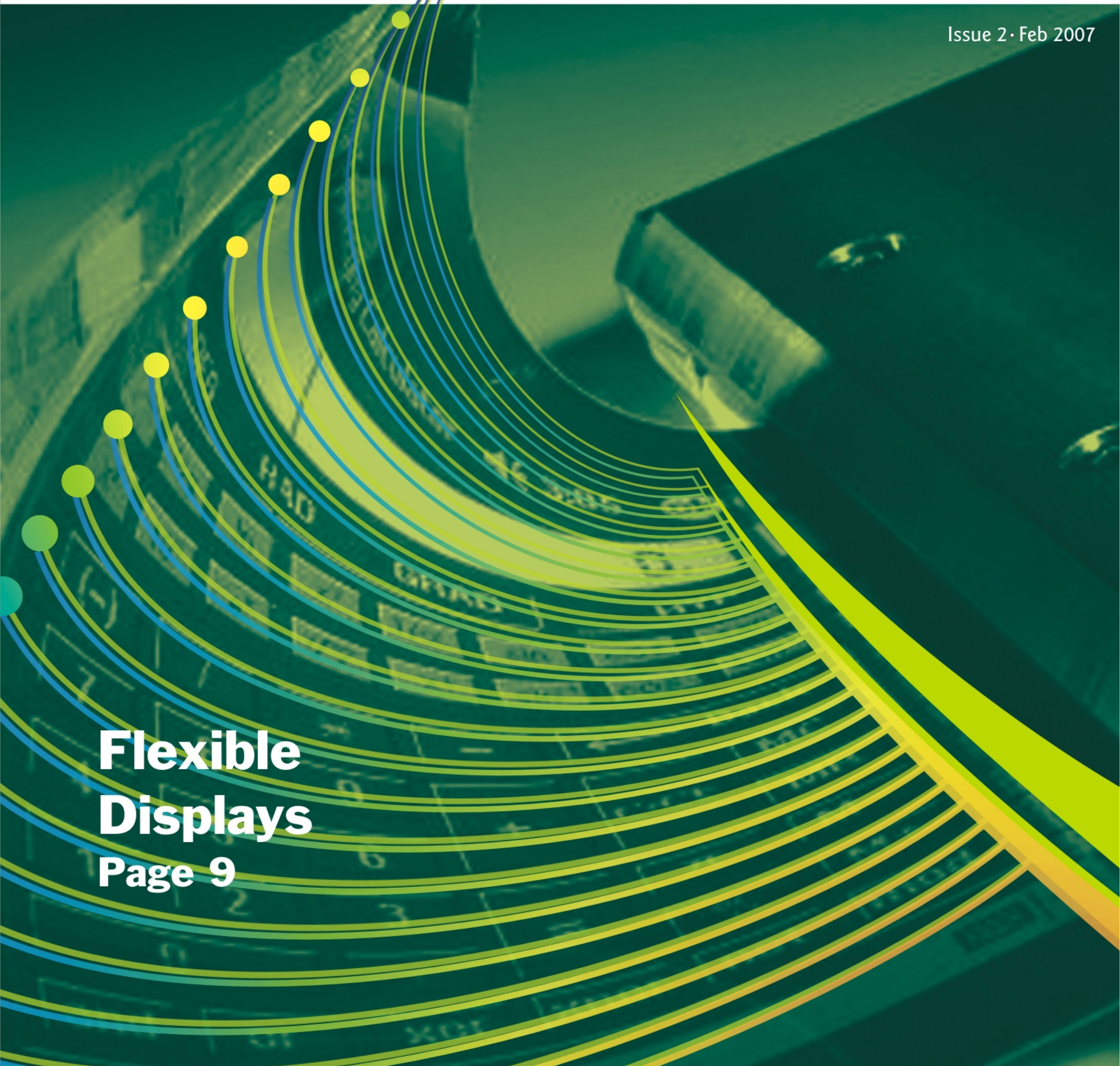
IIT BOMBAY

dhatuki

Metallurgical Engineering and Materials Science

Issue 2 · Feb 2007



Flexible Displays

Page 9

INSIDE

IIT BOMBAY

DHATUKI

Message from the HOD

Inside This Issue

Dear Readers,

Wish you all a very Happy New Year 2007!

This is the 2nd Issue of the Newsletter ' dhatuki ' and I am extremely pleased and feel proud of the quality and material content that the publishing team has put in this 2nd issue.

