



IEI - TLC - NEWS

IN-HOUSE NEWS LETTER OF



Issue No. 2016/10-12

THE INSTITUTION OF ENGINEERS (INDIA)
TIRUCHIRAPPALLI LOCAL CENTRE

CHAIRMAN: Er. R. SELVARAJ, FIE HON. SECRETARY: Er. S. LAKSHMANAN MIE

CHAIRMAN SPEAKS.....

Dear Engineers,

Wishing you & your family a very Happy & prosperous New Year 2017

It is my great pleasure to meet all of you through our IEI_TLC News Letter after myself taking over chairman of our center.

We continue to conduct the weekly lecture programs at our IEI-TLC in all the 15 disciplines of engineering. We keep sending the soft copy of the invitation to all our members .kindly make yourself convenient to attend the same in our premises on every Tuesday technical program.

The weekly technical program is the opportunity for us to enrich the latest technology and also it is a platform where we can meet regularly & chart out our future activities.

I request each member to bring & enroll a new member to increase our corporate membership.

I request all our engineering college faculties, Lecturers, professors, principals, Directors of private Engineering colleges to start student chapters in their institution which will make us to propagate the engineering knowledge in young engineering minds.

Engineering college student branches can avail the "R&D Grant in Aid" to the Institutional Member College projects and also the sponsorship to conduct seminars, workshops in their institution.

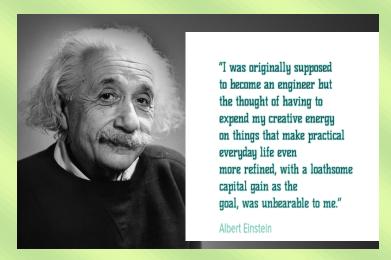
I also request our technician chapters attached to our local center to organize regular technical meeting, plan for industrial visit & plan for refresher courses etc.

We have to take care of our planet by less pollution free technologies to hand over this earth & universe safely to the next young generation.

Wishing you & your family all the best.

With Warm Regards,

(R. SELVARAJ)







IEI - TLC - NEWS

WISHES ITS READERS & MEMBERS

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IEI - TLC - NEWS

Congratulates



Mr. ATUL SOBTI CMD of BHEL & THE RECIPIENT OF

EMINENT ENGINEER AWARD 2016

For his notable achievements and contribution to the engineering profession, Mr. Atul Sobti, CMD, BHEL, was honoured as one of the country's eminent engineering personalities by The Institution of Engineers (India). He was felicitated with a plaque and citation at the 31st Indian Engineering Congress, held at Kolkata.









OUR PRESIDENT



ADDRESS

LVJ Projects Pvt Ltd Office Nos. 1 & 2, First Floor Shrikrishna Centre Mithakhali Six Roads, Navrangpura Ahmedabad 380009 Tel: (079) 26463061 / 30024061

Fax: (079) 26460012 Mobile: 9925206312

Email: navin@lvjprojects.com

Mr Navinchandra B Vasoya, FIE, has been elected as the President of The Institution of Engineers (India) for the Session 2016-2017, during the 691st Council Meeting of the Institution hosted by the Uttarakhand State Centre on September 24, 2016 at Haridwar.

Mr Navinchandra B Vasoya graduated in Chemical Engineering from Gujarat University. Mr Vasoya ventured into the business of manufacturing edible oil, de-oiled cake, solvent refined oil and managed the solvent extraction plant along with the refinery and oil mill including export of de-oiled cake and HPS kernel. He also established two manufacturing units for dyes and intermediates. He was also engaged in preparation of end-to-end project reports for various manufacturing units. As a Managing Director of a company involved in consultancy, project management, Industrial and engineering projects, construction of public infrastructure projects, industrial estate development etc, Mr Vasoya delivered projects of national importance.

He is a dynamic, result-driven leader with proven record in growth & customer development and also a Professional Engineer having diversified rich experience and expertise in Purchase, Sales & Marketing, Business Development, High Value Project Execution, Team Development, Mentoring & Coaching, Industrial Management, Marketing Management, Construction Management, Lead Generation, Forming Strategic Alliances, Financial & Operational Management and Compliances.

Mr Navin Vasoya is associated with and has been serving The Institution of Engineers (India) for more than two decades in various capacities. He was elected as Honorary Secretary for Session 2000-2002 and as Chairman, Gujarat State Centre, IEI for the Session 2002-2004. He was Vice-President of IEI during Session 2011-12. During his long association and involvement in the activities of IEI, he has served as the Chairman, Chemical Engineering Division Board during various Sessions. He led the delegation of IEI to attend IEA Convention at Sydney, Australia in 2012. He is Member of the Executive Committee of Federation of Engineering Institutions of South and Central Asia (FEISCA) and also FEISCA Representative to the World Federation of Engineering Organization (WFEO). Mr Vasoya is a Member of the Technical Standing Committee on "Information and Communication (WFEO - CIC)" for the term 2016-2019.

Mr Vasoya is also a Fellow of International Council of Consultants, Fellow of Indian Institution of Technical Arbitrators, Life Member of Indian Society of Technical Education, Member of Gujarat Chamber of Commerce & Industries and Member of Indo American Chamber of Commerce.

He has presented various papers at National and International Seminars and has widely travelled on various professional assignments countries like United Stated of America, United Kingdom, Germany, Belgium, France, Switzerland, Canada, Australia, China, Indonesia, Singapore, Malaysia, Thailand, Kenya, Nepal, Bangladesh, Sri Lanka, etc.





OUR SECRETARY GENERAL



MAJ GEN SOURESH BHATTACHARYA, VSM (RETD)
SECRETARY & DIRECTOR GENERAL

RESIDENCE

THE INSTITUTION OF ENGINEERS (INDIA) 8 GOKHALE ROAD KOLKATA 700020

Tel: 033-22238230 Email: sdg@ieindia.org

Maj Gen Souresh Bhattacharya has a distinguished Army career spanning 37 years. He did his ICSE from Sherwood College, Nainital and is an alumni of the National Defence Academy. He is a B.Tech in Electronics, has a Masters of Technology degree in Computer Engineering from IIT Kharagpur and is an MBA in Operations Management.

