost of research publication' (Einstein Dilemma) and solutions to overcome these issues. He emphasized the number of research publications and the difficulties to get the full text articles which are under the clutches of copyrights. Stressing the need for setting up of more Institutional Repositories as means of a prominent OA channel, he lauded the OA Movement and especially its advent in India. He further stated that the Academy intends to reach its estimate of >70,000 publications right from the Academy's inception from 1934 till date. He concluded his speech saying 'Authors have more right than publishers'.

In the conference, Prof. John Willinsky from Stanford University spoke on 'Global and Local Support for Making Research and Scholarship Publicly Available'. He spoke on the implications of openness and research publication

of openness. He expressed his pleasure being in India and Indian scientists promoting attitude towards OA. Quoting the example of Agropedia, the open access online resource, he emphasized the fact that open access is part of the history of science and now it is a basic human right. He also spoke about the advantages of using PKP's Open Journals System for publishing journals.

Dr D. K. Sahu, the next speaker from Medknow Publications spoke on 'Economics and Citation Impact of Open Access Journal Publishing in India: An Experience of Eight Years and Eighty Journals' and provided ample data to show how open access for journals is a win-win all the way. He listed seven myths about open access and highlighting the advantages of going open access.

Prof. Leslie Chan of University of Toronto spoke on, 'From Institutional Repositories to a Global Knowledge Commons'. He pointed out how OA enables peer-to-peer sharing, networked information economy and highlighted the user driven innovations, dissemination of information through philanthropy. He cited the examples substantiating the major advantages of adopting OA and also of a few harvesting archives in the world.

Mr Sunil Abraham of CIS spoke on 'Academic and Scholarly Communications in India: Copyrights Law Patent Law and PUPFIP' covering issues on copyright, the rights of authors, and the tremendous weaknesses of a bill before the Indian Parliament.

He explained the implications of Protection and Utilization of Public Funded Intellectual Property Bill (PUPFIP) which covers all research done in pursuance to government grants.

The highlight of the conference was the panel discussion on 'Scholarly Communication and Openness: Emerging Trends' effectively moderated by Prof. P. Balaram, Director IISc. The panelists were Prof. Willinsky, Prof. Chan, Dr Upadhyya, Mr N. V. Satyanarayana, CMD, Informatics and Prof. Subbaiah Arunachalam. Prof. Balaram opined that for authors, contribution in reputed and high impact journals is the main concern without getting into any legal problems like copyright. Mr Satyanarayana spoke about the publishers' attitude. Prof. Willinsky stressed the importance of IRs as the major OA channel which should be set up in every institution. Dr Upadhyya viewed that success of OA movement will depend on government policies and OA gives freedom for users than publishers and authors. He also opined that IRs are first hand information for providing scholarly communication.

Prof. Chan dealt with various issues for policymakers in making publications OA. Prof. Arunachalam said that National Knowledge Commission has to take initiatives to popularize OA implementation in the country.

The conference ended with vote of thanks proposed by Dr M. N. Satyanarayana, Convener GJC, NAL.



### Seminar on Non-Destructive Evaluation at NAL

As part of Golden Jubilee year of the National Aerospace Laboratories (NAL), Bangalore, Advanced Composites Division (ACD) of NAL organized a one-day seminar on 'Non-Destructive Evaluation (NDE) : Advances in NDE for Composites (SNDE-09)', on 27 April 2009.

Inaugurating the seminar, by Mr B.N. Misra, Executive Director (LCA & ASC), Hindustan Aeronautics Limited (HAL), Bangalore appreciated NAL for its contribution to LCA programme. Dr A.R. Upadhyaya in his Presidential Address, assured HAL that NAL with the help of TAML, Bangalore, will be able to support HAL in delivering LCA parts required for the future programmes. Dr M.R. Madhava, Head ACD, delivered the plenary talk on 'NDE of Composites', in which, he brought out clearly the important role played by NDE in qualifying LCA and SARAS components.

