

IIT-MADRAS NEWS



QUARTERLY REPORT OF ACTIVITIES AT IIT-MADRAS

Vol. 14 No.2

April 2010



Prof M.S.Ananth, Director welcoming distinguished visitor Prof.Charles M Vest, President of the National Academy of Engineering, USA to IIT Madras (News and more pictures in page 9)

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From the Desk of the Director

The major events during this quarter were the visit of Prof. Charles Vest, Emeritus President, MIT and the students cultural festival Saarang.

Prof. Charles M. Vest, Emeritus President, MIT and President, National Academy of Engineering, USA visited IIT Madras on January 20, 2010. He spoke about the challenges to engineering education in the 21st century. His talk provided the background for the launch of the Strategic Management Plan 2020.

Saarang was inaugurated in style on the 21st January with Dr. Balamuralikrishna's concert. The special popular and cultural lecture series by Kamal Hassan, Gowtham Menon, Sabu Cyril, Kavita Seth and others was a huge success. As per the tradition established in 2005, for the sixth year in succession, Saarang decided to donate a sum of Rs.8.3 lakhs (Choreo Nite Collection) as Charity to the following institutions identified by the Atma Charity Wing of Ladies Club, IIT Madras: Sri Matha Trust, Adyar; Gnana Deepam Special School, Pammal; Avvai Home & Orphanage, Adyar; VHS Diabetes Department, Taramani; Anbu Thondu Nilayam, Chengleput; Tribal Health initiative, Sittilingi, Dharmapuri Dist.; Prajwala, Hyderabad and Atma Charity Wing, IIT Madras.

This newsletter also outlines the research of Prof. Shanthi Pavan, Department of Electrical Engineering who was recently awarded the Swarnajayanthi Fellowship for the year 2009. It also has a write up about the National Centre for Catalysis Research, which is a unique centre set up by the Department of Science & Technology in IITM. Their research activities include a catalytic conversion of bio-glycerol into value-added chemicals, catalytic conversion of carbohydrates to key platform chemicals, catalytic oxidation of long-chain linear alkanes, hydrogen storage, ordered nanoporous titania, high surface area alumina, carbon material from natural sources etc.

During the last quarter under review 118 consultancy assignments and 44 sponsored projects for a total value of Rs.919.43 lakhs and Rs.2469.18 lakhs respectively have been undertaken.

Prof. M. S. ANANTH

Saarang 2010

Saarang, the annual cultural extravaganza of IIT Madras, started off on the 21st of January with an inauguration ceremony in the Open Air Theatre (OAT). Renowned Carnatic singer Padma Vibhushan Dr. Balamuralikrishna lit the lamp with Prof. M.S. Ananth, Director and Prof. M. Govardhan, Dean (Students), marking the start of the festival. The evening commenced with the first of the Professional Shows, the Classical Night, with Dr. Balamurali Krishna's performance followed by a stage show by the Daksha Seth Dance Company.

Saarang, this year, for the first time, had a QMS team, which proved to be of great importance.

Saarang had a lot of Spotlight events this year, with a few aimed at Corporate Social Responsibility and the empowerment of the youth. One of the major draws was the Habitat Youth Visionary Award (HYVA) 2010. HYVA is one of the most prestigious youth awards in the country and the semi-final for the south zone were held on 20th January in IIT Madras. Ten students were short-listed from over 150 applicants and had to present their vision about the nation in the presence of a jury in the IC&SR Auditorium. The event gave opportunity for participation from varied backgrounds as short-listed candidates belonged to fields ranging from engineering to law, economics and commerce.

In order to give back to the society, Saarang 2010 partnered with Volunteer giving everyone a chance to work with numerous NGOs across the country. Saarang Impact allowed people to help in whatever way they could, from teaching under-privileged kids to helping in a NGO working for animals.

Saarang Essence was a three day Youth Summit, aimed to shape future leaders through constructive discussions and interactive workshops, and lectures by speakers like Arun Shourie, who have long been associated with the field of policy making. Twenty four shortlisted entries were invited to participate in the Youth Summit. The summit had a field-visit to provide an in-depth perspective about the actual problems in governance and the participants had to engage in a public debate with a panel of journalists and society activists and were evaluated on the basis of their solutions.



Annual Cultural Festival Saarang 2010 being inaugurated by Dr.M.Balamurali Krishna

A maiden initiative was the Folklore – The Saarang Village in association with the Government of Gujarat. The area was set up with huts and haystacks creating a village like atmosphere. Each of three days culminated with a Food Festival. Dance troupes performed exotic dance forms such as of the Vasava Tribe from the Narmada District.

One event which showed enthusiasm from a huge number of students was the art exhibition called the Dreams on Canvas. Thirty selected applicants were supplied with raw materials like whitewash, dyes and texture materials to decorate the display area given to them. Lectures and workshops by eminent art personalities were conducted and the participants got to interact with them.