During his Army career, Maj Gen Bhattacharya who is a paratrooper, has held many prestigious Staff and Command assignments including serving as Chief Logistics Officer in UN Peacekeeping Operations in Mozambique and as Defence Attache to Kazakhstan and Kyrgyzstan (2004-2007). He has been Head of Engineering Support in the North East in 2009-10 and in Northern Command (J & K) in 2012-13. Maj Gen Bhattacharya was Additional Director General (Engineering Support Management) in Army Headquarters responsible for sustenance issues related to electronic, missile, Air Defence systems, Armaments and Small Arms. He has travelled widely in India and abroad. He is a recipient of the Vishisht Seva Medal for distinguished service during Command of a Battalion in the Kashmir Valley and Chief of Army Staff Commendation during his tenure as Defence Attache. He has also been awarded Army Training Command and Eastern Command Commendations as also the prestigious IETE Award for outstanding contribution in the development of military simulators. He is widely travelled and his interests include travelling and study of international relations.

Maj Gen Bhattacharya is a Fellow of IEI and IETE, Life Member of CSI and Member AIMA. He is a member of the prestigious India International Centre, Delhi Gymkhana Club, Calcutta Club and Outub Golf Club.



ANNUAL GENERAL MEETING OF TLC









The Annual General Meeting of the Tiruchirappalli Local Centre was conducted at the Institution Building, BHEL Premises, on 26th October 2016. Er. S. Karuppasamy, Chairman hoisted the IEI Flag and all the members gathered at the venue took the flag salutation. Following the flag hoisting, the members assembled in the lecture hall for the Annual General Meeting. Er. S Karuppasamy, Chairman of the Centre welcomed the gathering. Er. D Varatharajulu, Hon. Secretary presented the activity report and audited accounts for the year ended March 31, 2016. The AGM unanimously approved and adopted the same.

Then, Mr. Madhavan, Member, Nomination committee announced the election results for the period 2016-2018. Er. R. Selvaraj, FIE., Dy. GM, BHEL and Past Secretary of IEI, TLC was elected as Chairman, unanimously. Er. S Lakshmanan, MIE., Dy. Manager, BHEL, has been

elected Hon. Secretary of the Centre. Along with them the committee for the term 2016-18 also was elected unanimously.

Er. S Karuppasamy installed Er. R Selvaraj as Chairman. Then, the new chairman Er. R Selvaraj addressed the members. In his address, he said, "I am thankful to the members for the confidence posed on him and his team. It is a great privilege for me to join the galaxy of distinguished past chairmen of the centre."



He assured the members he and his team will take the centre

for further heights. He has acknowledged the immense contributions made by the past chairmen of the centres and appreciated the excellent work done by Er. S Karuppasamy and Er D Varatharajulu. He







also solicited the support of all members in executing his duties and responsibilities in the best possible way.

Senior members like Er. S Dharmaligam, Er. S Samidas, Er. P. Nagamanickam offered their felicitations during the AGM.

Er. S Lakshmanan, Hon. Secretary proposed the vote of thanks. Er. Madhavan,



conducted the proceedings.

The list of Committee members elected during the AGM is detailed below.



COMMITTEE FOR THE PERIOD 2016-2018

Chairman	ER R SELVARAJ FIE	rselvaraj@bheltry.co.in	
Hon. Secretary	ER S LAKSHMANAN MIE	laks@bheltry.co.in	
Imm. Past Chairman	ER S KARUPPASAMY FIE	sksamy.bhel@gmail.com	
Imm. Past Secretary	ER D VARATHARAJALU MIE	rajalu@bheltry.co.in	





Members

SL. No	Division	Name	Mail-ID	
1.	Aerospace Engineering	DR NADARAJA PILLAI S MIE	aeropillai@gmail.com	
2.	Agricultural Engineering	ER K R UDHAYAKUMAR MIE	udhayaa_try@yahoo.com	
3.	Architectural Engineering	ER MARUTHACHALAM ANAND MIE	anandbemba@gmail.com	
4.	Chemical Engineering	DR N ANANTHARAMAN FIE	naramanrect@yahoo.co.in	
5.	Civil Engineering	ER D HARSHA FIE	harsha_dorairajan@yahoo.co.in	
6.	Civil Engineering	DR G SWAMINATHAN FIE	gs@nitt.edu	
7.	Civil Engineering	ER B CHANDRAKANTH MIE	chandrakanth.bala@gmail.com	
8.	Computer Engineering	ER A ANAND MIE	anand_visuvasam@yahoo.com	
9.	Electrical Engineering	ER S DHARMALINGAM FIE	sdharma59@gmail.com	
10.	Electrical Engineering	ER N KUMARESAN MIE	nkumar@nitt.edu	
11.	Electronics & Tele- Communication Engineering	DR N SIVAKUMARAN MIE	nsk@nitt.edu	
12.	Environmental Engineering	DR S T RAMESH MIE	strames@nitt.edu	
13.	Marine Engineering	MR CHINNAPPAN A SEBASTIAN FIE		
14.	Mechanical Engineering	ER P NAGAMANICKAM FIE	pnagamanickam@gmail.com	



15.	Mechanical Engineering	ER N RAJASEKARAN MIE	nrajas@bheltry.co.in	
16.	Mechanical Engineering	ER R SIVARAMAKRISHNAN MIE	rsivaram@bheltry.co.in	
17.	Metallurgical & Materials Engineering	ER M ANVARALI MIE	man@bheltry.co.in	
18.	Mining Engineering	ER V ANNAMALAI MIE		9
19.	Production Engineering	ER S SAMIDAS FIE	ssdas1945@gmail.com	
20.	Textile Engineering	ER G BALAKRISHNAN AMIE	bal05kri@yahoo.com	



TLC at 31st INDIAN ENGINEERING CONGRESS

The 31st Indian Engineering Congress of IEI was held at Kolkata between December 16 and 18, 2016 at Kolkata. The theme of this year's congress was "SMART Technologies for Natural Resource Conservation and Sustainable Development".

Our Centre was represented by our Chairman Er. R Selvaraj and our immediate past chairman Er. S. Karuppasamy.