Materials Engineering is at the verge of a major revolution. The realization that after all it is the materials with their exotic properties that are at the heart of any device brings Materials Science & Engineering at the interface of all disciplines and makes it truly an interdisciplinary subject – spanning through disciplines like life sciences, optical communication and structural applications The huge thrust and expectations from Nanotechnology essentially circle around nano-materials and nano-engineering of materials.

I am confident that the 2nd issue of Dhatuki is once again an enjoyable reading experience. It gives a mixed flavor of the new developments in technology with information on the research outputs from the Department, sentiments of Alumni and the feelings of the students along with achievements of students and staff.

Finally I would urge all readers to give their feedback to us so that we can make future issues more enjoyable.

R. O. Dusane

Head Of Dept.

From the editor ' s desk

With great pleasure, I would like to present to you the much awaited second issue of the department newsletter Dhatuki. Though the second issue did take some time coming, we are delighted that we are finally bringing out this issue. There were a few hurdles that had to be surmounted and a few issues that had to be resolved. But with the excellent cooperation and suggestions we received from every quarter , we managed to overcome all the obstacles. I would like to specially extend my gratitude to the head of department, faculty members, alumni, students of the department and last, but not the least, the entire Dhatuki team. As before, please feel free to pour in with ideas and suggestions to make this newsletter a big success story. Till then, happy reading!

Thus speaketh the alumnus

- Dr Ganesh Skandan

As an undergraduate student in the department of Metallurgical Engg. at IIT Bombay, if only I had been more attentive in class when Prof. Rao taught us thermodynamics; if only I took first and second year physics and mathematics courses more seriously; if only I understood how materials can be modelled and their properties simulated. Why didn't I take my practical training seriously without considering it an obligation? Why didn't I call up senior people in nearby materials companies, Larsen & Toubro for example, and take their guidance to figure out what my goals in life should be? And the list of questions could go on and on. These thoughts often crossed my mind once I left the comfortable boundaries of the IIT campus and entered the real world where it soon became clear how limited my knowledge and experience was. I consider myself to be fortunate that at least I was asking myself these questions soon after I became a graduate student at Rutgers – The State University of New Jersey where I had to worry about getting a paycheck to cover my rent and food.

Nevertheless, my days in IIT Bombay as a B.Tech student between 1986 & 1990 were most memorable. I was able to strike a balance between studies and play, and managed to be among the top few in the class. In my third year I was voted the Best Sportsman of the Year for my hostel (H-6) and at the same time was able to eke out good GPAs in most of the semesters. But what I lacked was a vision for the future; so naturally there was no plan for the future. When asked as an undergraduate student what I wanted to do in life, my answer used to be that I want to go abroad for "*higher studies*" and get a job in a some big company. Things turned out quite differently.

For some inexplicable reason I got serious in graduate school, and started understanding some of the basics of materials science, such as what in the world is a "dislocation", & why does a defect in a material affect its properties. Perhaps the competition was a little less, or perhaps I got more personal attention from the faculty members. But I think it was also because I got engaged in research in my first semester itself, and soon became enamored by the fact that it was possible to do something that nobody else has ever done before – which is what fundamental research is all about! As I would learn a few years later, the trick is to make these innovations relevant to the people of the world. And that is what the best of entrepreneurs are good at.

> ***"If you come to a fork in the road, take it", Yogi Berra, Yankee pitcher***

As a relatively new graduate student I got engaged in writing papers and presenting them at conferences. I was one of the first generation of graduate students who worked on this emerging field of "Nanotechnology". A turning point was one such conference in my second year in graduate school. It was a four-day exclusive meeting on Nanomaterials, and the best and brightest from around the world had gathered. I was one of a handful of graduate students, and for the first time, I had a chance to talk one-on-one with senior scientists, business leaders, and entrepreneurs. Since I was never shy of talking, it was easy to engage these brilliant men and women in conversations. Ideas about what I wanted to do in life, and more importantly what I did not want to do, began to become clearer at that time. I got to attend conferences, mentor undergraduates and later freshers at that time. It was a defining experience. The rest of the years in graduate school were quite rewarding. I was even involved in special summer courses for high school students. I did a lot of teaching and developed the art of speaking to an audience, and making yourself clear.

Along the way I was awarded the *Hoeschst Celanese Award of Excellence in Graduate School* – the *$1000* that the award came with meant a lot as well in those days.

After graduate school I came pretty close to choosing an academic career, and there were options between joining a National Laboratory in the US and becoming a faculty in a University. I followed my instincts and pursued the path of entrepreneurship, launching Nanopowder Enterprises Inc. (now called NEI Corporation) in 1997 with the help of two other people, whom I hold in high esteem. Although my title was Vice President R&D, I was the only full-time employee of the company for well over a year. The initial years were rough, particularly because we were short on funding the enterprise. The technologies had a long way to go, and the markets we needed to target were at best nebulous to us.

