INAE Quarterly e-Newsletter Vol. IX, Issue 5, Sept I, 2018

From the Editor's Desk

Some Random Thoughts

Often, we ask ourselves a few hard questions. Like, what should we do, as a country, to become the real players; what are the forces that drive the young to succeed in thinking outside the box; are the minds of engineers different, or it is a combination of opportunity and resources that frame the mind; are we cultivating right kind of engineering mindset; what is more important for an engineer – insight or precision; can a person trained to solve expected problems deal with unexpected problems; what a general engineering toolkit must contain; shouldn't the practice of industry mentoring taken more seriously; why most engineers don't take as much pride in designing and fabricating a thing as they take pride in packaging it. We have asked these questions at the INAE youth conclaves held at Jaipur and Kharagpur in the past two years. Some trends are emerging.

No single actor can function in isolation. Even in a one-act-play we need many actors; they play their roles in different ways. In an innovation system experienced people mingle with newbies. Important is mixing of people of different backgrounds. Our country not only wants temperamentally innovators and thinkers but also people who can fit themselves into country's core values and systems. The diffusion of ideas and skills are important for innovation, and cooperation is essential for the exchange of ideas. More than relying on extrinsic motivation, there is a need to encourage intrinsic motivation.

We, the people of India, once believed that there was no country like ours, no king like ours, and no science like ours. Can we regain that spirit and confidence? Can we, a country of 1.2 billion people, get back literally to 'ZERO'?

Purnendu Ghosh
Chief Editor of Publications

ACADEMY ACTIVITIES

Abdul Kalam Technology Innovation National Fellowship

The second call for nominations for the year 2018-19has been announcedfor the INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship, launched in the year 2017; to recognize, encourage and support translational research by Indian Nationals working in various capacities of engineering profession, in **public funded institutions in the country.**

The Fellowship is applicable to persons engaged in the engineering profession only. The nominee should have a minimum of 5 years' service left in the parent organization. The Fellowship amount is Rs 25,000/- per month in addition to salary being drawn. A Research Grant of Rs.15.00 lakh per annum, which can be utilized for engineering research and innovation activity including hiring of manpower, consumables, national and international travel for research purposes, chemicals, equipment, etc will also be provided. A maximum of 10 Fellowships will be awarded per year. The duration of the Fellowship will be initially for three years, extendable by upto two more years depending on the performance and the Fellowship can be held for a maximum of 5 years. The guidelines and nomination proforma for the subject Fellowship can be downloaded from INAE website **www.inae.in**

Nominations are accepted for the Fellowship throughout the year. In addition, two calls for nominations are announced in each Financial Year. A soft copy of the nomination is required to be forwarded to INAE through email followed by one ink signed original hard copy to be sent to INAE Office, Gurgaon through Speed Post/Courier.

All the nominees who had applied earlier in response to the first call for nominations for the Financial Year 2018-19 are not eligible to apply again this year, since a nominee may apply only once in a year. However, a nominee may apply again once in each subsequent Financial Year till he/she has a residual service of five years left in his/her parent organization.

The **last date for the receipt of nominations for the second call** of Nominations for the Financial Year 2018-19 is **Dec 31, 2018**.

Selectionof Candidates for conferment of Abdul Kalam Technology Innovation National Fellowship by the Search – cum - Selection Expert Committee during Meeting on July 2, 2018

The Search – cum - Selection Expert Committee for the Abdul Kalam Technology Innovation National Fellowship,during its first meeting for the Financial Year 2018-19, held on July 2, 2018, considered the quality of the translational research in the proposalsand selected the following for conferment of the Fellowship w.e.f August 1, 2018.

i) Prof B Ravi, IIT Bombay
ii) Prof PV Madhusudhan Rao, IIT Delhi
iii) Prof Amrutur Bharadwaj, Indian Institute of Science, Bangalore
iv) Dr G Kumaraswamy, CSIR -NCL, Pune
v) Prof Samir K Pal, SN Bose National Centre for Basic Sciences, Kolkata

INAE Local Chapters- INAE Pune Local Chapter

Efforts have been made in the recent past to re-activate the INAE Local Chapters with a view to increase the outreach of the Academy. A meeting of the INAE Fellows based at Pune was held on April 21, 2018 at Thermax House, Pune which was attended by about fifteen INAE Fellows, wherein it was decided to launch the INAE Local Chapter at Pune. The names of Mr. MV Kotwal as the Chairman and Prof. Vinay Kulkarni as the Honorary Secretary of the Pune Local Chapter were unanimously proposed. It was suggested that the Pune Engineering Forum be formed under the aegis

of the INAE Pune Local Chapter to induct non-Fellows as members, so as to also involve them in the conduct of various activities to be undertaken.