ENERGY CONSERVATION DAY 2016

The IEI – TLC centre celebrated the ENERGY CONSERVATION DAY 2016 with a lecture on the topic "Energy Conservation through Energy Efficiency". The deliberations on the theme were made by Er. S. Mahadevan, BE, MBA, FIE, MIMA, Consultant, Energy and Energy Efficiency from Chennai, Er. P. Kothandaraman, former Dy. GM of BHEL and Er. M. Chandramohan, Dy. Director, PCRA, Chennai.



Er. S Lakshmanan, Hon. Secretary welcomed the gathering. Er R Selvaraj, Chairman of the centre chaired the session and addressed the members.

Er. S. Samidas & Er. P. Nagamanickam past chairmen of the centre and Er. Ramadas, Sr. Member of the institute graced the occasion and honoured the speakers.











The learnings of the proceedings of the day are shared below.





We all know that as a simple rule, demand for Energy keeps going up with increased developments and improving standards of living. We also know that in order to produce and make available more Secondary forms of Energy, i.e Heat, Fuel and Electricity, we need to consume more Primary resources like Coal or Oil or Gas or Nuclear or Renewable Sources. We are seeing in our country also that the demand has been galloping, far exceeding the supplies, that there have always been shortages. Due to depleting resources and due to environmental problems that go along with use of more and more of resources, the need for Conservation is propagated. Conservation, in simple terms, comprises of two important components, namely, Avoiding wastes and Using Energy Efficiently.





Inefficient use of Energy increases the demand much more and actually results in enormous consumption of Primary Sources. We are all reading every day about the pressures on Governments to provide more and more of Electricity and Petroleum Products due to galloping demands. Efficient use of Energy is a matter of great concern everywhere, but India needs to worry more as we really seem to be wasting enormous amount of Energy and consequently the resources, due to inefficiencies in all uses, partly due to subsidies and mostly due to ignorance.

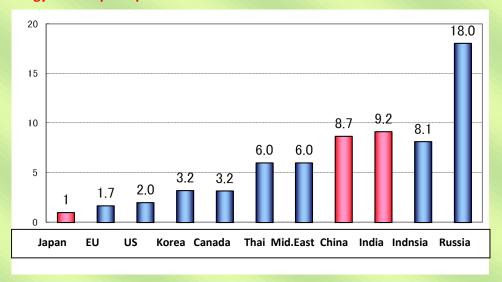






The ultimate measure of Efficiency or Inefficiency of a Country is the Total Primary Energy Spent by a Country in comparison to the GDP or the wealth generated in the forms of Agricultural Production, Industrial Production and Services Revenues generated by that Country. It is an alarming fact that India scores very poorly on this score as can be seen from the data provided below, extracted from one of the Presentations of Petroleum Conservation Research Association.

Primary Energy Consumption per GDP



Japanese primary energy consumption per GDP is the lowest in the world which is taken as 1 for comparison Energy Consumption per Unit of GDP by other countries. As can be seen from the Chart, India consumes about 9 times of Coal or Oil or other Primary materials to produce a Unit of GDP compared to Japan and the US 2 times, Korea 3.2 times and so on.

Energy efficiency is a way of managing and restraining the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input. For example, when a compact florescent light (CFL) bulb uses less energy (one-third to one-fifth) than an incandescent bulb to produce the same amount of light, the CFL is considered to be more energy efficient.

Conserving energy through efficient uses of Energy is our collective responsibility for a better tomorrow.



Message of Director General, Bureau of Energy Efficiency

With the growth of economy, the demand for energy has grown substantially. Further, the high level of energy intensity in some of the sectors is a matter of concern. In such a scenario efficient use of energy resources and their conservation assume tremendous significance and is essential for curtailment of wasteful consumption and sustainable development. Recognizing the fact that efficient use of energy and its conservation is the least-cost option to meet the increasing energy demand, Government of India has enacted the Energy Conservation Act, 2001 and established the Bureau of Energy Efficiency in March, 2002. The Act provides for institutionalizing and strengthening delivery mechanism for energy efficiency services in the country and provides the much-needed coordination between the various entities. Energy saving is a national cause and all of us will have to join hands and make all out efforts in making India an energy efficient economy and society so that not only we remain competitive within our own market but also are able to compete in the international market.

Small Drops make ocean

Wastes that may look very small and insignificant could actually add up to substantial quantities over a period of time if left unattended. It could be oil in a pipeline or compressed air in an industry or water in water supply lines. Oil Industry has measured that "LOSS OF ONE DROP OF OIL EVERY SECOND CAN COST OVER 2000 LITERS A YEAR". Same concept will also apply to 'little extra loss at each point and millions of such points will add up to huge total losses cumulatively. Road condition and speed breakers can be a simple example.

It will be interesting to just look at one category of automobiles, namely the passenger cars and the fuel efficiency of passenger cars measured as KMs per liter of fuel in small and medium cars like Premier Padmini and Ambassador, which were largely in use for decades till around 1990, used to be around 8 to 10 KMs per liter under ideal conditions and were much lower under actual conditions. With the introduction of Maruthi Cars in Indian market followed by many other makes and models of small and medium cars with overall efficiencies improved through addressing all elements and areas big and small, presently, declared figures are all around 20 to 25 KMs and they are somewhat achieved under actual conditions. TATAs who worked and brought out NANO cars are now working on cars with fuel efficiency of 100 KMs per liter of fuel. It is well known that the share of Electrical Energy, in the total basket of Energy forms of Heat, Fuel and Electricity, is almost 60% and this share is also steadily increasing. We see that most of Electrical Energy is actually an intermittent form of Energy for finally providing Mechanical Energy, apart from of course about 20% of it going to provide Lighting. Latest advancements in efficient use of Total Energy, demonstrate and provide solutions in which, Electrical and Mechanical Energy work together to provide much better "End Use Efficiencies" which is most critical. The ultimate solution to improving Efficiency of Energy use per unit of GDP generation by a country lies in looking at all avenues of wastes, small and big, and Efficiencies in all uses of Energy forms of Heat or Fuel or Electricity, small and big, be it in homes or transports or buildings or agriculture or industries.





Lecture on "Stereo Camera Based Navigational Aid For Visually Impaired" on 1st November 2016

Division: Computer Engineering



On 1st November 2016, Dr. G Balakrishnan, Professor in Computer Science Engineering Program and Director of Indra Ganesan College of Engineering, Tiruchirappalli, India delivered a lecture on "Stereo Camera Based Navigational Aid for Visually Impaired" at the Institution premises. The programme was organised jointly with the Computer Society of India,

Tiruchirappalli Chapter.