All that began to change in the year 2001 once I got my feet wet in the business world. We began putting together three essential components of any technology oriented business: (i) a solid technology base with a genuine potential, (ii) customers who are willing and able to buy the products, and (iii) a management team with a diverse set of skills. Today, I feel good about the company in that it is well positioned to be a leader in the field of Nanotechnology.

Sometime ago, I was recognized as an outstanding alumnus of the Graduate School at Rutgers University at its 50th anniversary. That was a good day!

The writer

Dr Ganesh Skandan, CEO NEI Corporation – earned his Ph.D in Materials Science and Engineering from Rutgers University where he worked on Nanomaterials for his doctoral work. As a graduate student he co-developed and patented two processes for producing nanoparticles, and received the *Hoechst Celanese award for Graduate Excellence*. Shortly after his graduate work, Dr. Skandan co-founded NEI Corporation.

As Vice President, R&D, at NEI Corporation, he led the development of an array of Nanomaterials He worked in this capacity for 6 years. Synthesis technologies today constitute the technology platform that NEI is built on. He was successful in utilizing federally funded programs for technology development. As CEO for the past three years, he has transitioned funded technology development programs into commercial products and assembled a strong management team to grow the company. His technical prowess, management skills and business acumen have enabled NEI to grow over the years into a financially stable Nanomaterials company.

Dr. Skandan was recognized as an outstanding alumnus of the Graduate School at Rutgers University at its 50th anniversary. He is frequently invited to speak at technical and business conferences and is associated with the *National Academy of Engineering through the Frontiers of Engineering Series Symposia*. He has authored encyclopedia articles and is also the director of an industry-oriented short course on Nanotechnology, organized by the Center for Professional Advancement.

- Varun Verma

Special Report

Materialising Dreams

Metallurgical Engg and Materials Science is one of the most scintillating branches of research in the world today. Unfortunately, it is by far one of the most misunderstood and berated departments at IITB. A department which is taken up just because one's JEE rank lands up between 1500 and 1700. Not any more though. Albeit a little late, students have started realising that MEMS is not just an easy ticket to a cushy software job, but an opportunity to be part of cutting edge research. On analysis though, one finds that perhaps we are not as well equipped as we could be. This article is an effort to analyse our department, to recognise its strengths and weaknesses and to increase awareness amongst both students and faculty.

First of all, we decided to conduct a survey so as to get an insight into the prevailing scenario and figure out what actually is the mind set of students in the different years. We carried out a survey in which we posed a relevant question (with four options) to each of the 2nd, 3rd, and 4th year students.

Sophomores

What kind of mindset you have for the dept?

1) See a bright future
2) Positive but still see a scope for improvement
3) Neutral
4) Wanted a branch change but couldn't get one

Thirdies

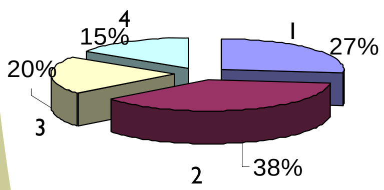
What are your priorities as a third year student?

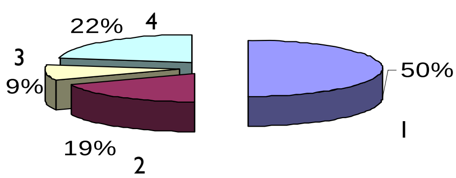
1) PT oriented, working towards resume enhancement
2) Research enthusiasm
3) More inclination towards extra curricular activities
4) Yet undecided

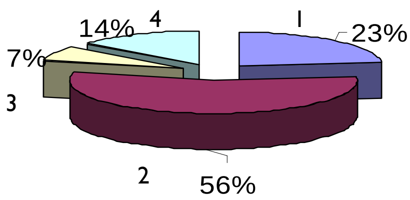
Fourthies

How do you think your dept. puts you in a futuristic frame?

1) Enthusiastic about research opportunities ahead
2) Unhappy about lesser core jobs and about lesser paying ones
3) Doors are open towards IT sector jobs
4) Also exploring other areas like Cat and UPSC







As the survey shows most of the sophomores are unclear about the department. They are very enthusiastic about the new opportunities available in IIT. While a large group thinks positively and thinks big about the department.