The Popular and Cultural Lecture Series were a huge success and were one of the most attended events at Saarang. Lectures were delivered by Kamal Hassan, Gowtham Menon, Sabu Cyril, Kavita Seth and many other popular artists from the field of art, music,

politics and film direction.

The traditional roster of events also drew quality participation with competitions like classical and freestyle solo dance, fine arts events like soap carving and face painting. In addition, Saarang 2010 also saw new events like 2HBC, a street style dance competition and sand sculpture and chocolate making workshops.

The Light Music Professional

show by Shankar Ehsaan and Loy was a grand success and had the best turnout in the last three years. The show started off with performance by Tarang winners. The SEL troop then performed to the likes of the audience with their greatest hit songs in different languages.

Saarang celebrated World Music Festival this year with artistes from Germany, France, U.S and Sweden. In association with the Goethe Institut/Max Mueller Bhavan, Chennai, T. Raumschmiere from Germany, played a unique blend of of Rock and Electro music at SAC on the 22nd as part of the

Mini – Proshows. On the 23rd, a folk band, *Ziskakan* performed at SAC presented by Alliance Francaise de Madras. The Rock Show featured Hurricane Bells from the USA, followed by Hammerfall, a heavy metal band from Sweden which marked the end of Saarang 2010.

Shanthi Pavan wins the Swarnajayanthi Fellowship Award

Dr. Shanthi Pavan, Professor, Department of Electrical Engineering at IIT Madras has been awarded the prestigious Swarnajayanthi Fellowship of the Government of India for the year 2009. The Swarnajayanthi Fellowships were instituted in 1997 to commemorate 50 years of Indian Independence. Under this scheme, a select number of young scientists with a proven track record are allowed to pursue research in frontier areas of science and engineering with generous funding and considerable flexibility. This year, Prof. Shanthi Pavan has been awarded the Fellowship in the Engineering Sciences category.

Prof. Shanthi Pavan works in the areas of analog/mixed-signal VLSI and RF/microwave integrated circuit design. He obtained the B.Tech in Electronics and Communication En-

gineering from IIT Madras in 1995 and the M.S and Sc.D degrees from Columbia University in the City of New York in 1997 and 1999 respectively. From 1997 to 2000 he was with the DSP R&D center of Texas Instruments in New Jersey. He then worked at the high speed electronics group at Bigbear Networks (now Vitesse Semiconductor) in California, before returning to his alma mater in 2002. His graduate research, conducted at Columbia University and Texas Instruments, focused on techniques for implementing high speed programmable analog filters in CMOS technologies intended for digital VLSI.

At IIT-Madras, Prof. Shanthi Pavan has been working on techniques for power-efficient implementation of adaptive equalizers for high speed data communication (operating a several gigabits per second). Conventional

implementations, based in the digital domain, or using transmission lines in the analog domain (which attempt to emulate the operation of their digital prototypes), result in large chips that consume excessive power and become increasingly difficult to realize at higher data rates. Prof. Shanthi Pavan's contribution to this area has been the "Lumped Parameter Equalizer" – which is an analog adaptive filtering and equalization technique suited for microwave speeds. It is a fundamental improvement which is particularly at suited for analog implementation and incorporates innovations in communication, electromagnetics and circuit design. This technique significantly reduces power dissipation and area when compared to prior art. This has resulted in a US patent assigned to IIT Madras. A paper describing this work (Power and Area Efficient Adaptive Equalization at Microwave Frequencies, IEEE TCAS, July 2008) received the 2009 IEEE Darlington Outstanding Paper Award, given to the author(s) of the best paper (bridging theory and practice) published in the IEEE Transactions on Circuits and Systems in the preceding two years. This is the first time since the inception of this award (about 40 years ago), that it has gone to work done in India.



Since 2005, Prof. Shanthi Pavan has been pursuing the design of a family of analog-to-digital converters known as continuous-time delta-sigma modulators. These converters have several attributes that make them especially suitable for realization in low-voltage CMOS technologies. Theoretical studies on various aspects of these modulators have resulted in several contributions to the literature in this area. These studies have also inspired new and improved architectures that dramatically enhance the linearity of these converters – without adding extra noise, while consuming less power. Several high performance converters incorporating these

design principles (achieving best in class measured performance) have been designed and fabricated.

The Swarnajayanthi Fellowship has been awarded for his proposal to investigate the general area of wideband circuits and systems in silicon. Specific focus will be on the design of programmable analog-to-digital converters with embedded filtering and automatic gain control, for software defined radio. Another problem that will be addressed is that of beam forming for ultra wideband signals (in the 3-10GHz band). Broadband beam forming (where the bandwidths can be a significant fraction of the center frequency) is a classic problem in several signal chains – and the techniques have

remained largely unchanged for the past fifty years. Prof. Shanthi Pavan’s proposal aims to investigate new approaches that significantly simplify the implementation of broadband beam formers.