The Inaugural programme was followed by two technical sessions. The first session was chaired by Mr M. Subba Rao, TAML, Bangalore and the second, by Dr B.R. Somashekar, NALTECH, NAL, Bangalore. There were six invited talks on current NDE techniques, namely, i) Acoustic wave based methods of SHM for composite structures; ii) Emerging trends in NDE of composites; iii) Guided ultrasonic wave techniques; iv) Optical NDE methods; v) Advanced NDE methods for spacecraft structural components; and vi) NADCAP road map; delivered by the following eminent personalities: Prof. C.R.L. Murthy, Department of Aerospace Engg. IISc., Bangalore, Dr J. Lahiri, ASL, Hyderabad; Prof. Krishnan Balasubramaniam, IIT-Madras, Chennai; Dr Annamalai Pillai, VSSC, Trivandrum; Sri M. Venkateswara Rao, ISAC, Bangalore; and Shri K. Chandran, CMD, HAL respectively.

The interactive session 'Way Forward' was chaired by Prof. C.R.L. Murthy, Department of Aerospace Engg. IISc., Bangalore.

Around 50 NDE practitioners from NAL, HAL, IISc., ASL, ISAC, TAML, ADE, ADA participated in the seminar. They also actively participated in the interactive sessions. The seminar provided forum for the participants to gain exposure to advanced NDE techniques for composite applications. It is anticipated that the interactive session would help to enhance the capabilities of existing NDE set-up by reducing the cost and time of inspection.

### International Field Workshop on Gold Metallogeny in India

The National Geophysical Research Institute (NGRI), Hyderabad, and the Department of Geology, University of Delhi, jointly organized an International Field Workshop on 'Gold Metallogeny in India' from 3-13 December 2008. A total of 40 research scientists and students representing 11 academic and research institutions, two geological organizations (GSI and USGS), and six exploration companies (Ivanhoe-Australia; HGML-India; Baldota Group-India; FIMI-India; Pebble Creek Mining Ltd-Canada; Newmont-Australia), actively participated in the Conference-cum-Field-Workshop. The Workshop format featured a two-day Opening Conference at NGRI, Hyderabad, followed by field trips to the Precambrian greenstone belt hosted by Hutti Gold Mines limited (HGML) and Kolar Gold Field (KGF) in Karnataka, and to the Proterozoic sedimentary rock-hosted Bhukia Gold Prospect in Rajasthan. The Workshop ended with a one-day Concluding Session at the University of Delhi, New Delhi.

The Opening Session held at NGRI, was inaugurated by Shri Shantanu Consul, Secretary to the Ministry of Mines, Government of India. Dr V.P. Dimri, Director, NGRI, welcomed the delegates in the presence of Dr V. Manjula, Managing Director, Hutti Gold Mines Ltd., Prof. M. Deb and Dr V. Balaram (Workshop Conveners). In his Inaugural Address, Shri Consul appreciated the efforts of the organizers in bringing together leading Indian



Prof. M. Deb, University of Delhi; Dr V. P. Dimri, Director, NGRI; Shri Santanu Consul, Secretary, Ministry of Mines, New Delhi; Prof. Richard J. Goldfarb, US Geological Survey, Boulder; Dr V. Manjula, MD, Hutti Gold Mines, Bangalore and Dr V. Balam, Scientist G, NGRI are seen on the dias during Inaugural Function

related to gold metallogeny in India.

The field studies commenced with a visit to the deepest part (2400' level) of the greenstone-hosted Hutti lode gold deposits, and the adjacent smaller satellite open pit gold mine at Uti being operated by HGML. A visit to the famous Kolar Gold Field near Bangalore, was utilized

geochronologic database;

- Need for reconstruction of granulite metamorphic facies terranes in exploration programs;
- To provide research facilities and funding for geochronological and other state-of-the-art instrumental analytical facilities for advanced geochemical studies;
- Need for encouragement and support from local government for fostering interest in exploration by private companies through timely action and total transparency in granting of mining leases by the local state governments;
- Need for coming together of industry and government, and support exchanges of information;
- Conducting advanced field and laboratory-oriented courses in the curriculum to reverse the trend of the general lack of interest in economic geology are required;
- Specialized short courses and workshops to be held on different related topics each year to aid young scientists in India; and finally
- A specialized institute to be developed to focus on the study of all aspects of gold geology through government and industry collaboration. International experts with different metallogeny expertise to be invited to such an institute on a regular basis to facilitate interaction between young and budding Indian and international scientists.