Third year students are in general more experienced and are mature enough to take any decision regarding future .The survey infers that a significant number of the students are Practical Training (PT) oriented as this is 'supposedly' the first foundation stone towards a successful professional career. Very few people are inclined towards extra-curriculars. What comes to the fore is the fact that a huge chunk of the student community is still undecided about their future career moves.

The real career decisions are taken in the fourth year because these are the life defining moments. Contrary to the popular belief, more than 50% of the fourthies aspire for a core job but are put off by the quality and quantity of the same. Only 7% of those surveyed are enthusiastic about IT jobs which proves that an IT job is never the desired option but always a compromise solution. But the most heartening aspect that the survey has brought to the fore is the fact that a surprisingly large number of the students have a strong inclination to do research in the field of Metallurgy and Materials Science.

What does the Metallurgical Department have to offer ?

As far as the infrastructure of the department is concerned, we find that there are 28 labs, 28 professors, over 300 undergraduate students and 50 postgraduate students. The labs have a wealth (quite literally) of equipment ranging from XRD, and Tensile Testing, to SEM. However, let us take a step by step journey at our interaction with the department.

Courses and Course Content: The first brush with the department courses is the Introductory course MM152. This course is just a broad overview of the content to be covered in the next three years. The course gives a student an idea about the field of Metallurgy and Materials Science where the students are encouraged to visit the different labs to get a feel of the department.

In the second year there is an increase in the number of department courses. The best part is that the students are exposed to a number of courses from other departments like the Electrical and Mechanical departments which helps to widen their knowledge base. The fourth semester is relatively more involved in terms of labs, two of which are in the electrical department !

In the third year begins the real tryst with Meta (acronym for the department). All courses are core courses which dwell upon all the aspects of Metallurgy and Materials Science in greater details. The seminar, an important exercise to be undertaken in the third year, becomes a tool to get a greater insight into the field of your choice.

The fourth year finds the students a little overloaded with five courses and three labs, along with the all important BTP/DDP. There are a host of electives offered during the fourth year which gives the students a whole plethora of options to choose from. But the students still believe that due to large student strength, more electives can still be floated.

Laboratories and other Facilities : Metallurgy is one of the core engineering fields, which would therefore require a good amalgamation with laboratory courses. There is very little chance of the average student getting to use the state of the art equipment that department boasts of. The equipment is too delicate to be handled without a trained supervisor, and more importantly, it's difficult for over 65 students to use a single SEM. However, these equipments can be brought out by their use during projects which solely depends upon the student's interest. A few labs can be rescheduled to ensure that the labs and the relevant theory run parallel during the same semester. A restructuring would be also be ideal in the case of a few other labs.

Another interesting idea would be, as Prof Bhargava suggested, doing away with the idea of labs completely. Barring a few necessary ones, project groups would be introduced. In this, a group of students could be given a particular metal, say copper, and asked to analyse its entire properties, mechanical, chemical etc. They could later on take up a project in the department involving copper and use whatever equipment that is necessary. This will not only increase student awareness about the facilities available in the department but help us appreciate the actual usage of the equipment for research purposes.

Other facilities that the department offers include the library and computer room. The computer room is reasonably well equipped and comfortable. But with the proposed increase in student intake due to the 'quota' system, the number of computers in the lab would be too few to meet the demands of such a large student community. Both the library and the computer room remain open till 10 pm in the night. Metallurgical Engg. & Materials Sciecne is a relatively obscure field in India, leading to a shortage of good reference material. While the central library has a good collection of books, the numbers are usually too small to be of any use to the entire department (3 textbooks for a class of 66!). More importantly, the books in the central library are not the latest versions. In such a scenario the department library becomes critical, because good reference material can be easily accessed there, and it can be updated much more frequently.

In conclusion we can say that, Metallurgy Engineering and Materials Science holds a lot in itself. We just need to work together and work, to encourage and eliminate the redundancy that has occupied our thoughts, and to take the department to greater heights.

by Kadam Aggarwal, Mudrika khandelwal ,Rajlakshmi Purkayastha
Gaurav Devasthali and Gaurav Bhattacharya

IITB MEMS CONQUERS PAN-IIT

In the recently held PAN IIT Global Conference, a team from IITB won an event in which the teams had to present their ideas on "New Environments for learning, teaching and research including creation, use & preservation of digital resources". And the team from IITB was from our department!!

The team comprised Prof Parag Bhargava and Shreerang Chatre, a fifth year dual degree student. They were helped by Prateek Jivrajka and Akash Agarwal, third year Btech students.

