



## I. Workshop on Metal Additive Processes under the aegis of NMTC & AEAMT

A **Workshop on Metal Additive Processes** was held on 10 Aug 2011 at CMTI, attended by around 80 representatives from CSIR laboratories, industries from Aerospace, Defense, Nuclear and General Engineering Sectors, and Academic Institutions in addition to CMTI Scientists.

Prof. S. Mohan, Chairman, Centre of Excellence in Nano Electronics, Indian Institute of Science, at the inaugural address, made reference to the different Surface Engineering processes such as tool bit coatings, electro deposition, modification of the surface including functional coatings. He suggested that, CMTI in its technology adoption exercise, having interaction with academics including many foreign universities, can make use of the present workshop as a hand-holding exercise with Dr. Jyoti Mazumder, Professor, University of Michigan, and share his expertise in solving problems related to metal additive processes.



Shri BR Satyan, Director, CMTI, in his address emphasised the importance of Institution-Industry interface towards leveraging technology and the role of Scientific knowledge, Technology and Engineering in the product development process. He pointed out that the role of highly capital intensive R&D should be to meet the requirements of unspecified, un-mentioned customers' needs, underlining the importance of meeting high accuracy aspects in a disciplined manner, fitness to standards, usefulness to the society, adherence to environmental regulations and responsibility for the products that are brought out.

Sri SM Shariff, Scientist, Centre for Laser Processing of Materials, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad made a presentation on **Laser Surface Modification by Cladding and Alloying**.

After a brief introduction to the concepts of laser cladding process, he elaborated on the developments in the areas of process optimization, MMC coating, laser alloying of metals, nanostructured composites and laser cladding applications followed by a comparison of the



cladding process with other technologies like thermal spraying, wafer surfacing in terms of coating process properties. He also mentioned about the popular laser alloying/cladding materials, laser surface cladding parameters, laser surface alloying of Ni-based alloy, applications and case studies.



Prof. Jyoti Mazumder made a presentation on **Introduction to DMD and its Application**. Prof. Mazumder outlined the various additive manufacturing processes based on laser sintering, laser cladding and droplet based deposition and direct metal deposition (DMD), with emphasis on the benefits of the additive processes in terms of energy savings, material & time savings. He further elaborated on the progress in modelling & measurement for DMD, art-to-part in Near Net shape, and laser material processing and the applications of DMD in many areas such as aerospace, medical, oil & gas, defense and automotives.

The presentations were followed by interactive session wherein many expressed their interest and willingness for collaboration with CMTI.

## II. Technical Presentation on UV Nanoimprint Lithography- Status and Applications

Prof. SV Sreenivasan, Professor and Thornton Centennial Fellow in Engineering at the University of Texas at Austin, made a presentation on **UV Nano Imprint Lithography- Status and Applications** with focus on Jet & Flash Imprint Lithography (J-FIL), dealing with the basics, technology and applications on 13 Jul 2011.

**Nano Imprint Lithography (NIL)** is a method of fabricating nanometer scale patterns, a high



resolution and high throughput technique based on the mechanical deformation of a resist layer with a stamp or mould presenting a surface topography including 3D features. Nano imprint lithography techniques are known to possess remarkable

replication capability down to sub 5nm resolution. Jet and Flash Imprint Lithography (J-FIL) process developed at the University of Texas at Austin is a fundamental UV-NIL process.

Prof Sreenivasan elucidated the technology behind J-FIL technology and explained its applications in patterning hard disk substrates. He elaborated on the current state of J-FIL technology in terabit density magnetic storage and advanced solid state memory. He also mentioned about the stepper lithography and substrate lithography tools developed using the J-FIL technology. J-FIL finds applications in CMOS IC fabrication, nanowire molecular memory, nanoelectronic devices, magnetic storage devices, photonic devices, etc. J-FIL involves fabrication of master templates, template replication, high-volume imprinting with precisely controlled residual layers, dual-sided imprinting and defect inspection. J-FIL process uses drop dispensing of UV curable resists for high resolution patterning. Residual layer

is due to the indisposed fluid. Residual layer needs to be thin and uniform, avoid non uniformities, wedges and varying thickness. The residual layer of polymer between features is removed by an etch process.