economic geologists for identifying new ore deposits, formulating strategies for implementation of suitable mining and extraction strategies by which India could improve upon its continued low gold production in the forthcoming years. Dr Dimri, in his Welcome Address, stressed on the important role of the research institutes by providing fundamental and basic information to help in reversing the present day low-tonnage gold production in the country. Dr Manjula urged the researchers and academicians in suggesting suitable multidisciplinary and modern exploration techniques for locating new and hidden gold mineralized zones within the country. The academic part of the workshop commenced with presentations of papers by participants from India and abroad on themes such as global perspectives on the nature of orogenic gold deposits in different countries, review of the present-day Indian gold mining industry with emphasis on the Dharwar Craton of southern India, as well as key issues

to view the surface expression of the mafic volcanic rock stratigraphy that hosts the world-class gold and sulfide-rich quartz lodes, some of which were mined to a depth of more than 10,000' in the past. The field trip ended with a visit to the Bhukia gold prospect located in the Aravalli Craton in southern Rajasthan.

The concluding session, held at the University of Delhi, included presentation of papers on gold metallogeny in the eastern and central Indian Cratons as well as a few deposits within the greenstone belts of the Dharwar Craton.

Important recommendations that emerged were:

- Reinventing the ore mineralized zones in a more regional context by understanding the regional structures and their kinematic history and geophysical data acquisition for locating favourable structures;
- Need for evaluating both metamorphic and magmatic fluids, and developing a robust



### INDIA-IIASA Training Workshop on Mathematical Modelling

A five-day training workshop was held during 23-27 February 2009 at the National Institute of Science Technology and Development Studies (NISTADS), New Delhi, in collaboration with International Institute for Applied Systems Analysis (IIASA), Austria and Technology Information, Forecasting and Assessment Council (TIFAC), New Delhi.

The inaugural session was chaired by Prof. Kirit S. Parikh, Member, Planning Commission. In his Welcome Address Dr P. Banerjee, Director, NISTADS, called Prof. Parikh as the pioneer of Mathematical Modeling in the country, and highlighted the contribution of Prof. Parikh in the field of energy. Prof. Parikh has been actively involved in framing the Energy Policy of the country and had worked extensively in developing various energy related models. The chapter on 'Energy' in the Planning Commission document was framed under the guidance of Prof. Parikh. Prof. Parikh, is the Founder Director of Indira Gandhi Institute of Development Research (IGIDR), Mumbai, and also Head of the National Committee of TIFAC, a National Member Organization (NMO) of IIASA. Dr Banerjee also spoke about the background of the training programme and how the idea was conceived between TIFAC and NISTADS. He then invited Prof. Parikh to Chair the Inaugural Session and deliver his Keynote Address.

Prof Parikh spoke about the history of constitution of International Institute for Applied

Systems Analysis (IIASA), a non-governmental research institute founded in 1972. At first the member countries were from the developed world e.g. Eastern Europe, Russia and USA. IIASA conducted policy-oriented research into problems that were global in nature, too large or too complex to be solved by a single country or academic discipline. Prof Parikh felt that to solve global problems one should have perceptions about the problems in developing countries as well. Thus, inclusion of developing countries in IIASA's list of member countries was essential. After a lot of effort, finally two years ago India was enlisted as a member country and TIFAC, the National Member Organization (NMO). As a step forward of such an association, interaction was necessary and this was the main idea behind the training workshop, which was attended by considerable number of young research workers.

Talking about the importance of modelling, Prof. Parikh laid emphasis on how modelling helps in policy analysis. He also explained the concept of 'Systems Analysis', which is quantitative and multidisciplinary in nature. It is the idea to look at things in a broader prospective by posing questions. Prof. Parikh then introduced the various types of mental and formal models. He described mental model as the experience integrated in the context of theory whereas formal models were the theoretical/empirical quantitative models. In this context he referred to Joseph Stiglitz on 'Commodity Stabilization'.