In 2010, Prof. Shanthi Pavan received the Technomenter award from the India Semiconductor Association for excellence in mentoring and research (in the area of VLSI) in the country. In 2009, he was awarded the Young Faculty Recognition Award (YFRA) by IIT Madras for excellence in teaching and research. He also received the Young Engineer Award from the Indian National Academy of Engineering in 2006.

National Centre for Catalysis Research

The National Centre for Catalysis Research (NCCR) was established at the Indian Institute of Technology, Madras by Department of Science and Technology, Government of India in July 2006 with the following mandates as shown in Fig.1.

Since its inception, the Centre has been concentrating on successfully fulfilling these mandates. The main activities of the Centre in the last 3 years are summarised.

1. Academic Activities: The centre has been organising the orientation for research scholars in the field of catalysis. This programme is a unique course for preparing the research scholars for research in this interdisciplinary area of Catalysis. The course has been hailed by the participants and in successive years the demand for this course is increasing. The eleventh course will be held in the month of November 2010. The centre has also brought out successfully three well received monographs originating from this course.

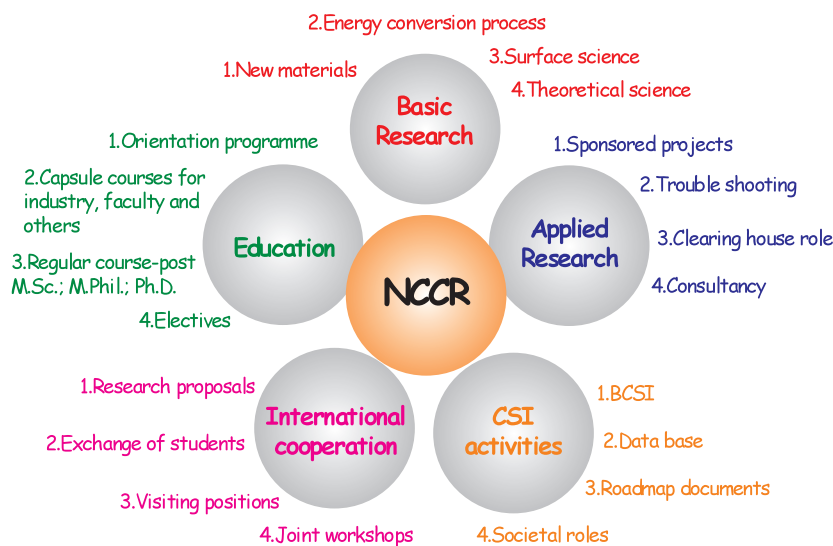


Fig.1. Pictorial representation of the principal activities of NCCR.

The centre has also introduced an M Tech programme in Catalyst Technology, in the year 2009. This is a specialized M Tech programme which can cater to the human resource requirements of Indian Chemical Industry.

The faculty of this centre organizes capsule courses for industries. The faculties of the centre also participate in the academic programmes of other institutions like Anna University, Tezpur University and University of Pune.

2. Research Activities:

NCCR has been engaged in research activities both for government sponsored agencies and also for public and private sector industries. Some of the industrial research programmes handled by NCCR are as follows:

- (i) “Adsorptive desulphurization “ and “End point reduction” sponsored by Chennai Petroleum Corporation Limited
- (ii) Development of alumina with speci-

fied textural characteristics sponsored by Indian Oil Corporation Limited.

(iii) Hydrocarbon traps for Nissan Motor Company

(iv) Development of Chromia Alumina Catalyst for Shriram Fibres Limited

(v) Solar energy induced decomposition of water sponsored by Tata Chemicals Limited.

(vi) Active catalyst development on stainless steel grids for Shell, The Netherlands

The centre has also been carrying out development work as one of the partners of the CSIR mission mode project on the conversion of glycerol to value added products. The Ministry of New and Renewable Energy also has sanctioned a mission mode project to the centre as the nodal agency for development of hydrogen storage materials based on carbon materials.

A number of these projects have been successful at the laboratory scale and are awaiting exploitation.

3. Societal Activities:

The centre is responsible for fostering the Catalysis Society of India, one of the active scientific professional societies of this country. On behalf of the society the centre is bringing out a scientific journal named Bulletin of the Catalysis Society of India and also maintains a web server for scientific documentation in the field of catalysis. The centre also conducts various science programmes on regular basis for the Childrens' Club of Madras.

4. Facilities at the centre:

The centre has developed in this period a well equipped laboratory with various kinds of spectroscopic and catalytic reactors which can be employed for carrying out research in frontier areas in this field. The use of the facilities of the centre is extended to various academic and industrial organizations.