Accordingly, a meeting of the INAE Pune Local Chapter was held on July 27, 2018 during which the "Pune Engineering Forum" was inaugurated by Dr BN Suresh, President, INAE who also delivered the Inaugural Address. It is envisaged that the said Forum will facilitate effective communication and collaboration among engineers, to synergise the capability and enhance the outreach of MSMEs and Entrepreneurs. The Forum will also help facilitate technical sessions and programmes that are relevant to Society in and around Pune. The highlight of the function on July 27, 2018 was an interactive Panel Discussion on the topic "Are engineers of India ready for challenges of the next decade and beyond?". Eminent panellists were chosen to represent different perspectives including Prof Bharatkumar Ahuja, Director, College of Engineering, Pune; Prof Sanjay Dhande, Former Director, IIT Kanpur; Mr Pravin Mehta, OS &DG, Armament & Combat Engineering Systems, DRDO; Dr Prahalada, FNAE, Former Chief Controller, R&D, DRDO; Dr Anant Sardeshmukh, DG & member of Executive Board MCCIA; Mr Prakash Telang, former MD, Tata Motors and Dr Harrick Vin, VP and Head Digitate, TCS. The Panel Discussion was well attended by engineers from Academia, R&D and Industry as well as engineering students studying in Pune. The discussions were highly interactive and the delegates as well as engineering students participated and asked pertinent questions regarding the readiness of engineers in India to face the challenges of the next decade. One of the unique features of the event was that the dignitaries were felicitated with certificates indicating that a bountiful tree had been planted at "Tree for Tigers", the periphery of Sariska Tiger Reserve, Alwar, Rajasthan on their behalf thereby marking this as an initiative in protecting the environment.

INAE-DST Consultative meeting on "Laboratory Safe Practices and Waste Disposal in Academic and R&D Institutes" on July 28, 2018 at Savitribai Phule University, Pune

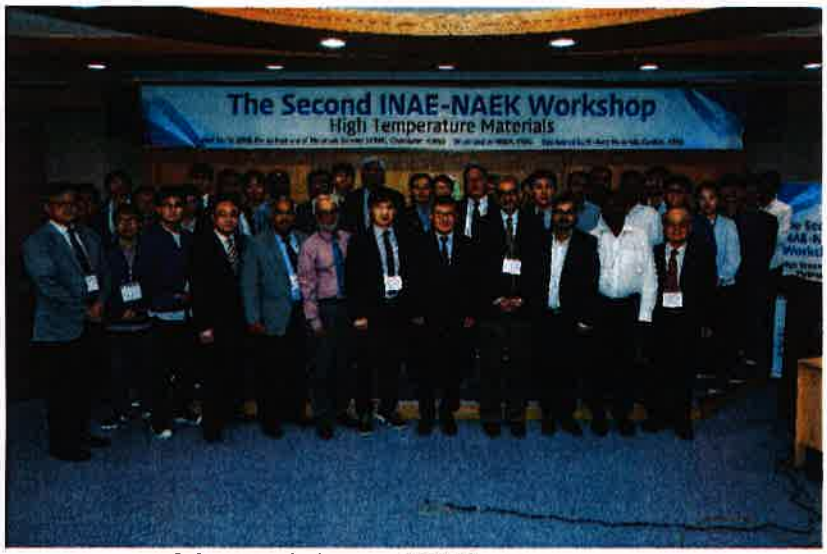
The INAE-DST Consultative meeting on "Laboratory Safe Practices and Waste Disposal in Academic and R&D Institutes" was held on July 28, 2018 at Savitribai Phule University, Pune. A brief background of the genesis of the meeting is as follows. INAE was requested by Department of Science and Technology (DST), Government of India to create a plan of action to enhance the awareness of health and safety issues in chemical and biological laboratories in Universities, Research Institutes and Colleges. The purpose of the exercise is to provide these institutions with knowledge, tools and resources to ensure that highest standards of safety and personal protection are followed. As a first step, it was proposed to conduct a workshop of selected stakeholders from Academia, R&D institutions and Industry to deliberate on issues, define best practices and identify the state-of-the- art techniques in practice presently. Accordingly, an Organizing Committee was constituted with Dr. S Sivaram, FNAE, Former Director, CSIR-NCL and currently the Chair Professor at IISER Pune as the Chairman and Dr GS Grover, Former Chief Scientist, CSIR-NCL as the Convener for planning and conduct of the same so as to arrive at actionable recommendations and also to establish a pilot plant for disposal of the chemical waste in one of the engineering colleges located at Pune.