The ideas had to be sent as a document for the elimination round in which 6 IITs participated. The final round, held on 24th December in Mumbai was a presentation round in which we competed against IITD. Our team proposed a bagful of innovative and practical ideas on learning methods, course contents, faculty, research and so on. The ideas were highly appreciated.

The team was awarded a trophy and a ***cash prize of Rs.50,000 !!***

Truly, a glorious moment for the department.

Powai To PSLV

Our department boasts of some of the finest metallurgists and material scientists around. The fact that they are the stars in their fields has been proved from time to time. One such advancement is the development of an ultrahigh strength steel which is going places and spaces, literally.

The ultrahigh strength steel is called modified 15CDV6. Its competitors are maraging steel, and a variety known as D6AC. But the former is highly expensive and the latter has poor weldability. Modified 15CDV6 is made to undergo a process known as Electro Slag Remelting or ESR. After ESR, we get steel of high strength and ductility. The process has been in place since 1950s, but an expertise in this process in our country was unheard of.

Some 35 years ago, *Prof P. Krishna Rao and Prof Krishna M.Gupt* (now superannuated), were involved in mastering the intricacies of the highly convoluted process; *Prof N.B Ballal* joined the group around 25 years ago. It started with IIT Bombay's association with Indian Tool Manufacturer (ITM), which set up the first ESR plant employing IITB's technology.

Since then, the technology has been transferred to a number of industries. Nasik Steels, founded by an alumnus was one of the first industries to be benefited. It has been a common occurrence hence. To AV alloys Hyderabad, not only did we transfer the technology, but also designed and commissioned the equipment. Since the customers of the company vary from die manufacturers to nuclear power plants, it would not be an exaggeration to say that the beneficiaries of the technology developed by us go far and wide.

Time for the flagship event: The department was contacted in 1981 by *Vikram Sarabhai Space Centre (VSSC)*, the leading space research organization of the country, for developing a ultra high strength steel to replace maraging steel for primary rocket casing applications. It was customized for them by 1984. Since then, VSSC has done some work on it. Numerous tests were carried out and it has satisfied all requirements. The steel has been found to be ready for use in space vehicles. We have also supplied a complete research ESR facility to VSSC for the development of cryogenic engine materials. So parts of the next PSLV or GSLV might be made of the steel that was developed right here, in our department.

Such developments not only fill us with a sense of pride, but also reaffirm the fact

that IITs are helping the country to grow and prosper. We are sure that our department would continue contributing extensively to the technological advancement of the nation.

—Pallav Jhawar & Kadam agarwal

Apeksha Khandelwal, sophomore, as a part of a four member team stood 5th in the world in American Society of Mechanical Engineers' (ASME) design problem held in Chicago, USA, in November, 2006. They stood 1st in the 1st round held at IIT, and also stood 1st in the 2nd round in region 13 (comprises whole world excluding North America). Congrats!!!

The B.Tech project report of Sneha Gupta (B.Tech batch 2002) has been selected for Indian National Academy of Engineering's (INAE) innovative student's project award (2006).

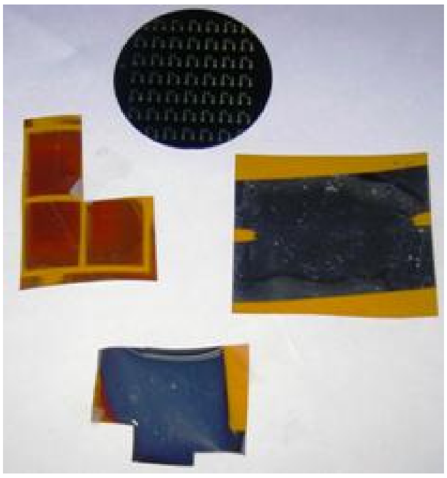
Her report titled "Nanocrystalline silicon formation through aluminium induced crystallization" was prepared under Prof R.O Dusane. The work has been accepted in the 4th international conference on HWCVD held in Gifu, Japan, October 2006. Kudos to Sneha!!