5. International Collaborations:

The centre has established contacts and entered into an MOU with the Catalysis Research Centre at Munich, Centre for advanced Chemical Materials, Kyungpook National University, Korea and National Institute of Materials Sciences, Japan for joint research activities. The centre has also initiated collaborative research programme with Institute of Isotopes, Budapest, Institute of Atomic & Molecular Sciences, Academia Sinica & Center for Condensed Matter Sciences, NTU Taiwan and the University of Sydney, Australia. The centre has proposed joint research programmes with laboratories in China, Russia and European Union,

In the following paragraphs the details of a few of the research programmes undertaken by the centre in the recent past are given.

1.A. Catalytic Conversion of Bio-Glycerol into Value-added Chemicals

Biodiesel is an attractive bio-renewable alternative to petroleum-based transportation fuels. It does not contribute significantly to the greenhouse effect, contains no aromatic species and is free of sulfur. On the other hand, the by-product glycerol from the production of biodiesel may be utilized as a building block that might serve as an important bio-

refinery feedstock. Thus, there is an increasing attention for the conversion of the by-product to value added products. It can be converted to many value added product such as acrolein/acrolic acid, propane diols, glyceric acid/glyceraldehyde through various kinds of reaction (Fig. 2). Conversion of glycerol into such useful products is a challenging catalytic reaction.

Glycerol can be converted into acrolein and hydroxyacetone (acetol) through dehydration and further converted into propane diols through hydrogenation. For example, dehydration of glycerol in the presence catalysts such as silicotungstic acid supported on ordered porous silica shows complete glycerol conversion (100%) with maximum acrolein selectivity (81%).

On the other hand, copper oxide supported on zinc oxide catalyst shows a maximum selectivity (90%) of the intermediate hydroxyl acetone with a glycerol conversion of 45%. Hydrogenolysis of glycerol (Fig. 3) over reduced copper oxide-zinc oxide supported on γ -alumina (HSAI-25) catalyst leads to 88% 1,2-propane diol selectivity with a 55% conversion of glycerol

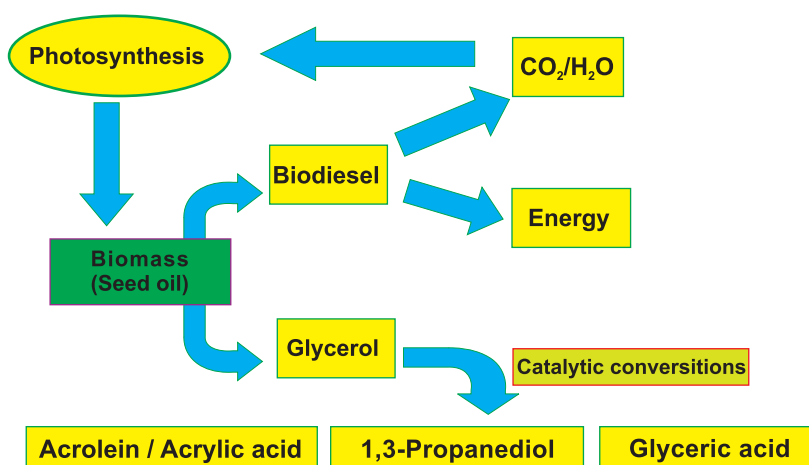


Fig. 2. Conversion of bio-glycerol into useful products.

In the case of the conversion to glyceric acid, the oxidation of glycerol was performed using nano-gold supported carbon. A maximum selectivity of > 90% glyceric acid was achieved with a glycerol conversion of > 70%.

Even though a variety of value added products such as mono isopropyl ether of glycerol can be formed by a catalytic etherification reaction, the formation of any of the products is still challenging. It is also desirable in devising catalytic routes where the selectivity of the most value added product such as mono isopropyl ether of glycerol has to be optimized. The process, for the selective formation of mono isopropyl ether of glycerol, comprises the steps of reacting glycerol and isopropyl alcohol in a reactor with a zeolite catalyst heated in an inert atmosphere at 423-473 K for 6 h. The resulting product, viz., mono isopropyl ether of glycerol (3-isopropoxy 1,2-propane diol), has a selectivity of 80-90% with a conversion of 15-40%, while that of other by products including diether being relatively low.

I.B. Catalytic Conversion of Carbohydrates to Key Platform Chemicals

Cellulose hydrolysis over alumina supported catalysts resulted in 24% yield of sorbitol. On the other hand, *o*-isopropylidene is a central intermediate product for numerous other glucose derivatives which is obtained by the condensation of monosaccharides with acetone. For this purpose, solid superacid catalysts such as sulphated metal oxides as well as sulphonic acid functionalised mesoporous silica were employed for the conversion of D-Glucose into mono- and di-isopropylidene (70 : 30 ratio).

I.C. Catalytic Oxidation of Long-chain Linear Alkanes

Terminally oxidized hydrocarbons, i.e., at the α - or 1- positions, are important feedstocks for the chemical and pharmaceutical industry, but the selective oxidation of only the terminal methyl groups in alkanes remains a challenging task. It is well known that some enzymes are capable of performing selective terminal oxidations. Thus, cobalt and manganese containing aluminophosphate molecular sieves / phthalocyanine Catalysts were successfully employed for the terminal oxidation of long-chain linear alkanes such as dodecane and tetradecane using molecular oxygen.