The INAE-DST Consultative meeting on "Laboratory Safe Practices and Waste Disposal in Academic and R&D Institutes" commenced with the Welcome Address by Dr S Sivaram, FNAE, followed by the Address byDr. ADShaligram, Registrar, SPPU. Dr BN Suresh, President, INAE delivered the Inaugural Address while Dr Dilip B Boralkar, Adjunct Professor, SPPU delivered an enlightening Keynote Address. The programme featured three Technical Sessions on "Sharing of Best Practices: Academic labs" Chaired by Dr Pradip, Vice President, INAE; "Sharing of Best Practices: Chemical and Pharma Industry" Chaired by Prof Suresh Gosavi and "Sharing of Best Practices: Other Academic Institutions" Chaired by Prof AB Pandit. The speakers comprised of eminent Academicians and scientists from NCL, Pune; UICT, Mumbai; IISc, Bangalore; SPPU Pune; Lupin Limited, Pune; Reliance India Limited, Mumbai; BASF India, Mumbai; Tata R&D Design Centre, Pune; Aditya Birla S&T Co, Mumbai, NCCS Pune; NEERI, Nagpur and IIT Bombay. The workshop concluded with a Discussion session Chaired by Dr S Sivaram wherein the draft recommendations were deliberated upon. Actionable recommendations are being finalized for submission to DST.

The Second INAE-NAEK Workshop on High Temperature Materials held on May 14-15, 2018 at Changwon, Korea

The first INAE-NAEK workshop on High Temperature Materials was held at Bangalore on March 16-17, 2017. Dr AR Upadhya (ADA) and Professor Dipankar Banerjee (IISc) jointly convened the workshop supported by an organizing committee with experts from DRDO, ISRO, CSIR, IISc and ADA. Dr. Kyung Ho Shin, KIST led the 10-member Korean-delegation. The presentations covered the current and future directions in high temperature materials ranging from high temperature alloys, polymer matrix composites and ultra-high temperature ceramic composites, which are of interest to DAE, ISRO, DRDO and A-USC power plants. As a measure of follow up and reciprocation, INAE and NAEK jointly organized a similar two-day event in Changwon, Korea during May 14-15, 2018 where a delegation from INAE participated. The objective of the workshop was to extend the discussion and converge on suitable measures of scientific cooperation and engineering collaboration in the theme of High Temperature Materials. This follow up INAE-NAEK workshop in Changwon was aimed at converting the excellent beginning made in the previous event organized in Bangalore in March 2017 into a more meaningful scientific collaboration for mutual interest and benefit. Both these joint Indo-Korean workshops assume special significance as developing appropriate technology including designing and development of high temperature resistant metallic/ceramic alloys and coatings is absolutely crucial for India to achieve leadership and self-reliance in aerospace, defense, and thermal/nuclear power generation initiatives. The deliberations held in the workshop in the form of presentations and follow up discussion helped the participating scientists and technologists from either side to converge on suitable approaches for future development and trouble-shooting and probable scope for future scientific cooperation and engineering collaboration.

The INAE delegation was led by Indranil Manna, FNAE, Vice-President, INAE, IIT-Kharagpur and comprised of Prof Dipankar Banerjee, FNAE, IISc Bangalore; Dr SoumitroTarafdar, FNAE, CSIR-NML, Jamshedpur, DR Debashish Bhattacharjee, FNAE, Tata Steel, Dr G Padmanabham, ARCI, Hyderabad, Dr A. Udaykumar, CSIR-NAL, Bangalore, Dr G.V. Prasad Reddy, IGCAR, Kalpakkam, Dr Shubhra Bajpai, CSIR-IMMT, Bhubaneswar, Dr ZafirAlam, DMRL, Hyderabad, Dr RenjithDevasia, VSSC, ISRO, Trivandrum and Dr T Venkateswaran, VSSC, ISRO, Trivandrum as members. The NAEK side also comprised of members from academia, R&D laboratories and industry.



Inauguration of the Workshop in KIMS, Changwon on May 14, 2018

The Scope of Deliberations in the Workshop is highlighted as follows. High temperature materials are a class of advanced solids that can not only withstand the aggressive condition of high temperature (oxidation, erosion, creep) but necessarily should be able to retain the mechanical strength, structural integrity, dimensional tolerance and toughness for extended period of time. The workshop covered almost the entire range of engineering solids used at elevated temperature for load bearing or structural applications like, superalloy, aluminides, ODS alloy, ferritic and austenitic stainless steel, Al alloy composites, Ti alloy/aluminides, C-C and C-SiC composites, non-oxide ceramics (di-borides,

carbides) and coatings of various kinds applied by various techniques. The application domains covered in the workshop were truly wide and extensive, as stated below;

- power generation equipment including turbines, heat exchangers, boilers, pipes
- future generation power generators (ultra-supercritical generators)
- aero-engine (turbine and compressor) components and coatings
- petro-chemical refinery and distillation plants
- refractory, furnace linings, oven, hot chambers
- autoclave, nozzle, dies, moulds,
- satellite launch vehicles, rockets, re-entry vehicle
- atomic and nuclear power plants
- thermal protection/barrier coatings and reclamation

A panoramic view of the proceedings

Industry Visits were organized in Changwon on May 15, 2018 to Doosan Heavy Industries & Construction Co., Ltd., a company founded in 1962 and is headquartered in Changwon, South Korea. This industry operates as an engineering, procurement, and construction contractor. The company offers turn-key wind power generation systems, ultra-supercritical pulverized coal thermal power plants, post carbon capture and oxy-fuel combustion technologies, superconducting generators/motors, and integrated gasification combined cycle technologies; coal-fired thermal and combined cycle power plants. A visit to Hanwha Aerospace Company was also organized. Established in 1977, Hanwha Aerospace began building businesses in the aircraft engine and film camera industry and built components for optics, video, and aircraft engines to expand into aircraft/gas turbine engines businesses. As South Korea's only producer of gas turbine engines, Hanwha Aerospace has an unmatched competitive edge in the engine business.