Prof Parikh also explained structural model, econometric model, normative model and laid stress on choosing the parameters for modeling in the right manner. The selected parameters, should be able to describe the real situation. He thus gave overall idea of modelling highlighting various type of models. Emphasizing the necessity of models, Prof. Parikh highlighted the issue of climate change, which needs to be addressed globally. As climate change is associated with water availability, modelling plays a key role in determining various changes, e.g. change in the kind of crops/cropping pattern, to overcome the situation. Prof. Parikh concluded by emphasizing the need to bring together young researchers who can work on mathematical modelling.

Prof. Marek Makowski from the Systems Research Institute of the Polish Academy of Sciences mentioned about his long-term relation with IIASA since he joined the institute in 1987. He is currently the Project Leader of the Integrated Modelling Environment Project. He spoke about his experience in modelling 'similar problems in a different way' or 'different problems in similar way'. So, there is no single recipe for a particular problem, and called for learning from each other's experience.

Dr L. P. Rai, Coordinator of the workshop, gave the vote of thanks. He talked about the important role mathematical modelling plays in natural and social sciences. He mentioned that the workshop was possible with the blessings of Prof.



Kirit Parikh and due to collaboration with IIASA. He thanked Dr P. Banerjee, Director, NISTADS, who had taken interest and given valuable suggestion from time to time for the workshop. Lastly, he thanked the 30 participants from reputed institutes who had come to attend and mentioned about the excellent response received for participation in the workshop.

The Inaugural Session was followed by several rigorous training sessions during the five days. The first training session was an interactive session in which the participants introduced themselves and expressed their expectations from the training programme. In the following sessions lectures were delivered by Prof. Marek Makowski on, Modelling Primer I & II, Good Modelling Practice and Structured Modelling Technologies; Dr L. P. Rai on, Introduction to Mathematical Modelling, Innovation Diffusion Model, Technology Substitution Model and Growth Models; Prof. Karmeshu on, Monte Carlo Method; Prof. Pami Dua on, Econometric Modeling and Forecasting; and Prof. R. Raghava on, Atmospheric Prognosis evidenced by Beautiful Charts and Graphs. In between, participants were provided hands-on training using various software-based mathematical modelling. Prof. Marek practically trained the participants on Multi-Criteria Analysis with Illustrative Applications. The professionals from SYSTAT gave hands-on training software for the mathematical modeling. Participants thus gained both theoretical and practical knowledge. Frequent brain storming sessions were also a part of the

programme.

On the last day, the last session was a “Question-Answer session/ Feedback Session”. The session began with a small explanatory note by Dr Marek, who explained that the course was moduled in a general way for a heterogeneous group, so that everybody could be benefited. He then asked for suggestions, and based on the feedback, said that in the next workshop specific problems would be addressed based on the interest of the participants. He explained the possibility to join IIASA in different schemes like YSSP, Post Doc. Programme, etc. He also emphasized on the quality of the research proposal that should be submitted to avail these opportunities. The participants expressed that the workshop was very useful and urged to organize more of such workshops, which would concentrate more on problems, diffusion modelling, ecological modeling, etc. Some were more keen to have pre-course material for next workshop. Some good suggestions were also made on demonstration and making online groups for the participants. Dr Rai and Dr Marek promised to consider all the suggestions while organizing future workshops. In between Mr Manish from TIFAC summarized the whole programme on behalf of TIFAC and welcomed all participants for joint proposal (along with IIASA) of research for near future.

Certificates were distributed to the participants in the presence of Dr P. Banerjee, Director, NISTADS, Prof. Marek Makowski and Dr L. P. Rai. The programme ended with a vote of thanks by Dr P. Banerjee.

## Training Programme on Appropriate Rural Housing Technologies

The Central Building Research Institute (CBRI), Roorkee, organized the first training programme of its kind on Appropriate Rural Housing Technologies during 19-20 February 2009, jointly with North East Institute of Science & Technology (NEIST), Jorhat, at NEIST Campus. The programme evoked a very good response from Civil Engineers of the District Rural Development Agency of North-East State, M.E.S., Professionals and NGO's. Forty two Construction Engineers and Masons from M.E.S., State DRDA, Contractors, Faculty of Engineering Colleges and NEIST attended the training programme. Meghalaya Council of Science & Technology, Shillong, also deputed three NGOs to participate in the training.