The centre has also been developing various materials for catalytic applications and many of the new materials have been designated accordingly with IIT specific names. A brief description of these research efforts is given.

II. A. NANOPOROUS MATERIALS

Since its inception, NCCR has developed a series of ordered / disordered nanoporous materials including silicas (IITM-56), aluminas (HSAI-25)(Aluminas) - High Surface Area IIT), carbons (NCCR-1), metal oxides (TMON-75) (Metal oxides) - Transition Metal Oxide NCCR/Nanoporous) for use as catalysts, or catalyst support for a variety of applications.

II.A.1. Ordered Nanoporous Carbon

Porous carbon materials have extensively been employed in variety of applications including gas separation, water purification, catalyst supports, hydrogen storage, and electrodes for batteries and fuel cells. However, the controlled fabrication of ordered nanoporous carbon arrays remains a synthetic challenge to scientists. On the

other hand, the resulting materials possess exotic properties that have been extensively exploited in the material research in the form of nanowire, nanotube and nanocage. They are typically produced using nanoporous hard (silica) and soft (block polymers) templates, e.g., CMK, NCCR, OMC, FDU, etc. These carbons possess high surface area, large pore volume and enhanced mesoporosity that are desirable for electrocatalyst support materials.

It is expected that the traditional systems for energy conversion would be partly replaced by fuel cells in a medium/long term. The most investigated fuel cells are polymeric electrolyte membrane fuel cells using methanol as possible combustible fuel. The commonly used electrocatalyst, both for cathode and anode, is platinum supported on a variety of carbons. However, it is necessary to obtain a more effective catalyst, both in catalytic performance and electronic conductivity. To achieve a higher efficiency of the electrocatalysts, platinum has to be well dispersed on the support thereby a reduction is achieved in active metal content; in addition sintering problems can also be avoided. Nanoporous carbons, designated as CMK-3 or NCCR-1, are excellent candidates for such purpose as these catalyst systems (Pt/CMK-3; Pt/NCCR-1) give promising electrocatalytic activity for methanol oxidation.

It can be seen from Table 1 that Pt/NCCR-1 exhibits higher activity than that of the catalyst prepared using commercial carbon (Pt/CDX-975) or commercial Pt/E-TEK catalyst. As stated earlier, the enhanced activity is due to the better dispersion

and utilization of the Pt catalyst, which originate, respectively, from a higher surface area, large pore volume and oxy-functional groups present in the carbon materials. The study also demonstrates that optimized carbon supports not only exhibit higher current density and low activity loss but also can offer significant cost savings by lowering the extent of catalyst loading.

of 2.7 wt% for CMK-3 at 77 K and 45 bar pressure and 1.9 wt% for NCCR-1 at 77 K and 25 bar pressure was achieved. These results suggest that chemisorption or other chemical storage methods should be combined with physisorption if carbon materials are to be considered for hydrogen storage application.

II. B. Ordered Nanoporous Silica

II.C. Ordered Nanoporous Titania

High surface area nanoporous titanium dioxides (TMON-75) have been synthesized using non-ionic surfactant by hydrothermal treatment. The calcined catalyst possessed mesoporous framework with anatase structure and showed photocatalytic activity about 60% higher than that of commercial TiO₂ (Degussa P25).

II. D. High Surface Area Alumina

High surface area aluminas, (α -alumina (HSAI-25)) in the range 300-400 m²/g were successfully prepared and characterized. Silicotungstic acid supported on α -alumina showed 99 % glycerol conversion with a maximum acrolein selectivity of 54 % for more than 20 h. On the other hand, Cu/ZnO supported on α -alumina exhibited a 55% glycerol conversion with a maximum 1,2-propane diol selectivity of 88%.

III. Carbon Material from Natural Sources

Many hidden treasures of nature have not yet been exploited fully by mankind. Carbon materials are one such age old materials employed for the benefit of mankind in diverse ways though not to its full potential. Activated carbon materials are being used for electrode (super capacitor and fuel cell) fabrication, water purification, hydrogen storage and for the removal of toxic chemicals from water and air. The applications of carbon materials to mankind are diverse.

Owing to the great utility and urgent demand for such carbon materials, has been made significant progress in evolving methods for producing micro porous high specific surface area carbon materials with interesting properties and applications from unconventional carbon precursors like Calotropis

Table 1: Measured activity for methanol oxidation at 0.7 V.

Electrocatalyst [†]	Current density (mA/cm ²)	Activity loss after 3 h (%)
Pt/ NCCR-1 [‡]	69.6	8.0
Pt/ CMK-3 [‡]	93.2	28.0
Pt/CDX-975 [§]	48.2	61.0
Pt/E-TEK [¶]	47.6	47.0

[†]20 wt % platinum on carbon; [‡]Nanoporous carbon; [§]Commercial carbon; [¶]Commercial catalyst.