Visit to Korean Institute of Materials Science (KIMS) on May 15, 2018

The deliberations during the workshop were fruitful and it is envisaged that the exchange of ideas and expertise will be effectively utilized to gain greater benefit by way of further deliberations and mutual cooperation. More precisely, it was decided that future interaction between INAE and NAEK should focus upon:

(a) High temperature materials for power generation systems by thermal, renewable and nuclear routes. The focus should be on system engineering and not just designing or developing a few key components.

(b) High temperature advanced ceramics (carbides and di-borides) including ceramic-ceramic (C-C, C-SiC, etc.) composites and coatings for space technology, high temperature devices and armaments.

INAE Engineering Heritage - Metallurgy Study Group:Annual Meeting and Workshop on Digital Museum of Metallic Objects

INAE Study Group on Engineering Heritage – Metallurgy organised its Annual Meeting and Workshop on 'Digital Museum of Metallic Objects' in association with College of Engineering Pune (COEP) at Deccan College Post Graduate & Research Institute, Pune during July 20 - 21, 2018. The members of the study group and young researchers from different institutions across the country were invited to present their work. The objective of the meeting was to review on-going research and activities on metallurgical heritage and bring out recommendations with a view to move forward and utilize the recent data and analysis to unravel the mystery and excitements in the area of ancient metallurgical objects. Another important aim of the meeting was to propose a digital museum for metallic objects in particular and artefacts, in general. Forty-Nine post graduate students including researchers in Deccan College Post Graduate and Research Institute, Pune and College of Engineering Pune (COEP) attended all the sessions.

Dr U. KamachiMudali, Chairman,INAE Engineering Heritage - Metallurgy Study Group, in his Welcome Address, summarized the outcome of the last annual meeting held during January 27-28, 2017 at SASTRA University, Tanjore and explained how the research movement can be further strengthened through systematic studies on various archaeological objects. Also, he recalled the earlier celebration of Delhi Pillar as world metallurgical heritage by American Society of Metals, New Delhi. Further, he highlighted the need of Digital Museum in the present context and how it can be taken to the next generation. As Department of Metallurgy and Materials Science, College of Engineering Pune will be celebrating its 75 years and Deccan College Post Graduate and Research Institute, Pune will be completing its 200 years in 2021, Dr.N.B. Dhokey, Head, Department of Metallurgy and Materials Science, College of Engineering Pune in his Address, suggestedhosting an international conference in association with Deccan College in the year 2021-22. The Inauguration ended with vote of thanks By Prof. Sushma Deo, Head, Department of AIHC and Archaeology, Deccan College, Post Graduate & Research Institute, Pune.

Lighting of Lamp by Dr. U. KamachiMudali, Chairman, INAE Engineering Heritage—Metallurgy Study Group.

Some of the remarks by the dignitaries participating in the event are summarized below.

Dr.Pradip, Vice President, INAE and Shri. M.V. Kotwal, Chairman of INAE Pune Chapter offered felicitations and emphasized collaboration among different specialists like archaeo-metallurgists, engineers and archaeologists specializing in virtual image technology for developing Digital museum on metal artefacts. Prof. Prasad Joshi, Pro-Vice Chancellor, Deccan College Post Graduate & Research Institute, Pune, briefly spoke about reference of metals in ancient literature and Sanskrit studies and explained how these references can be used in reconstructing ancient metallurgy. Prof. Vasant Shinde, Vice Chancellor, Deccan College Post Graduate and Research Institute, Pune talked about the metal objects found from the Harappan context. He has cited examples from various archaeological sites and its immense importance because artefacts talk about the site's functionality. He also talked about the creation of a digital museum which will give a virtual tour of archaeological sites along artefacts found from excavated context.

Dr. Pradip, Vice President, INAE addressing the gathering During the INAE Engineering Heritage—Metallurgy Study Group meeting.

Felicitation of Dr. U. KamachiMudali, Chairman INAE Engineering Heritage—Metallurgy Study Group by Dr. V.S. Shinde, Vice Chancellor, Deccan College Post Graduate & Research Institute

The details regarding the academic sessions during the event are highlighted below. The first academic session, chaired by Dr. R K Mohanty, Deccan Collegefeatured three speakers. In this session, Dr S. Udaya Kumar, NIAS Bangalore demonstrated use of thearchaeo-experimental approach in understanding the Indian metal heritage of bronze images of Harappan Culture. His hypothesis was important in the sense it was a first attempt to explain small size images found in Harappan Culture. Ms Diya Mukherjee, Deccan College presented comparative studies of Harappan metal culture and Dokra brassware technique. She explained the technology of Lost Wax Casting process in the context of the ancient techniques, provided comparative analyses featuring both the cultures, and talked about

the regional variation in Dokra technology. Dr. Niloy Nath, Deccan College, using mathematical modelling, elaborated upon thermo- chemistry of megalithic iron smelting at Naikund, ancient Vidarbha region of Maharashtra.