Flexible Displays

Check out this image. What if it was your television screen? It's no science fiction. It's called flexible display- a technology that has been under perusal for the last twenty years with heavy investments from various industries. A flexible display is a thin, flexible, and clear substrate with the barrier properties of glass. Researchers are working to combine polymer and metal-foil substrates together with thin film transistor (TFT) back plates that will make the flexible display a commercial reality. The flexible display will offer many benefits over the existing display technologies such as a reduction in thickness, light weight and improved durability. The potential uses are expected to be huge and diverse. Think of anything under the sun that uses a screen: mobile phones, MP3 players, PDAs and flexible displays pop up! Also it would give birth to a new gamut of products. Imagine the possibilities, televisions so thin and flexible they can be rolled up and taken along; reusable electronic newspapers that can download the latest news; electronic wallpaper that can display images such as paintings; or a jacket with a screen sewn into its sleeve to allow its wearer to read e-mail while on the run. Currently, liquid-crystal is the leading technology in flexible displays due to its low power consumption. However, there are some performance trade-offs between brightness and definition in comparison to battery life. Other promising technologies for full-color flexible displays are Organic Light-Emitting Diodes (OLEDs), and Polymer Light Emitting Diodes (PLEDs). The former is self-luminous and does not require backlighting, though it lacks in brightness. The latter is an electroluminescent polymer that emits light when subjected to an electric current. It is used as a thin film for full-spectrum color displays and requires a relatively small amount of power.

As with all new technology, the price is expected to be high when flexible displays finally appear. However, once the technology is in place and mass production begins, the prices will fall. It should not be too long before everything we view will be through clear, scratch free, flexible displays .

Developments in our Department:



In our department, a lot of work is being carried out in this area. The group led by Prof. R.O. Dusane has successfully developed the core materials in the thin film form which are necessary for the fabrication of the Thin Film Transistors (TFT) which drive the optical displays- the so called Active Matrix Liquid Crystal Display (AMLCD) by a new technique called the Hot Wire Chemical Vapor Deposition (HWCVD). These include thin films of amorphous and microcrystalline silicon – both intrinsic as well as doped and the insulating amorphous silicon nitride which is used as the GATE dielectric in the TFT. These thin films have been deposited at substrate temperatures which are conducive for plastic substrates. Presently the group is busy developing the Transparent Conducting Oxide (TCO) layer – another unavoidable component of the flexible display at such low substrate temperatures .

— Aayesha Ghanekar

Solid Oxide Fuel Cells

The researchers and environmentalists long dreamt of an environment friendly, highly efficient power source. Solid Oxide Fuel Cells (SOFCs) has proved to be just the thing of their dreams. SOFC is a basically an assembly of five components- a solid electrolyte, two electrodes and two interconnect wires. It is an energy conversion system where a direct conversion of chemical energy into electrical energy takes place. Thus, seen this way, a SOFC is like a battery but with the difference that where a battery gets depleted of fuel after a while, a SOFC may be replenished with fuel to provide a continuous supply of electric power. Generally, SOFC operates between 600-1000C and is a highly efficient system where its efficiency can be as high as 57%. This is the highest efficiency device for fuel to power conversion yet devised and this is not all; larger hybrid systems when fully developed are expected to have efficiency levels upto 75%!

The basic idea and the materials for a fuel cell had been proposed by Nerst in the 1890s, but the first "Solid oxide fuel cell" was patented in 1962 by Weissbart and Ruka. All this time, beginning 19th century had gone into the experiments to understand the ionic and vacancy mobility, and it was during this time that the theory of disorder in solids was proposed by Frenkel, Schottky and Wangner, the methodology for X-Ray structure analysis and isotope methods for investigation of diffusion processes were developed. The method of electrochemical thermometry by which we determine elevated temperatures on thermodynamic scale using CO, CO2, O2 concentration cells was also developed as a by-product of SOFC development. Since the development of the first SOFC, the bulk of research went into development of electrode materials and the betterment of cell design for optimum output. In the 1970s, research on electrode materials fetched good results giving us our today's most common electrode materials, but despite this, the development could not go on because manufacturing costs were not sufficiently economic. Thus, in 1978 a new cell design of long tubular cells was instrumental in the breakthrough and it led to devising of the first SOFC generator containing 324 cells. Today, we have moved far ahead from the concept of a single SOFC producing meager power to large assemblies containing stacks of thousands of SOFCs producing as much as 300kW of power.

The first SOFCs were used as oxygen sensors in automobiles. Today also every automobile carries a SOFC as oxygen sensor for exhaust gases but its designed has tremendously improved producing linear response as compared to logarithmic one of previous type. Beside this, these sensors find applications in food storage, metal processing and flame controllers. The other applications of SOFCs are as clean and quiet distributed power generation units like in hospitals, hotels, sports facilities etc, where they have replaced the traditionally used diesel engines. SOFCs could also be used as auxiliary power supply for running air conditioners.