The ordered nanoporous carbons obtained *via* the template carbonization method, viz., CMK-3, NCCR-1, FDU-17, etc. are attractive for hydrogen storage purpose. These carbon materials exhibit enhanced (and reversible) hydrogen storage capacity. For example, a hydrogen uptake capacity of 2.7 wt% for CMK-3 at 77 K and 45 bar pressure and 1.9 wt% for NCCR-1 at 77 K and 25 bar pressure was achieved. These results suggest that chemisorption or other chemical storage methods should be combined with physisorption if carbon materials are to be considered for hydrogen storage application.

II.A.2. Hydrogen Storage

The ordered nanoporous carbons obtained *via* the template carbonization method, viz., CMK-3, NCCR-1, FDU-17, etc. are attractive for hydrogen storage purpose. These carbon materials exhibit enhanced (and reversible) hydrogen storage capacity. For example, a hydrogen uptake capacity

Ordered nanoporous molecular sieves are special class of materials with ordered arrays of uniform pores, high surface areas and large pore volumes. These periodic surfactant-mediated silica/silica-based materials, designated as MCM-41, MCM-48, SBA-15, SBA-3, etc., are promising for a variety applications including catalysis, adsorption and separation processes. Two most common types involve SBA-15 and MCM-41 and has ordered structures consisting of uniform nanopores. The former possesses larger pores, thicker walls and higher thermal stability as compared to the latter. Therefore, it is of interest to make materials with a combination of moderate pore size and thicker wall structure. The desired characteristics were made possible with the advent of oligomeric alkyl poly ethylene oxide (Brij-56) surfactant template, resulting in a novel silicate material, designated as IITM-56, with a (moderate) pore size of 35 Å and a wall thickness of 24 Å.

gigantea, Borassus flabellifera, Limonia acidissima and Ipomoea carnea. Such an attempt is necessary from economical as well as environment view points.

The carbon materials have been successfully used for the fabrication of fuel cell electrode materials, designing

adsorbents for the sorption of mercury and some typical dye compounds like methylene blue. Commercially available activated carbon materials like Calgon carbon, adsorbent carbon and several others have also been tailored for the removal of organo sulphur compounds for diesel (adsorptive desulphurization).

NCCR is thus poised for a growth and can therefore serve as a useful unit in the activities of IIT Madras in the years to come.

**Dr. P.Selvam and Dr. B.Viswanathan
Centre for Catalysis Research**

Visit of Prof.Charles M Vest

Prof. Charles M Vest, President of the National Academy of Engineering and President Emeritus of the Massachusetts Institute of Technology visited IIT Madras on 20 Jan 2010. Dr. Vest has enormously contributed to the development of science, technology and innovation policy; building partnerships among academia, government and industry; and championing the importance of open, global scientific communication, travel and sharing of intellectual resources. He spearheaded the MIT's launching of Open Course Ware (OCW) initiative; co-founding of the Alliance for Global Sustainability; enhancing the racial, gender and cultural diversity of its students and faculty; establishment of major new institutes in neuroscience and genomic medicine.

He has also served on various federal committees and commissions, including the Presidents Committee of Advisors on Science and Technology (PCAST) the Commission on the Intelligence Capabilities of the United States. He serves on the boards of several non-profit organizations and foundations devoted to education, science and technology.

He spent the whole day at IIT Madras interacting with faculty, administrators and students. Along with Prof.M.S.Ananth, Director, IIT Madras and Dr.Gururaj Deshpande, a Distinguished alumnus of IIT Madras. Dr. Vest visited the Heritage Centre where



Prof.Charles M Vest visiting Heritage Center of IIT Madras

the growth of IIT Madras during the last 50 years are captured and displayed. In the forenoon he had a meeting with Director, Deputy Director, all Deans and Academic Heads of the Institute and discussed on various issues which will be the background for the launch of the Strategic Management

Plan 2020 for IIT Madras. This was followed by his visit to IITM Research Park. Later in the IC&SR Auditorium Prof. Vest addressed all faculty and students of IIT Madras on the topic "Engineering Education in the 21st Century".



Dr.Gururaj Deshpande, Prof. Charles M Vest, Prof. M.S. Ananth,Director and Prof. V.G. Idichandy,Deputy Director - during the discussions.

Institute Industry Interaction

The Consultancy assignment and Sponsored Research projects approved during the year 2009-10 touched all time record of Rs.3031 lakhs and Rs.9538 lakhs respectively.