The second academic session had three speakers and was chaired by Dr. PP Deshpande, COE, Pune. In this session, Dr. S. Jaikishan, BVB Hyderabad reviewed the developments in wootz steel technology in northern Telangana region. Dr. KantiPawar, presented an over view on recent studies on metal objects in terms of archaeological perspectives. K. Jitendra Babu, Hyderabad presented work on metallurgy in Sanskrit literature with evidences.

The Third academic session began on second day of the conference, i.e. 21 July 2018, and it was chaired by Dr. S Jaikishan. In this session, Dr Amrita Sarkar, Deccan College presented on a futuristic model of Archaeology museum for kids and proposed a virtual version for the kids instead of the traditional way of organizing museum artefacts. She suggested an interactive programme like storytelling, creation of a model for excavations and different kinds of hands on activities. Her paper focused on university museums with reference to Deccan College Post Graduate & Research Institute, Pune. Dr. P.P. Deshpande presented recent work on technical investigations on bronze artefacts from Megalithic sites and explained how these ideas can be used in modern technology. At the end of this session, Dr R.K.Mohanty reviewed metallurgical aspects of early iron age megalithic cultures and explained reconstruction of manufacturing processes.

In the concluding note, Dr. U. KamachiMudali appealed all members to express their views, way forward, and contributions to studies on ancient metallic objects. He also proposed that INAE Study Group on Engineering Heritage – Metallurgy annual meeting to be conducted, on a regular annual basis, at places like Deccan College Post Graduate & Research Institute, Pune. In addition, he suggested an idea of one day workshop on 'Materials Characterization Techniques' that could be held in Deccan College Post Graduate and Research Institute, Pune in this academic year and the idea was immediately accepted by Prof. V.S. Shinde, Vice Chancellor, Deccan College Post Graduate & Research Institute, Pune.

Concluding Session of INAE Engineering Heritage - Metallurgy Study Group with all participants giving their views.

During the Concluding Session, Prof. A P Jamkhedkar, Chancellor, Deccan College Post Graduate & Research Institute, Pune and President of Indian Council of Historical Research, New Delhi briefed regarding the presentations of the workshops and their importance in the context of Digital museum. The session was concluded by Prof. V.S. Shinde with his innovative ideas on Digital museum and its importance in spreading awareness of cultural heritage studies.All participants visited museums at

Deccan College Post Graduate and Research Institute, Pune and witnessed the various artefacts displayed in the gallery both days. To sum up, the annual meeting and workshop was successful, and helped young post graduate students to consider undertaking studies in metallurgical heritage of India, and discussions were also held on technology for digitalizing museums.

INAE Second Youth Conclave Held on Aug 11-12, 2018 at IIT Kharagpur

INAE Second Youth Conclave was organized at Indian Institute of Technology, Kharagpur on Aug 11-12, 2018. Prof. ParthaPratim Chakrabarti, Director IIT, Kharagpur along with Prof Manoj Tiwari IIT Kharagpur and Prof. Jayanta Mukhopadhyay, IIT Kharagpur organised the event.

The Conclave was organized in two phases. Phase I (Mar 23-25, 2018) involved a Pre-Conclave activity where students from different engineering colleges and institutions at graduate level presented their ideas on six identified problem statements namely (a) **Academic Planning** (b) **Town Planning** (c) **Optimizing Food Chain** (d) **Health Care App** (e) **Digitization of Agriculture sector** and (d) **Swachh Bharat**. The groups were shortlisted and first three performing groups were awarded according to the merit of projects. All the shortlisted student groups were invited in the final conclave (Phase II) to present projects based on the problem statements they had worked earlier.

The Conclave was attended by more than 230 engineering students from all over the country, and about 40 INAE Fellows participated in the deliberations. The conclave was inaugurated by the Chief Guest, Prof. Anil D Sahasrabudhe, Chairman AICTE and Guest of Honour was Dr. BN Suresh, Chancellor IIST and President, INAE. The Inaugural Session was followed by six sessions on "Indian Innovation", "Freedom of Research in Academics", "Science and Technology in Ancient India: Myth and Reality", "How to become an Entrepreneur?". Students team presented and demonstrated on the above mentioned problem statements. Each participating team was judged by a panel of judges consisting of experts from academia and industry. Top three from each group were awarded prize money of Rs. 1,00,000 for the winner, Rs. 50,000 for the first runner-up and Rs. 25,000 for the second runner-up.