His lecture presented a review on vision aided systems and proposes an approach for visual rehabilitation using stereo vision technology. The proposed system utilizes stereo vision, image processing methodology and a sonification procedure to support blind navigation. The developed system includes wearable computer. Stereo cameras a vision sensor and stereo earphones, all moulded in a helmet. The image of the scene in front of visually handicapped is captured by the vision sensors. The captured images are processed to enhance the important features in the scene in front, for



navigation assistance. The image processing is designed as model of human vision by identifying the obstacles and their depth information. The processed image is mapped on to musical stereo sound for the blind's understanding of the scene in front. The developed method has been tested in the indoor and outdoor environments and the proposed image processing methodology is

found to be effective for object identification.

The event was jointly organised with CSI, Tiruchy chapter.

Lecture on "Mystery of the Mind & Decision Making" on 8th November 2016

Division: General & Inter Disciplinary





On 8th November 2016, the gathering at the premises of our institution witnessed a different and interesting lecture by Dr. Subburethina Bharathi professor and Director of MAM B School. He delivered an interesting lecture on "Mystery of the Mind and Decision Making". The author kept the audience participative and elaborated about the Mysteries involved in decision





making done by Mind and Mapping management carried out by Mind.





Lecture on "Light Emitting Diodes & Its Driver Topologies" on 15th November 2016

Division: Electrical Engineering

On 15th November 2016, Dr. Kevin Ark Kumar, Sr. Engineer (M&S), Unit II of BHEL, Tiruchirappalli



delivered a lecture on "Light Emitting Diodes & Its Driver Topologies" at the institution premises.

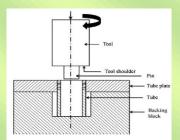
In his lecture the speaker said, "Light Emitting Diode (LED) is clearly emerging as an alternative illuminating element in the recent days. The advantages of LED include long life time, fast response and smaller size. Therefore, LEDs have been widely used for various lighting applications, such as traffic lights, flash lights,

automotive lightings, signage and LCD television backlights".

His speech also covered the features and properties of LED, the drivers of LED and the differentiating characteristics of each method of drivers.

Lecture on "Friction Welding of Tube to Tube Plate using an External Tool" on 22nd November 2016

Division: Metallurgical and Materials Engineering



Dr. S. Muthukumaran, Associate Professor, MME Dept. of NIT, Tiruchirappalli delivered a lecture on "Friction Welding of Tube to Tube Plate using an External Tool (FWTPET)", a patented technology to the gathering at our premises on 22nd November 2016.







IWS, IIM, ISNT and IIW, the professor elaborated on the theme of the presentation

In the event jointly organised along with



and its advantages. He said, "FWTPET is a solid state welding process suitable to join to tube plates. It is suitable to join either similar or dissimilar materials with enhanced mechanical properties including tensile strength. The important parameters affecting the quality of the weld are tool rotational speed shoulder.

weld are tool rotational speed, shoulder diameter and clearance between pin and tube. FWTPET can be carried out using either clearance method or interference



method. But in practice, the clearance method offers more flexibility to adopt. The solid state bonding is an eco-friendly process."





Lecture on "Lean Tool - Value Stream Mapping" on 29th November 2016



Production Engineering Division:

Er. D. Aravindhan, Manager, BHEL delivered a lecture on "Lean Tool - Value Stream Mapping" on 29th November 2016.

The speaker in his presentation said, "The



LEAN Tools are KAIZEN, GEMBA, Level Scheduling, 5S, Visual Factory, Andon, Muda, Six Big Losses, PDCA, Root Cause Analysis, Poka-Yoke, FMEA, FMS, 6Sigma, Cellular Manufacturing, Hoshin Kanri, Bench Marking, SMART Goals, Empowerment, Jidoka, OEE, TPM, SMED, Standardized Work, Bottleneck Analysis, One piece Flow, JIT, Kanban, Value Stream Mapping.

Lean is the set of tools that assist in the identification and steady elimination





Value Stream Mapping is all the ACTIONS, (both value-added and nonvalue-added) currently required to bring a product through the production, information flow across boundaries, from raw material into the arms of the customer. BHEL, Tiruchy implemented Lean in Long Lead time Products like Valves, Drum, Headers, Spiral Water Wall Panels, etc."

Lecture on "Design of RCC Structures using STRUDS package" on 06th December 2016

Division: Civil Engineering

The lecture organised under civil engineering division on 06th December 2016 on the topic "Design of RCC Structures using STRUDS package" briefed about the features of the STRUDS software package. It is used for designing of RCC and Steel structures to Indian codes. The Main features of this software are

- Design multi-storey and high rise concrete buildings quickly and
- Design all building components including slabs, beams, columns, shear walls and foundations
- Apply a variety of loads like UDL, point loads and external moments to the model
- Design steel trusses supported by concrete columns
- Perform seismic analysis as per IS:1893
- . Generate detailed CAD drawings, design schedules, BOQ and calculation reports
- Import and export building models with other structural software
- Perform advanced 3D space frame analysis, with optional plane grid and plane frame analysis
- Perform wind load analysis to code IS:875
- Apply seismic analysis by response spectrum analysis
- Consider floor diaphragm effect in analysis
- Perform torsion analysis due to eccentricity between centre of mass and centre of rigidity







- Undertake shear wall analysis
- Produce analysis results for forces and displacements
- Produce clear diagrams for shear force, bending moment and deflections
- Product written and graphical representation for end moments and end reactions
- Produce detailed calculation reports
- Prepare floor-wise design schedules for all components
- Adopt ductile detailing as per IS:13920 and normal detailing as per SP-34
- Generate multi-layered DXF drawings for slabs, beams, columns, shear walls and footings
- Produce BOQ / material lists of concrete and steel components including slabs, beams, columns, foundations.
- Export models to other structural software

Lecture on "Smart Materials" on 20th December 2016



Division: Mechanical Engineering

Dr A Kumaravel, Professor and Head, Department of Mechanical Engineering, K.S.R College of Technology, Tiruchengode delivered a lecture on" Smart Materials". The following are the highlights of the lecture programme.