The list of advantages that SOFCs have, is a long one. One of its greatest benefits is that it can utilize a wide range of fuels including hydrogen and hydrocarbons, which reduce its operating cost. The hydrocarbons can be directly injected into the SOFCs. Due to high efficiency and pollution free performance of SOFCs, they are competitors of heat engines for power generation. In an SOFC, heat is inevitably generated by ohmic losses, electrode over potentials etc and so a good heat management system is required for improvement of efficiency. The high operating temperatures of SOFCs make them tolerant to impurities and help in at least partially reforming the hydrocarbon fuels. The high amount of heat involved my also be used to produce hot water in case of residential systems or utilized for coal gasification in stationary power generation plants.

However, a high temperature operation has its disadvantages too as it slows the startup and necessitates significant thermal shielding for heat retention. It also places stringent durability requirements on the materials and thus development of high durability, low-cost materials is a primary challenge in this technology.

The main drawback of SOFCs has been their complexity and high cost. Therefore, bulk of research in going into figuring out ways to reduce cost. It has been estimated that with mass production, costs competitive with present large power station costs would be achieved in the near future.

... Article continues on page 12

Space Crunch

The Indian Institutes of Technology admit students who are like uncut diamonds and chisel them to brilliance. The best academicians, the best entrepreneurs, best known names from the corporate world have been products of the IITs. No wonder, the Government of India would want more people to graduate from these centers of excellence. Hence there is a conspicuous increase in the number of students getting into IIT. The department of Metallurgical Engg. and Materials science at IIT Bombay is no exception to the above mentioned observation. Here are the statistics about the available class rooms in the department and the number of students which these can accommodate.

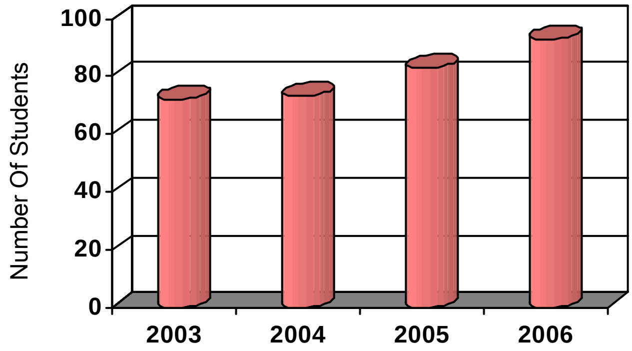


Figure 1

CLASS ROOM	MAXIMUM CAPACITY
Room 101	90
Room 102	90
Room 107	55
Seminar Room	55
Electronic class room	25
PG classrooms (4 in number)	15 (each)

Table 1

Problems will crop up with the controversial decision of introducing a 49.5% quota. Consequentially, the student intake would swell to 150.

The pertinent question is how will we cope up with this increase? In this article we would try to explore the possible problems that would stem and how well equipped is our department to handle them.

Some Problems are

1) Classrooms of insufficient capacity: The data for the department class rooms is shown in table 1. With the strength reaching 150, they would fail to meet the requirements.

2) Labs: With the current infrastructure, students have to perform the experiments in large groups. In few labs , 5-10 students work on single experiment in a batch of 66 students. Obviously all of them do not get sufficient time to actually work on the experiments. The situation with an increased strength is not difficult to imagine.

Allocation of seminars, B. Tech Projects (BTP) and Dual Degree Projects (DDP) would become a major issue with the huge batch sizes. There are 28 faculty members in the department . For the current third year batch, on an average every faculty member has two students under him for seminar. But when the batch sizes would become 150, the number would grow to 5. The BTPs and DDPs scenario would also be the same. The Professors would find it difficult to give quality time to each and every student in that case. Result would be that the qualities of seminars and the projects would go down. There have been a lot of discussions going on in the department and the institute to tackle these issues, and things have already started materializing.

Institute is coming up with a centralized teaching facility. Metallurgy, Physics, Aerospace, and Chemistry-the four adjoining departments would be sharing a common teaching facility or "teaching complex". This would be located in between the Physics department and our department. This is expected to be battle ready by July 2008. Our department has asked for 4 classrooms of capacity 200 each and 2 classrooms of capacity 150 each in the complex. In the long run all the teaching would shift to these complexes and the department would just host laboratories and a few PG classrooms. Till then we are planning to shift to the Main Building for lectures.

Turning to labs: Every year a reasonable amount of money is allotted to laboratories. The up gradation is carried out on a priority basis. For example 5-6 new equipments have been added to the Powder Metallurgy lab, and in the words of Prof Bhargava, "The situation is certainly better than the last year". Similar upgradation has also been noticed in other labs.