Dr Purnendu Ghosh, Vice-President, INAE conferring Prize to Awardees

INAE had also organised an Online Second National Essay Competition on the topic "National Challenge and the Engineering Solution". The shortlisted essays were reviewed by a distinguished Selection Committee and four awardees were selected. Mr. Angshuman Pal from Jadavpur University won the First Prize of Rs. 25,000; Mr. Gulam Sarwar from IIT Bombay won the second prize of Rs. 15, 000 and third prize was won by two participants Ms. YasaswiniAluru from KL University & Mr. Sangam Sahu from School of Aeronautics, Neemrana of Rs. 10000 each.

Prof Indranil Manna, Vice-President, INAE conferring Prize to Awardees

The Conclave concluded with the award ceremony for the awardees. The students were involved in interaction with INAE Fellows from Academia, R&D and Industry during the sessions. Dr. BN Suresh, President, INAE congratulated all the awardees. He inducted all the awardees as INAE Student Members for a period of 5 years. He encouraged them to be involved with INAE activities.

Engineers Conclave 2018

The Engineers Conclave 2018 is being hosted jointly with Larsen & Toubro Ltd. on Oct 4-6, 2018 at LDA Lonawala. The themes of the EC2018 are: Theme I: "Defence Manufacturing in Industry" to be coordinated by L&T and Theme II: "Engineering Challenges in Urban Infrastructure" coordinated by INAE. The Theme II was identified by INAE based on the discussions with Mr Amitabh Kant, CEO, Niti Aayog who posed a challenge to the Academy on how to improve and make the Urban infrastructure more aesthetic with use of the best engineering techniques and practices in planning of urban areas. The Engineers Conclave 2018 will be the first of the Conclaves to be held jointly with industry. Maximum participation of INAE Fellows and Young Associates is sought in the forthcoming Engineers Conclave 2018.

Extension of AICTE-INAE DVP Scheme to Retired INAE Fellows

INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" during 1999. Under this scheme, Industry experts are encouraged to give series of lectures at an educational institution in their proximity for a specific time period. This scheme has become popular among industry experts as well as educational institutions. Based on the deliberations during meetings with AICTE held last year it was decided that the scheme be extended to all retired INAE Fellows and retired persons from Industry.The frequency of visits to an engineering college by a DVP has been increased to up to three times a semester with a maximum period of three days per visit.The honorarium paid to the visiting Industry Expert has been increased to Rs. 10,000/- per lecture day as approved by AICTE.The AICTE-INAE DVP Scheme has since been extended to the retired INAE Fellows and nominations have since been invited under the scheme. Accordingly, the nominations under the AICTE-INAE Distinguished Visiting Professorship Scheme were invited from the Fellowship and the thirteen applications received from the Fellows were selected by the Selection Committee as Distinguished Visiting Professors.

Annals of INAE

The soft copy of the Annals of the INAE Volume XV, April2018 containing the text of the lectures delivered by Life Time Contribution Awardees; newly elected Fellows of the Academy and INAE

Young Engineer Awardees 2017 has been uploaded on INAE website under the Publications sub-head. The same can be downloaded from the link given below

http://inae.in/ebook/inae-annals-2018/mobile/index.html#p=1

INAE on Facebook and Twitter

INAE has created a Facebook and Twitter Account to post the news of recent INAE activities in the Social Media. The same can be viewed at the link below.

(a) Facebook -link https://www.facebook.com/pages/Indian-National-Academy-of-Engineering/714509531987607?ref=hl

(b) Twitter handle link https://twitter.com/inaehq1

All INAE Fellows are requested to visit and follow the above to increase the visibility of INAE in Social media.

Important Meetings held during June, July and August2018

- **INAE Governing Council Meeting held on June 21, 2018 at INAE Office, Gurgaon**
- **INAE Finance Committee Meeting held on June 21, 2018 at INAE Office, Gurgaon**
- **Selection Committee for Life Time Award, Prof. Jai Krishna & Prof. SN Mitra Memorial Awards and Outstanding Teachers Awardheld on June 21, 2018 at INAE Office, Gurgaon**
- **Second meeting of Sectional Committee held on June 22, 2108 at INSA, New Delhi**
- **General Body Meeting on June 22, 2018 at INSA, New Delhi**
- **Meeting of Project Monitoring Committee (PMC) of the Medium-Term Research Study (MTRS) on "Lessons from Some of the Major Disasters in India"held on June 27, 2018 at INAE Office, Gurgaon**
- **Meeting of INAE Forum on Engineering Interventions for Disaster Mitigationheldon June 27, 2018 at INAE Office, Gurgaon**
- **First Meeting of the Search-cum-Selection Committee for Abdul Kalam National Innovation Fellowship for the Year 2018-19 held on July 2, 2018 at INAE Office, Gurgaon**
- **Meeting of the AICTE-INAE Programmes Committee held on July 2, 2018 at INAE Office, Gurgaon**
- **Selection Committee Meeting for Shortlisting of Nominations to be called for presentations for the Innovative Student Projects Award 2018 and Innovator entrepreneur Award 2018 held on July 20, 2018 at INAE Office, Gurgaon**
- **Meetings of INAE Forum on "Civil Infrastructure" held on June 2, 2018 and Aug 4, 2018 at New Delhi**
- **Presentations by Shortlisted Candidates for INAE Young Engineer Award and Innovator Entrepreneur Award before Selection Committee held on Aug 16, 2018 and for Innovative Student Projects Awardheld on Aug 17, 2018 at INSA, New Delhi**