• Smart materials are used in aerospace applications, marine applications, automotive applications, structural applications, and

computers and electronic devices etc.

- Piezoelectric materials which have capability to produce a voltage when surface strain is applied.
 Conversely, the material undergoes deformation (stress) when an electric field is applied across it. The most commonly used piezoelectric ceramic today is lead zirconium titanate (PZT).
- Piezoelectric materials are widely utilized as electromechanical energy converters for actuators, sensors, and transformers.
- Electrostrictive materials can also change their dimensions on the application of an electric field.
 Although the changes thus obtained are not linear in either direction, these materials have widespread application in medical and engineering fields.
- Magnetostrictive materials are quite similar to Electrostrictive materials, except for the fact that
 they respond to magnetic fields. The most widely used Magnetostrictive material is TERFENOLD, which is made from the rarest of the rare earth elements, i.e. Terbium. This material is highly
 non-linear and has the capability to produce large strains.
- The magnetostrictive materials and their applications such as: Reaction Mass Actuator, A standard Terfenol-D Actuator, Linear Motor Based on Terfenol-D (Worm Motor), Terfenol-D in Sonar Transducers, Terfenol-D Wireless Rotational Motor, Terfenol-D Electro-Hydraulic Actuator, Wireless Linear Micro-Motor, Magnetostrictive Film Applications, Magnetostrictive Contactless Torque Sensors and many other applications.
- Shape Memory Alloys (SMAs) are metallic alloys that undergo a solid-to-solid phase transformation which can exhibit large recoverable strains. Example: Nitinol. Upon heating the material in the martensitic phase, a reverse phase transformation takes place and as a result the material transforms to austenite.



- Magnetorheological materials (MR) are again based on a mineral or silicone oil carrier but this time the solid dispersed within the fluid is a magnetically soft material (such as iron) and the properties of the fluid are altered by applying a magnetic field. In both cases the dispersed particles are of the order of microns in size. The smart fluids are used in vibration damping and variable torque transmission in automotive and aerospace industries. MR dampers are used to control the suspension in cars to allow the feel of the ride to be varied. Dampers are also used in prosthetic limbs to allow the patient to adapt to various movements for example the change from running to walking.
 - Export models to other structural software

Lecture on "3D Printing & other digitalization initiatives in Manufacturing" on 27th December 2016

Division: Computer Engineering

In the lecture programme organised in association with the Computer Society of India, Er M Sathese, Senior Engineer, Boiler Production, BHEL, Tiruchirappalli made a presentation on "3D Printing & other digitalization initiatives in Manufacturing". The following are the salient features of the lecture delivered on 27th December 2016.





Additive Manufacturing (AM) is an appropriate name to describe the technologies that build 3D objects by adding layer-upon-layer of material, whether the material is plastic, metal, concrete or even human tissue. The term AM encompasses many technologies like 3D Printing, Rapid Prototyping etc, early use of AM in the form of Rapid Prototyping focused

on preproduction visualization models. More recently, AM is being used to fabricate end-use products in aircraft, dental restorations, medical implants, automobiles, and even fashion products.

Few processes of Additive Manufacturing (AM):



Stereo lithography: Very high end technology utilizing laser technology to cure layer-upon-layer of photopolymer resin (polymer that changes properties when exposed to light). The build occurs in a pool of resin. A laser beam, directed into the pool of resin, traces the cross-section pattern

of the model for that particular layer and

cures it. During the build cycle, the platform on which the build is repositioned, lowering by a single layer thickness. The process repeats until the build or model is completed and fascinating to watch. Specialized material may be needed to add support to some model features. Models can be machined and used as patterns for injection moulding, thermoforming or other casting processes.



Fused Deposition Modelling: Process oriented involving use of thermoplastic (polymer that changes to a liquid upon the application of heat and solidifies to a solid when cooled) materials injected through indexing nozzles onto a platform. The nozzles trace the cross-section pattern for each particular layer with the thermoplastic material hardening prior to the application of the next layer. The process repeats





until the build or model is completed and fascinating to watch. Specialized material may be need to add support to some model features. Similar to SLA, the models can be machined or used as patterns. Very easy-to-use and cool.

Selective Laser Sintering (SLS): Somewhat like SLA technology Selective Laser Sintering (SLS) utilizes a high powered laser to fuse small particles of plastic, metal, ceramic or glass. During the build cycle, the platform on which the build is repositioned, lowering by a single layer thickness. The process repeats until the build or model is completed. Unlike SLA technology, support material is not needed as the build is supported by unsintered material.

Multi-Jet Modelling: Multi-Jet Modelling is similar to an inkjet printer in that a head, capable of shuttling back and forth (3 dimensions-x, y, z)) incorporates hundreds of small jets to apply a layer of thermo polymer material, layer-by-layer.

Internet of Things (IoT): The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A thing, in the Internet of Things, can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low -- or any other natural or man-made object that can be assigned an IP address and provided with the ability to transfer data over a network. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), microservices and the internet. The convergence has helped tear down the silo walls between operational technology (OT) and information technology (IT), allowing unstructured machine-generated data to be analyzed for insights that will drive improvements.



JANUARY 2017			
Date	Division	Topic	Speaker
03-01-2017	Marine Engineering	Ocean Energy	Er Deepak Kumar Nayak, BHEL
10-01-2017	Computer Engineering	Security in Cloud	Er K Vignesh, MAMCE
17-01-2017	Production Engineering	Energy Efficiency in Welding - Equipment, Processes, Practices and Environment	Er V Ratchanniya Samuel, BHEL
24-01-2017	Metallurgical and Materials Engineering	Synthesis of Al-MoO3 composites through Optimized powder metallurgy parameters	Dr M Ravichandran, CCET
31-01-2017	Agricultural Engineering	Technological Disruptive ideas in Farming – Opportunities for Engineers	Er P Gomathi Nayagam, Consultant Agricultural Engineer





FEBRUARY 2017			
Date	Division	Topic	Speaker
07-02-2017	Metallurgical and Materials Engineering	Bio Materials	Dr. N. Ramesh babu, NITT
14-02-2017	Computer Engineering	Information System and The Entropy	Er .Parigyan Singh, BHEL
21-02-2017	Mechanical Engineering	Mems Based Poxket Factory	Er TTM. Kannan, IGCE
28-02-2017	Production Engineering	Familiarisation of Different NDE Methods	Er T. Gurunathan, BHEL

For Details Please see Engagement Column of Leading Newspapers of Tiruchirappalli



Nanomaterials & Nanoscience



Courtesy: Nanowerk.com

Nanomaterials are not simply another step in the miniaturization of materials or particles. They often require very different production approaches. There are several processes to create various sizes of nanomaterials, classified as 'top-down' and 'bottom-up'. Although large numbers of nanomaterials are currently at the laboratory stage of manufacture, many of them already are being commercialized.