On a short term basis, the easiest model that could be implemented is getting the lab done in shifts. By this, the total number of students per batch goes down and more students get to actually do the experiments. However this model would impose a huge pressure on the concerned faculty since they would have to devote a double or a triple amount of time than what they do now.

Talks of seminars being held over two semesters are in progress. B.Techs would have their seminars in one semester, and the Duals in the next. Also students would be encouraged to take seminars in other departments, since Metallurgy and Materials Science is closely associated with every field of technology.

No doubt that the situation is not perfect now. But as is evident, we are trying very hard to make sure that we continue doing well. With the kind of dedication that the department faculty is showing, we can be rest assured that the situation would not go haywire.

— Sai krishna & Pallav Jhawar

Neelkanth Bardhan, a sophomore of the department attended a conference titled: '*International Seminar on Ceramics – CeraTec 2007*' organized by the Indian Ceramics Society, at Visakhapatnam, Andhra Pradesh, From 8th to 10th January, 2007. The themes of the conference were Education in Ceramic Technology, Energy efficient systems, Advanced ceramics and Solid waste utilization.

He was accompanied by Prof Parag Bhargava and Ajay Kumar Jena (2nd year, M.Tech MEMS)

They presented 2 research papers, viz.:

(i) 'Influence of plaster of paris mold microstructure on sintered slip cast compacts' by Neelkanth Bardhan, Sabyasachi Roy, Ajay Kumar Jena and Parag Bhargava

(ii) 'Property Prediction of Slip-Cast Alumina bodies from Rheological behavior of the Slurry' by Ajay Kumar Jena, Sabyasachi Roy, Neelkanth Bardhan, Parag Bhargava.

The conference was attended by over 400 delegates from reputed institutes all over India (like the IITs, NITs, Central Glass and Ceramics Research Institute, Regional Research Labs etc.), from various industries, as well as experts from Italy, Germany & Russia. Way to go Neelkanth!

SOFC article continued…

Thus, having seen all the advantages it is no wonder that new collaborative programs are being initiated in the United States, Europe and Japan such as the Solid State Energy Conversion Alliance (SSECA). There has been a dramatic rise in the funding for SOFC development worldwide which would go on for at least a decade. The race for developing a better, efficient, cost effective, environment friendly power source is on.

Current work on SOFC in the department

- A project being undertaken by Prof Bhargava for Bhabha Atomic research Center, in which tubular fuel cell rods which also work as cathodes are being made by Electrophoretic deposition.

- Other research includes preparation of electrolyte materials which can reduce operating temperatures of the fuel cell.

— Chinmay Singh

We bid adieu…

Over the last couple of years, a few of our faculty members have superannuated. We would like to take this opportunity to express our deep sense of gratitude and indebtedness to these faculty members who contributed immensely towards the field of metallurgy and materials science in general and to the department in particular . We wish them all the best for future.

Prof T. R. R. Mohan

Prof T.R.R.Mohan superannuated in September 2004. He joined the department in 1969. He has been a guide to over 200 undergraduate, 107 M.Tech and 22 PhD students. He has over 140 publications to his credit. He was a visiting faculty to various US universities and has held prestigious positions like Vice President, Powder Metallurgy Association of India.

Prof K. M. Gupt

Prof K.M Gupt superannuated in January 2005. He has over 37 years of experience in teaching and research. He has been a guide to over 60 B.Tech, 65 M.Tech and 15 Phd students. He has an expertise in iron and steel making technologies like Electro Slag Remelting. He has over 70 publications to his credit.

Prof M. P. Dixit

Prof Mukund Purushottam Dixit, superannuated in June 2005. He has guided over 40 Btech, and 25 Mtech students for their projects. His taught courses on engineering metallurgy, quality control, non destructive testing of metals. He was conferred with the Binani Silver medal by Indian Institute of Foundrymen. He has over 25 publications to his credit.

Prof B. Tirumala Rao

Prof B.Tirumala Rao attained superannuation in October 2005. He was with our department for over 33 years. He was involved with the teaching of courses such as characterization of materials, metallurgical analysis, and advanced ceramics. He has been a guide to over 75 B. Tech, 40 M. Tech and 5 PhD students. He has over 40 publications to his name.

Life @ Meta

Sophies Vs Thirdies Footer Match

Formals Day

MEN at Work

Freshie Welcome

Kurta Day

— Designed by Varun Verma

Team Dhatuki

Contact us at
dhatuki@gmail.com
arunabhsinha@iitb.ac.in
smalik@iitb.ac.in

Department of Metallurgical Engineering and Materials Science , IIT Bombay