Dr P.G. Rao, Director, NEIST, inaugurated the programme, which was attended by over 200 scientists, special invitees and participants. In his inaugural speech, Dr Rao appreciated the efforts of CBRI for taking an initiative for transfer of technologies developed by CBRI to the field level and thanked CBRI for selecting Jorhat the place for the first of such efforts in this region. Dr Rao



## Training Programme



Shri S. G. Dave, Scientist G, highlighting CSIR-RSWNET programme and training activities

further assured to extend full cooperation of NEIST for the organization of such practical programmes in all states of NE region. He informed that R&D efforts of CSIR scientists can benefit a large number of rural and tribal people in making their life more healthy and comfortable. Construction of rural houses using appropriate technologies may help in making the houses for BPL families both economical and durable.

Shri S.G. Dave, Scientist 'G' and Nodal Officer CSIR-RSWNET Programme, CBRI, Roorkee, narrated the importance and background of the Project. He also briefed on outcome of earlier programmes and their impact at those places. Shri Dave explained the two days training schedule and informed about the special efforts made by CBRI Scientists for better understanding of these technologies by the local engineers and masons.

trainees and highlighted the importance of such programmes in North East Region. Two technical publications, viz. *Gramin Bhavan* and *Appropriate Rural Housing Technologies*, specially compiled and prepared for skilled workers and engineering community, were released by the Director, NEIST in the Inaugural Session. The training included technical deliberations, discussions and demonstration of CBRI technologies on: Improved Building Materials and Construction Technologies, Efficient Planning and Design, Earthquake Resistant Features, Rural Sanitation, On-site Tests and Quality Control, and Ferrocement Technologies. The deliberations were mainly focused on: Precast Stone Masonry blocks, Cement Concrete Blocks, Pre-cast RCC Roofing Components, Planks and Joists, L-panels, Brick Panels and Joist, Earth Quake Resistant Features in zone five, Improved

These include Mud House Technologies, Plinth Protection, Non-erodable Mud Plaster, Fire Retardant Thatch Roof, Two pit Toilet Sanitation, Wastewater Disposal System, Improved bricks from inferior soil, Ferrocement products and technologies and Samagri evam Taknik (in Hindi) .

During the programme, CBRI processes and technologies were displayed through charts and models. The precast concrete and ferrocement technologies, NEM plaster, EQ resistant technologies, planning, orientation and designing of rural housing has generated a considerable debate and interest among the trainees. The technical video films on CBRI overview and Innovative masonry blocks were also screened.

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On the second day, a special interactive session was arranged in which trainees discussed typical housing problems of North-East regions with the CBRI faculty. The trainees from Meghalaya requested the faculty to organize such programme near Shillong for the benefit of NGOs. They informed that Meghalaya Council of Science & Technology is associated in promotion of low cost housing programmes through a team of NGOs. These NGOs are working on field level training and also for model constructions of rural houses all over the state. Following the training from CBRI, these NGOs with the support of Meghalaya Council of S&T, may work as resource persons for field implementation of CBRI technologies for construction of low cost houses in the State of Meghalaya.



## UNU-MERIT-NISTADS-CDS Training Programme on 'Design and Evaluation of Innovation Policy for Developing Countries (DEIP)'

A Training programme on Design and Evaluation of Innovation Policy for Developing Countries (DEIP) was organized at the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, jointly with United Nations University-Maastricht Economic and Social Research and Training Center on Innovation and Technology (UNU-MERIT), Maastricht, Netherlands, and Centre for Development Studies (CDS), Trivandrum during 02-07 February 2009. The objective of the programme was to acquaint participants about the design of innovation policies and evaluation of the effectiveness of the policy instruments using science, technology and innovation indicators of both conventional and non-conventional varieties.