During the quarter Jan 2010 - Mar 2010, **118** Consultancy assignments and **44** Sponsored Projects were taken up with a total value of Rs. **919.43** lakhs and Rs. **2469.18** lakhs respectively. Some of the major Research Projects/Consultancy assignments approved during the quarter are as follows:

Sponsored Research Projects

Department and Project	Principal Investigator
Aerospace Engineering :Aircraft maneuver design by using bifurcation analysis and nonlinear control techniques	Dr. Nandan Kumar Sinha
Applied Mechanics :Buckling control of cylindrical/conical shells for aerospace applications using PZT actuators	Dr. Lakshmana Rao C
SIMUGLASS: Development of a synergistic computational tool for material modeling, process simulation and optimization of optical glass molding	Dr. Ramesh K
Prediction of 2D and 3D aerodynamic characteristics for unsteady post-stall flow	Dr. Rinku Mukherjee
Biotechnology : Effect of sorghum whole grain diet or sub-components on human health	Dr. Chandra T S
Evaluation of the performance of a recombinant thermostable endoglucanase under Cost effective enzyme immobilized active food packaging	Dr. Mukesh Doble
Studying the proliferation and differentiation potential of an engineered cardiac biomaterial : A natural matrix for cardiac support and regeneration	Dr. Rama S Verma
Identification of novel biomarkers and elucidation of the molecular basis of phenotypic features of fanconi anemia using micro array analysis	Dr. Rama S Verma
Targeting P21 activated kinase 1 (Pak1) signaling in alcohol induced liver cancer	Dr. Rayala Suresh Kumar
Centre for Catalysis Research : AMCOS advanced materials as CO ₂ removers: A computational study of CO ₂ sorption thermodynamics and kinetics	Dr. Viswanathan B
Studies on hydrogen storage in carbon materials	Dr. Viswanathan B
Chemical Engineering : Inkjet printing of conducting polymers for optoelectronic devices - processability and wetting characteristics	Dr. Susy Varughese
Chemistry : Group 4 metal complexes derived from Schiff's base and amide ligand scaffolds: Synthesis, characterization and polymerization studies	Dr. Debashis Chakraborty
Engineering internally functionalized pores derived from cyclic peptides	Dr. Nandita Madhavan
New methods for the synthesis of medium-ring azacycles based on vinylogous carbamates	Dr. Santhosh J Gharpure
Civil Engineering : Development of structural health monitoring for civil infrastructure using smart sensing technologies	Dr. Meher Prasad A
Studies on geosynthetic based erosion control measures along east coast of India between Chennai and Sriharilkota	Dr. Rajagopal K
Advanced Traveler Information Systems (ATIS) for Indian Cities	Dr. Sivanandan R
Computer Science & Engineering : Functional genomics of orphan structural proteome	Dr. Ashish Tendulkar
On the capacity, routing and reliability issues in multi-hop wireless networks	Dr. Siva Ram Murthy C
Electrical Engineering : CSTRl Center - IIT Madras (SEED Division)	Dr. Ashok Jhunjhunwala
Distributed strain & temperature sensing using inelastic processes in optical fibers	Dr. Balaji Srinivasan
Identification and control of active collocated structures	Dr. Bharath Bhikkaji
Modeling and analysis of subsea drive systems	Dr. Krishna Vasudevan
Ultrawide band circuits and systems in silicon (Swarnajayanti Fellowship)	Dr. Shanthi Pavan

Department and Project	Principal Investigator
Studies on bearing current and shaft voltage in modern industrial drives	Dr. Srirama Srinivas
Humanities & Social Sciences : Imaging cinema: Emerging trends in filmmaking	Dr. Aysha Iqbal
Indo-German Centre for Sustainability	Dr. Sudhir Chella Rajan
Mathematics : Study of Bargmann transform and sampling theory	Dr. Radha R
Mechanical Engineering :Investigation of mixing in gas turbine cooling rings with porous medium modeling	Dr. Kumaraswamy S
Studies on hydraulic lifting and plugging of large solids in hoses	Dr. Sarit Kumar Das
Studies on hydrogen-air-steam mixture within a confinement	Dr. Venkateshan S P
Estimation of anisotropic conductivity of plates using the inverse heat transfer method	Dr. Arun Narasimhan
Metallurgical & Materials Engineering : Development of superplastic forming and diffusion bonding technology for fabrication of Tejas aircraft components	Dr. Bhattacharya S S
Enhancing ballistic performance of armor welds using carbide-free bainite fillers	Dr. Janaki Ram G D
Evaluation of creep rupture behaviour of GTM-SU-718 alloy in salt environment	Dr. Kamaraj M
Investigation on functional performance of coastal structures through numerical modelling	Dr. Sundar V
Physics : Moduli stabilization, magnetized branes and particles	Dr. Prasanta Kumar Tripathy
Design and development of multileaf collimator	Dr. Subrahmanyam A