Below we outline some examples of nanomaterials and the range of nanoscience that is aimed at understanding their properties. As will be seen, the behavior of some nanomaterials is well understood, whereas others present greater challenges.

Nanoscale in One Dimension – Thin films, layers and surfaces

One-dimensional nanomaterials, such as thin films and engineered surfaces, have been developed and used for decades in fields such as electronic device manufacture, chemistry and engineering.

In the silicon integrated-circuit industry, for example, many devices rely on thin films for their operation, and control of film thicknesses approaching the atomic level is routine.

Monolayers (layers that are one atom or molecule deep) are also routinely made and used in chemistry. The most important example of this new class of materials is graphene.

The formation and properties of these layers are reasonably well understood from the atomic level upwards, even in quite complex layers (such as lubricants). Advances are being made in the control of the composition and smoothness of surfaces, and the growth of films.

Engineered surfaces with tailored properties such as large surface area or specific reactivity are used routinely in a range of applications such as in fuel cells and catalysts. The large surface area provided





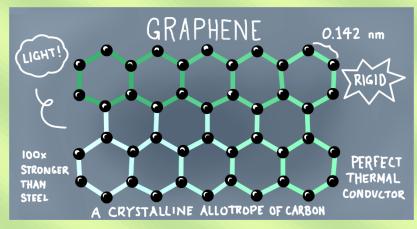
by nanoparticles, together with their ability to self assemble on a support surface, could be of use in all of these applications.

Although they represent incremental developments, surfaces with enhanced properties should find applications throughout the chemicals and energy sectors.

The benefits could surpass the obvious economic and resource savings achieved by higher activity and greater selectivity in reactors and separation processes, to enabling small-scale distributed processing (making chemicals as close as possible to the point of use). There is already a move in the chemical industry towards this.

Another use could be the small-scale, on-site production of high value chemicals such as pharmaceuticals.

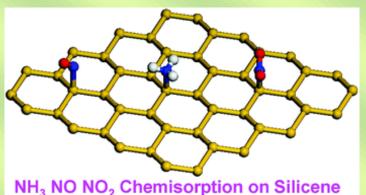
Nanoscale in One Dimension –Graphene and other single- and few-layer materials



Graphene is an atomic-scale honeycomb lattice made of carbon atoms. Graphene is undoubtedly emerging as one of the most promising nanomaterials because of its unique combination of superb properties, which opens a way for its exploitation in a wide spectrum of applications ranging from electronics to optics, sensors

and biodevices.

For instance, grapheme based nanomaterials have many promising applications in energy-related areas. Just some recent examples: Graphene improves both energy capacity and charge rate in rechargeable batteries; activated graphene makes superior super capacitors for energy storage; graphene electrodes may lead to a promising approach for making solar cells that are inexpensive, lightweight and flexible; and multifunctional graphene mats are promising substrates for catalytic



systems. The fascination with atomic-layer materials that has started with graphene has spurred researchers to look for other 2D structures like for instance metal carbides and nitrides.

One particularly interesting analogue to graphene would be 2D silicon – silicene – because it could be synthesized and processed using mature semiconductor

techniques, and more easily integrated into existing electronics than graphene is currently.

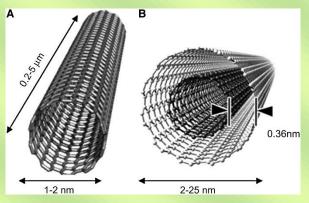




Another material of interest is 2D boron, an element with worlds of unexplored potential. And yet another new two dimensional material – made up of layers of crystal known as molybdenum oxides – has unique properties that encourage the free flow of electrons at ultra-high speeds.

Nanoscale in Two Dimensions

Two dimensional nanomaterials such as tubes and wires have generated considerable interest among the scientific community in recent years. In particular, their novel electrical and mechanical properties are the subject of intense research.



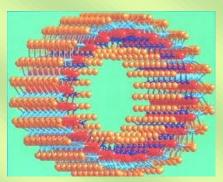
Carbon nanotubes

Carbon nanotubes (CNTs) were first observed by Sumio lijima in 1991. CNTs are extended tubes of rolled graphene sheets. There are two types of CNT: single-walled (one tube) or multi-walled (several concentric tubes). Both of these are typically a few nanometres in diameter and several micrometres to centimetres long. CNTs have assumed an important role in the context of nanomaterials, because of their

novel chemical and physical properties. They are mechanically very strong (their Young's modulus is over 1 terapascal, making CNTs as stiff as diamond), flexible (about their axis), and can conduct electricity extremely well (the helicity of the graphene sheet determines whether the CNT is a semiconductor or metallic). All of these remarkable properties give CNTs a range of potential applications: for example, in reinforced composites, sensors, nanoelectronics and display devices.

CNTs are now available commercially in limited quantities. They can be grown by several techniques. However, the selective and uniform production of CNTs with specific dimensions and physical properties is yet to be achieved. The potential similarity in size and shape between CNTs and asbestos fibres has led to concerns about their safety.

Inorganic nanotubes



Inorganic nanotubes and inorganic fullerene-like materials based on layered compounds such as molybdenum disulphide were discovered shortly after CNTs. They have excellent tribological (lubricating) properties, resistance to shockwave impact, catalytic reactivity, and high capacity for hydrogen and lithium storage, which suggest a range of promising applications. Oxide-based nanotubes (such as titanium dioxide) are being explored for their applications in catalysis, photo-catalysis and energy storage.



Nanowires



sembly. They can be made from a wide range of materials. Semiconductor nanowires made of silicon, gallium nitride and indium phosphide have demonstrated remarkable optical, electronic and magnetic characteristics (for example, silica nanowires can bend light around very tight corners).