- **Selection Committee for Foreign Fellows held on Aug 24, 2018 at India International Centre, New Delhi**

- **INAE Governing Council Meeting held on Aug 24, 2018 at India International Centre, New Delhi**

Academia Industry Interaction

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions have become essential with the world over technological changes in recent times which can impart relevant knowledge to the students in the engineering institutions that would be sustainable in the changing conditions. While industries could gain by using the academia's knowledge base to improve the industry's cost, quality and global competitive dimensions; thereby reducing dependence on foreign know-how and expenditure on internal R&D, academics benefit by seeing their knowledge and expertise being fruitfully utilized practically and also by strengthening of curricula of educational programs being offered at engineering colleges/institutions. INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" in 1999. Under this scheme, Industry experts are encouraged to give a few lectures in engineering institutions. This scheme has become popular among industry experts as well as engineering colleges.

Brief details pertaining to recent visits of industry experts under this scheme are given below.

Dr. Ananta Lal Das Ex Director, Society for Applied Microwave Electronics Engineering and Research (SAMEER)	National Institute of Technical Teachers Training and Research, Chandigarh Jun 21, 2018	Delivered lecture on "Antenna Fundamental Concepts" and guided projects of ME students. According to the feedback received from engineering college, the DVP interacted extensively with the students. His expertise helped students to find new upcoming areas of research.
Dr. Vishwas R. Udpikar Managing Director, SCI-COM Software India Pvt. Ltd.	Rajarambapu Institute of Technology, Sangli Jul 19, 2018	Delivered lectures on "New Sensor Technology for Automation: 3D Camera", "Satellite Receiver Technology (India's contribution to SAR Operations Worldwide)", and "Digital Image Processing on High Speed Processing Hardware". According to the feedback from the engineering college, the industry expert has suggested undertaking of projects on image processing technologies. He has also given inputs for improvement in existing syllabus.

International Conferences/Seminars being organized by IITs/other Institutions

To view a list of International Conferences/Seminars being held in the month of September, October and November 2018 click here.

Life Time Contribution Award in Engineering and Prof. Jai Krishna & Prof. SN Mitra Memorial Awards for the year 2018

The Selection Committee on Life Time Contribution Award, Prof Jai Krishna & Prof SN Mitra Memorial Awards and Outstanding Teachers Award during its meeting on June 21, 2018 and recommended the following for conferment of awards.

(a) Life Time Contribution Award in Engineering 2018

- Dr. RK Bhandari, Formerly Director, Central Building Research Institute, Roorkee & Programme Director, UN-HABITAT, Nairobi. Formerly Chairman, Centre for Disaster Mitigation and Management, VIT, Vellore

- Prof. JM Vasi, Professor, Department of Electrical Engineering, Indian Institute of Technology, Mumbai.

(b) Prof Jai Krishna Memorial Award 2018

- Dr. TK Alex, Formerly Director, ISRO Satellite Centre, Bangalore.

(c) ***Prof SN Mitra Memorial Award 2018***

- Mr. B Prasada Rao, Managing Director, Steag Energy Services India, STEAG Energy Services (India) Pvt. Ltd. and Formerly CMD, Bharat Heavy Electricals Ltd. (BHEL), New Delhi.

Honours and Awards

1.	Dr BN Suresh, FNAE, President, INAE, and Chancellor of Indian Institute of Space Science and Technology, Thiruvanthapuram and Honorary Distinguished Professor, ISRO, Bangalore and was recently awarded the **2018 INCOSE Pioneer Award by International Council on Systems Engineering (INCOSE)**. He joins a distinguished group of individuals who by their achievements in the engineering of systems, have contributed uniquely to major products or outcomes enhancing society. The award recognizes his pioneering work in Space Systems Engineering as the backbone of successful launches by ISRO. He was awarded for being an outstanding practitioner and researcher in Systems Engineering of complex Space Systems such Control Systems, Actuation Systems, Simulation & Test Systems, and Launch Vehicle Systems and for being a thought leader who has made significant contributions to Design, Mission Planning and R&D Management for the Indian Space Program. The award was conferred during the plenary session at the International Symposium in Washington D.C., USA, on 7 – 12 July 2108.  *Dr BN Suresh, President, INAE receiving the 2018 INCOSE Pioneer Award by International Council on Systems Engineering (INCOSE) at Washington DC, USA.*
2	Prof Pushpak Bhattacharyya, FNAE, Director, IIT Patna was conferred with the **"Distinguished Alumnus Award" by IIT Kharagpur** for the year 2018. The award conferment ceremony took place during the 64th Annual Convocation of IIT Kharagpur on 20th July 2018.