Prof. Sreenivasan also pointed out the challenges involved in the commercialization and productisation of this technology and his readiness to transfer the technology to the industry. Prof. Sreenivasan has over 100 technical articles and over 75 patents in the area of nanomanufacturing and several awards including the 2011 ASME William T Ennor Manufacturing Technology Award.

### III. Technical Presentation on Plasma Ion based FIB system

Shri PY Nabhiraj, Scientist, at Variable Energy Cyclotron Centre, Kolkata, made a presentation on Focused Ion Beam (FIB). Shri Nabhiraj doing his doctoral research under Prof Mohan, GC & RAB Member and Mentor, CMTI, is working on MEMS, MEMS devices and FIB system related areas. Shri Nabhiraj, in his address reviewed the drawbacks of some of the micromachining processes based on wet etching, reaction ion etching, laser etching, and FIB. He outlined the motivation for the **Plasma ion based FIB system**. The new type of FIB system has been indigenously designed and developed by using plasma based ion source to produce high intensity ion currents of heavy gaseous elements. In an initial attempt with a two lens focusing column, argon ion beam of about  $1.0\mu\text{A}$  was focused to  $<8\mu\text{m}$  spot. Several experiments were carried out to perform milling on silicon and steel. The milling rates of  $300\mu\text{m}^3$  on steel with 7keV argon ion beam have been measured. With this milling rate,  $50\times 50\times 50\mu\text{m}^3$  silicon would be milled in  $<2$  minutes as compared to 12 hours with LMIS based system.



Shri Nabhiraj deliberated on the FIB Systems, FIB in milling applications, nano-indentation, microtool fabrication and in accelerometer milling & depositing platinum.

### IV. Visit of Joint Secretary, DIPP



Shri Chitanya Prasad, Joint Secretary, Ministry of Commerce & Industry, Department of Industrial Policy & Promotion (DIPP), visited CMTI on 25 Aug 2011 in connection with UNIDO project at the International Centre for Advanced

Manufacturing Technology (ICAMT). During the occasion, he visited the laboratories, and facilities at CMTI and had interactions with the senior officials.

### V. OTHER VISITS

A team of officials from 515 Army Base Workshop, Bangalore comprising Col. K Satish Omar,

Col. Bhatia and others visited CMTI on 7th Jul 2011 to explore the possibilities of Technology Support for their product development activities. The Workshop is on the lookout for support for manufacture of hundreds of spares for defense related equipment and complex profile components. The visiting team was taken around the facilities at CMTI and was appraised of the capabilities. The officials were appreciative of the high-tech facilities and showed their keenness in getting trained in CNC technology as part of their modernization program.

## VI. Library Day

Library Day was celebrated on 19 Aug 2011 in commemoration of the 118th Birthday of Dr. Shiyali Ramamrita Ranganathan, Father of Library Science. As a part of the programme,



Shri MS Sridhar, Retired Head, Library and Documentation Division of ISRO Satellite was invited to give a talk at CMTI on **Scholarly Communications and Open Access Systems for R&D and Academy.** In his

deliberations on the topic, Shri Sridhar pointed to the irony of scholarly communication scenario whereby scholars, who sweat and toil to do research, produce papers, review and edit them and the same scholars have to pay the publishers to read their own papers. He recounted the varying and conflicting interests of the stakeholders like librarians, authors, users, institutions and the publishers towards these scholarly communications -- while price control is the concern of the librarian, profit is the interest of the publisher; faster and easy access is the concern of the user while better Return on Investment is the Institution's concern. Bringing to the notice of the scientists and the librarians, the solution in the form of Open Access movement, he enumerated the benefits to the individual authors, researchers, institutions and research processes, in the form of free access to the articles, sharing of knowledge, accelerating research at zero marginal cost, giving competition to traditional publishers, increasing pressure on publishing industry, increased author submissions and increased number of readers and citations.

## VII. Training programmes

Training was imparted on Maintenance of **CNC Machines (Mech & Hydraulic)** to industry participants, wherein topics related to CNC Machine architecture, condition monitoring, calibration and TPM were discussed.

## VIII. Retirement

Shri S Kannan, who joined as Watchman in 1985 retired as Security Guard III after 26 years of service in Jul 2011.

CMTI wishes him a peaceful and healthy retired life.