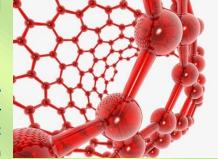
Nanowires have potential applications in high-density data storage, either as magnetic read heads or as patterned storage nedia, and electronic and opto-electronic nanodevices, for metallic erconnects of quantum devices and nanodevices.

The preparation of these nanowires relies on sophisticated growth techniques, which include self assembly processes, where atoms arrange themselves naturally on stepped surfaces, chemical vapour deposition (CVD) onto patterned substrates, electroplating or molecular beam epitaxy (MBE). The

'molecular beams' are typically from thermally evaporated elemental sources.

Biopolymers

The variability and site recognition of biopolymers, such as DNA molecules, offer a wide range of opportunities for the self-organization of wire nanostructures into much more complex patterns. The DNA backbones may then, for example, be coated in



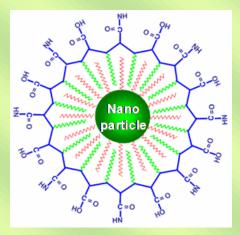
metal. They also offer opportunities to link nano- and biotechnology in, for example, biocompatible sensors and small, simple motors.

Such self-assembly of organic backbone nanostructures is often controlled by weak interactions, such as hydrogen bonds, hydrophobic, or van der Waals interactions (generally in aqueous environments) and hence requires quite different synthesis strategies to CNTs, for example.

The combination of one-dimensional nanostructures consisting of biopolymers and inorganic compounds opens up a number of scientific and technological opportunities.

Nanoscale in Three Dimensions

Nanoparticles



Nanoparticles are often defined as particles of less than 100 nm in diameter. We classify nanoparticles to be particles less than 100 nm in diameter that exhibit new or enhanced size-dependent properties compared with larger particles of the same material.

Nanoparticles exist widely in the natural world: for example as the products of photochemical and volcanic activity, and created by plants and algae. They have also been created for thousands of years as products of combustion and food cooking, and more recently from vehicle exhausts. Deliberately manufactured



nanoparticles, such as metal oxides, are by comparison in the minority. Nanoparticles are of interest because of the new properties (such as chemical reactivity and optical behaviour) that they exhibit compared with larger particles of the same materials.

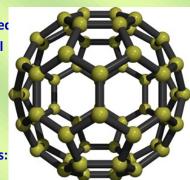
For example, titanium dioxide and zinc oxide become transparent at the nanoscale, however are able to absorb and reflect UV light, and have found application in sunscreens.

Nanoparticles have a range of potential applications: in the short-term in new cosmetics, textiles and paints; in the longer term, in methods of targeted drug delivery where they could be to used deliver drugs to a specific site in the body.

Nanoparticles can also be arranged into layers on surfaces, providing a large surface area and hence enhanced activity, relevant to a range of potential applications such as catalysts. Manufactured nanoparticles are typically not products in their own right, but generally serve as raw materials, ingredients or additives in existing products. Nanoparticles are currently in a number of consumer products such as cosmetics and their enhanced or novel properties may have implications for their toxicity. For most applications, nanoparticles will be fixed (for example, attached to a surface or within in a composite) although in others they will be free or suspended in fluid. Whether they are fixed or free will have a significant affect on their potential health, safety and environmental impacts.

Fullerenes (carbon 60)

In the mid-1980s a new class of carbon material was discovered called carbon 60 (C60). Harry Kroto andRichard Smalley, the experimental chemists who discovered C60 named it "buckminsterfullerene", in recognition of the architect Buckminster Fuller, who was well-known for building geodesic domes, and the term fullerenes was then given to any closed carbon cage. C60 are spherical molecules about 1nm in diameter, comprising 60 carbon atoms arranged as 20 hexagons and 12 pentagons: the configuration of a football.

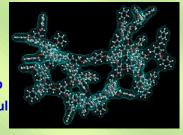


In 1990, a technique to produce larger quantities of C60 was developed by resistively heating graphite rods in a helium atmosphere.

Several applications are envisaged for fullerenes, such as miniature 'ball bearings' to lubricate surfaces, drug delivery vehicles and in electronic circuits.

Dendrimers

Dendrimers are spherical polymeric molecules, formed through a nanoscale hierarchical self-assembly process. There are many types of dendrimer; the smallest is several nanometres in size. Dendrimers are used in conventional applications such as coatings and inks, but they also have a range of interesting properties which could lead to useful applications.

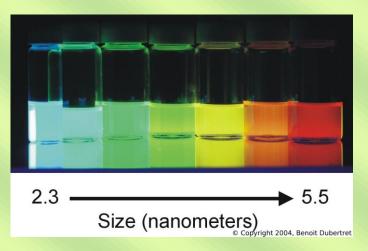


For example, dendrimers can act as nanoscale carrier molecules and as such could be used in drug delivery. Environmental clean-up could be assisted by dendrimers as they can trap metal ions, which could then be filtered out of water with ultra-filtration techniques.



Quantum dots

Nanoparticles of semiconductors (quantum dots) were theorized in the 1970s and initially created in the early 1980s. If semiconductor particles are made small enough, quantum effects come into play, which limit the energies at which electrons and holes (the absence of an electron) can exist in the particles. As energy is related to wavelength (or colour), this means that the optical properties of the particle can be finely tuned depending on its size. Thus,



particles can be made to emit or absorb specific wavelengths (colours) of light, merely by controlling their size.

Recently, quantum dots have found applications in composites, solar cells (Gratzel cells) and fluorescent biological labels (for example to trace a biological molecule) which use both the small particle size and tuneable energy levels.

Recent advances in chemistry have resulted in the preparation of monolayer-protected, high-quality, monodispersed, crystalline quantum dots as small as 2nm in diameter, which can be conveniently treated and processed as a typical chemical reagent.





NANOTECHNOLOGY APPLICATIONS

Areas where nanotechnology is used

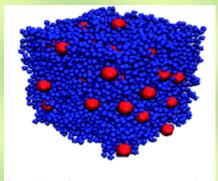
Today, a life without nanotechnology is hard to imagine. Nanotechnologies – to be more specific: nanomaterials – are already used in numerous products and industrial applications. Our Nanotechnology Products and Applications database already provides an overview of how nanomaterials and nanostructuring applications are used today in industrial and commercial applications across industries (please note: This is NOT a consumer products database that you can find elsewhere; so no antibacterial socks, bathroom cleaners, face creams, or pet products here...).