The programme dealt with policy design issues, besides issues and techniques related to the monitoring and evaluation of innovation policies by providing a common platform for experts, policy makers and researchers for interacting and exchanging their ideas and views on National Innovation Policy (NIP), Intellectual Property (IP), and constraints of Research and Development (R&D) specially designed for developing



Address by Prof. Adam Szirmai

countries. More than 60 participants attended the programme. They were from different organizations; UNU-MERIT and Franzen/Partners, Netherlands, Ministry of Science Technology and Innovation (MOSTI) Malaysia and TIFAC, FICCI, DST, MoES, Universities, CSIR, NGOs and Industry from India. The core faculty for the programme comprised Dr Parthasarathi Banerjee, NISTADS, Prof. Adam Szirmai, Prof. Micheline Goedhuys, Prof. Pierre Mohnen, Prof. Claire Nauwelaers, Dr Padmashree Gehl Sampath, UNU-MERIT; Prof. Rakesh Basant, IIM, Ahmedabad; Prof. Sunil Mani, CDS, Trivandrum; and Dr Rajeswari Raina, CPR, New Delhi.

Inaugurating the programme, Dr Parthasarathi Banerjee, Director, NISTADS, emphasized on the need to strengthen National Innovation System (NIP). During the training programme several

contemporary issues and problems and their possible solutions were discussed. Dr Banerjee stressed on the need to improve infrastructure for innovation (incubators, government research institutes, standards distribution), nature of geographic specialization with decentralized regulative institutions. Dr Szirmai dealt with the issues of labour productivity, shifts in

global leadership and increase in global inequality. He argued that catch up in modern globalised International order is closely linked with technology diffusion and technology acquisition. Prof. Claire talked about future challenges for innovation policies and interface between traditional and new innovation policies with comparative references from developed and developing countries stressing on benchmarking evaluation. Also she underlined the combination of policy instruments, which interact to influence the quantity and quality of R&D investments in public and private sectors.

Prof. Basant advocated for Creation of Innovation Based Enterprises to gain benefit of IPR regime in India. Prof. Sunilmani talked about growth of innovative activity in developing countries and growing importance of Brazil, China



## Honours & Awards

and India as R&D spenders. He also discussed the importance of measuring of innovation to improve competency in R&D in developing countries. Prof. Mohnen supported this view by increasing R&D intensity. The other issues discussed during the programme were: brain drain, mobility of human capital, cluster networking in innovation system and the role of R&D in economic growth. Case studies were presented by the participants wherein role of R&D clusters, incubators, public-private partnership in R&D and role of ICT in economic growth were discussed extensively. In their concluding remarks Dr Banerjee, Prof. Adam Szirmai, and Prof. Sunilmani, emphasized on conducting such programmes more frequently in the developing countries to cope with future challenges in NIP and related issues.

### The Great Son of India Award to Shri G. K. Prasad

**S**hri Gyanendra Kishore Prasad, Senior Hindi Officer of Central Mining and Fuel Research Institute (CMFRI), Dhanbad, has been awarded the 'Great Son of India' Award-2008 of the Research Council of Outstanding Achievers, for his outstanding long services to the cause of promoting Hindi in the field of S&T besides other notable contributions towards Hindi implementation. The award, comprising a shield and a certificate of merit was given to Shri Prasad by the Minister for Science & Technology and Earth Sciences, Shri Kapil Sibal.



### Plants & Environmental Pollution (ICPEP-4)

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**Dr Rakesh Tuli**  
Director NBRI &  
President ISEB  
E-mail: dofficenbri@sify.com

**Dr K.J. Ahmad**  
Secretary, ISEB &  
Organizing Secretary  
ICPEP-4  
E-mail: isebnbrillko@sify.com

**Dr R.D. Tripathi**  
Scientist, NBRI &  
Organizing Secretary  
ICPEP-4  
E-mail: tripathird@gmail.com

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Contact

**Organizing Secretaries, ICPEP-4**  
National Botanical Research Institute  
Rana Pratap Marg, Lucknow-226001, India  
E-mail: isebnbrillko@sify.com  
URL: <http://isebindia.com>

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Phone: 25846301; Fax: 25847062; E-mail: [bck@niscair.res.in](mailto:bck@niscair.res.in); [meenakshi@niscair.res.in](mailto:meenakshi@niscair.res.in); [vineeta@niscair.res.in](mailto:vineeta@niscair.res.in); Website: <http://www.niscair.res.in>

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