Industrial Consultancy

Department and Project	Principal Investigator
Aerospace Engineering : Helicopter borne time domain electromagnetic system (TDEM)	Dr. Santhakumar S
Design of FRP towers	Dr. Velmurugan R
Chemical Engineering : Process modeling of a seawater FGD	Dr. Sreenivas Jayanti
Chemistry : Development of a methodology for the production of Tolvaptan	Dr. Sankararaman S
Civil Engineering : Proof checking of PAN OASIS project at Noida	Dr. Alagusundaramoorthy P
Selection of Controlled fill for PA and FD Foundations of Mettur Thermal Power Project	Dr. Bominathan A
Proof checking of our project Brigade North star at Brigade gateway	Dr. Devdas Menon
Foundation & ash dyke for Chitrangi Power Plant	Dr. Gandhi S R
Effective utilisation of Building information models for integrated project delivery	Dr. Koshy Varghese
Testing of Biaxial Hollow Slab	Dr. Nageswara Rao B
Proof checking and laboratory testing of geogride panel \ block connections	Dr. Rajagopal K
Chennai Metro Rail Project. Phase I Specialist Geotechnical Laboratory Tests	Dr. Robinson R G
Land Use Development Plan for Port Area	Dr. Thamizh Arasan V
Road and service area design for Maruti - Zuzuki Project	Dr. Thamizh Arasan V
Suitability study of dumped ash for land filling and providing design parameters for foundation design	Dr. Thyagaraj T
Road Safety Assessment of the Upgraded Roads under TNRSR	Dr. Veeraraghavan A
Karnataka State Highway Network Improvement Strategy	Dr. Veeraraghavan A
Mechanical Engineering : Seismic Test of Cermic/Polymer Surge Arresters	Dr. Chandramouli P
Studies on lime stone characterization, flue gas sampling, sintering and depositions analysis of CFB boiler phase-I.collection of In-situ deposit samples	Dr. Prasad B V S S S
Fatigue Testing of Flanges	Dr. Raghu Prakash
Installation of solar thermal air conditioning system	Dr. Srinivasa Reddy K

Department and Project	Principal Investigator
Retained Austenite analysis on 50 Samples	Dr. Kesavan Nair P
Ocean Engineering: Testing of Dyneema Nylon Nets and Accessories	Dr. Anantha Subramanian V
R.C. Tsunami Protection-cum-boundary wall	Dr. Mani J S
Structural design review of MHN project	Dr. Nallayarasu S
Approach Jetty at Landfall Point of PVC plant at Cuddalore	
Feasibility study for chemical handling terminal at Raswa Canal, Port Said, Egypt	
Transportation analysis for barge mounted structures	
Wave prediction at offshore locations of south of Cuddalore	
Stage -2 Testing of kolos armour units	Dr. Sannasiraj S A
Construction of fishing Harbour at Valiyathura in Thiruvananthapuram District - Model Studies	Dr. Sundar V
Physical model testing for the Upper Zakum Project	Dr. Sundar V
Report on production of a turtle deflector of a trailing hopper dredger	Dr. Sundaravadivelu R
Strengthening of VOC Wharf - berths no. 1 to 4 to cater to 12.80 m draughtvessels	
Selection of consultants for an ensuing alternate base near vizag	
Physical model studying and to analyze the stability of rubble stone for the training walls at Pudukkupam Village in Bahour Commune, Puducherry	
Consultancy services for construction of captive barge jetty at IFFCO Kandla	
Sophisticated Analytical Instrument Facility	Dr. Sivaramakrishnan N
Identification, estimation & analysis of ore	

Research Based Industrial Consultancy

Department and Project	Principal Investigator
Biotechnology : Microbial population analysis during detergent washing of fabrics	Dr. Chandraraj K
Synthesis and determination of activities of catecholamine release-inhibitor peptides	Dr.Nitish Ranjan Mahapatra
Civil Engineering : Comprehensive study of Marine structures in JN Port	Dr. Alagusundaramoorthy P
Electrical Engineering : Design and Development of LPDC Codes	Dr. Andrew Thangaraj
Development of Prototype for IGBT based High Frequency HVR	Dr. Srirama Srinivas
Mechanical Engineering : Develop Nondestructive Evaluation techniques for condition monitoring of Reformer Tube furnace tubes	Dr. Krishnan Balasubramaniam
Model based investigation of Nondestructive Techniques of Thick and multilayered composites	Dr. Krishnan Balasubramaniam
Feasibility study on a Wobble plate engine for propulsion	Dr. Ramesh A
Physics: Development of high efficient and high durable Pt dispersed Nitrogen doped functionalized Carbon based electrocatalyst for proton exchange membrane fuel cell	Dr. Ramaprabhu S
Development of nanomaterial based high thermal conducting insulating fluids	Dr. Ramaprabhu S

Retainer Consultancy

Department and Organization	Principal Investigator
Electrical Engineering	Dr. Nagendra Krishnapura Dr. Shanthi Pavan Dr. Shanthi Pavan
M/s.Cosmic Circuits Pvt. Ltd.,	
M/s.Dream Catcher Consulting Sdn Bhd.,	
M/s.Research Centre Imarat	