Here is a brief overview of some current applications of nanomaterials. Most of them represent evolutionary developments of existing technologies: for example, the reduction in size of electronics devices.

Nanocomposites

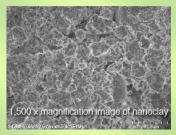
An important use of nanoparticles and nanotubes is in composites, mate rials that combine one or more separate components and which are designed to exhibit overall the best properties of each component. This multi-functionality applies not only to mechanical properties, but extends to optical, electrical and magnetic ones.

Currently, carbon fibres and bundles of multi-walled CNTs are used in polymers to control or enhance conductivity, with applications such as antistatic packaging. The use of individual CNTs in composites is a potential long-term application. A particular type of nanocomposite is where nanoparticles act as fillers in a matrix; for example, carbon black used as a filler to reinforce car tyres. However, particles of carbon black can range from tens to hundreds of nanometres in size, so not all carbon black falls within our definition of nanoparticles.



Snapshot of polymer nanocomposites

Nanoclays



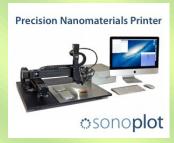
Clays containing naturally occurring nanoparticles have long been important as construction materials and are undergoing continuous improvement. Clay particle based composites – containing plastics and nano-sized flakes of clay – are also finding applications such as use in car bumpers.

Nanocoatings and nanostructured surfaces

Coatings with thickness controlled at the nano- or atomic scale have been in routine production for some time, for example in molecular beam epitaxy or metal oxide chemical vapor deposition for optoelectonic devices, or in catalytically active and chemically functionalized surfaces. Recently developed applications include the self-cleaning window, which is coated in highly activated titanium dioxide, engineered to be highly hydrophobic (water repellent) and antibacterial, and coatings based on nanoparticulate oxides that catalytically destroy chemical agents.



Wear and scratch-resistant hard coatings are significantly improved by nanoscale intermediate layers (or multilayers) between the hard outer layer and the substrate material. The intermediate layers give good bonding and graded matching of elastic and thermal properties, thus improving adhesion. A range of enhanced textiles, such as breathable, waterproof and stainresistant fabrics, have been enabled by the improved control of porosity at the nanoscale and surface roughness in a variety of polymers and inorganics.



Tougher and Harder Cutting Tools

Cutting tools made of nanocrystalline materials, such as tungsten carbide, tantalum carbide and titanium carbide, are more wear and erosion-resistant, and last longer than their conventional (large-grained) counterparts. They are finding applications in the drills used to bore holes in circuit boards.

Nanopaints

Incorporating nanoparticles in paints could improve their performance, for example by making them lighter and giving them different properties. Thinner paint coatings ('lightweighting'), used for example on aircraft, would reduce their weight, which could be beneficial to the environment. However, the whole life cycle of the aircraft needs to be considered before overall benefits can be claimed. It may also be possible to substantially reduce solvent content of paints, with resulting environmental benefits. New types of foulingresistant marine paint could be developed and are urgently needed as alternatives to tributyl tin (TBT), now that the ecological impacts of TBT have been recognised. Antifouling surface treatment is also valuable in process applications such as heat exchange, where it could lead to energy savings. If they can be produced at sufficiently low cost, fouling-resistant coatings could be used in routine duties such as piping for domestic and industrial water systems. It remains speculation whether very effective anti-fouling coatings could reduce the use of biocides, including chlorine. Other novel, and more long-term, applications for nanoparticles might lie in paints that change colour in response to change in temperature or chemical environment, or paints that have reduced infra-red absorptivity and so reduce heat loss.

Concerns about the health and environmental impacts of nanoparticles may require the need for the durability and abrasion behaviour of nano-engineered paints and coatings to be addressed, so that abrasion products take the form of coarse or microscopic agglomerates rather than individual nanoparticles.

Nanolubricants

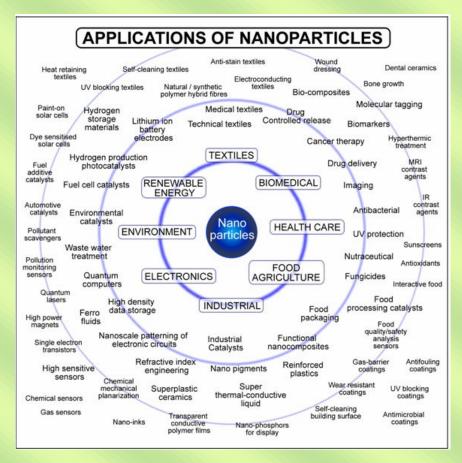
Nanospheres of inorganic materials could be used as lubricants, in essence by acting as nanosized 'ball bearings'. The controlled shape is claimed to make them more durable than conventional solid lubricants and wear additives. Whether the increased financial and resource cost of producing them is offset by the longer service life of lubricants and parts remains to be investigated. It is also claimed that these nanoparticles reduce friction between metal surfaces, particularly at high normal loads. If so, they should find their first applications in high-performance engines and drivers; this could include the energy sector as well as transport. There is a further claim that this type of lubricant is effective even if the metal surfaces are not highly smooth. Again, the benefits of reduced cost and resource input for machining must be compared against production of nanolubricants. In all these applications, the





particles would be dispersed in a conventional liquid lubricant; design of the lubricant system must therefore include measures to contain and manage waste.

In the following, we are taking a closer look at how nanotechnologies already are impacting many industrial areas. An excellent staring point is this chart that lists an impressive array of applications of nanoparticles:



Source: "Commercial scale production of inorganic nanoparticles"

...... To be continued

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On behalf of the Institution of Engineers (India), Tiruchirappalli Local Centre, published by Er. S. Lakshmanan, Hon. Secretary, IEI, TLC

Edited by: Er. S. Dharmalingam FIE, Er. N Rajasekaran MIE & Er. A. Anand MIE. Feedback & Suggestions are welcome through E mail to: ieitlc1973@gmail.com