3	Dr S Venkata Mohan FNAE, Principal Scientist, Bioengineering and Environmental Sciences Lab, CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad was conferred with **'Most Outstanding Researcher in the field of Environmental Science 2018'**, Faculty Research Award by Carrer360 based on a composite score generated by evaluating academic output in SCOPUS indexed journals for the year 2015-17. The award was selected using Scopus data, on academic output, h-index and citation count assessed by eminent academicians. The award was presented by Hon'ble Human Resource Development Minister Shri Prakash Javadekar.
4	Dr B M Reddy, FNAE,Raja Ramanna Distinguished Fellow and former Chief Scientist & Head, Inorganic and Physical Chemistry Division, CSIR-IICT, Hyderabad was honoured by the Elsevier Science Publisher's flagship Journal "Molecular Catalysis" (IF = 3.958) with a special issue on the occasion of his 60th birthday: Metal Oxides in Catalysis - Professor Benjaram M. Reddy Festschrift

News of Fellows

1.	Dr S Venkata Mohan FNAE, Principal Scientist, Bioengineering and Environmental Sciences Lab, CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad was selected as the prestigious **'Tata Innovation Fellow'** for year 2018 byDepartment of Biotechnology (DBT), Government of India.
2	Prof. S.N. Mukhopadhyay, FNAE, Adjunct Professor, Department of Biological Sciences, BITS, Pilani, Rajasthan was author of the Fourth Edition of the book **"Process Biotechnology Fundamentals"** which was published by Viva Books, New Delhi in Feb. 2018."
3	Prof Bimalendu B. Bhattacharya FNAE, President, Indian Centre for Space Physics and Former Director, Indian School of Mines deliveredthe First PN Bose Memorial Lecture organized at the Centre for Excellence, TISCO, Jamshedpur on May 12, 2018 on the topic **'Recent Trends in the Field of Applied Geology and Geophysics'.** The celebrations were held to commemorate the 163rd birth anniversary of Shri PN Bosefor his invaluable contributions towards the setting up of Tata Steel, India's first integrated steel plant at Sakchi. Professor Bimalendu B. Bhattacharya also delivered a lecture in the GEOCLUB at the headquarters of Geological Survey of India presided over by the Director General, Geological Survey of India, Kolkata on May 29, 2018 on the topic **"Synergy of Geophysics and Geology in Mineral Exploration – Not a Random Walk".**
4	Dr B M Reddy, FNAE former Chief Scientist and Head, Inorganic and Physical Chemistry Division, CSIR-IICT, Hyderabad was offered the Raja Ramanna Fellowship (RRF) by the Department of Atomic Energy (DAE). Dr Reddy joined under this scheme at CSIR-IICT with effect from January 2018.

International Conferences in September, October and November 2018

International Conference in Chemical Engineering, Bioprocess, Textile, Mining, Energy Technologies (TECHNOVA-2018) on September 8, 2018 at New Delhi
https://conferencealerts.com/show-event?id=202654

FLAME2018 --International Conference on Future Learning Aspects of Mechanical Engineering on October 3-5, 2018 at Noida, Delhi NCR
https://conferencealerts.com/show-event?id=193692

2018 Fourth IEEE International Conference on Research in Computational Intelligence and Communication Networks on November 22-23, 2018 at Kolkata, West Bengal
https://conferencealerts.com/show-event?id=203181

Civil Engineering

1. Using Coal Waste to Create Sustainable Concrete

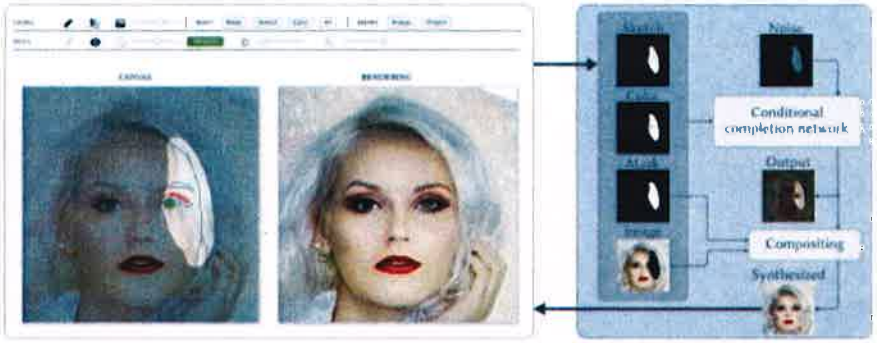
New coal concrete reduces energy demand, greenhouse emissions

Researcher looks at the data log, which is used to gather data from sensors buried under the concrete test plot.

Washington State University researchers have created a sustainable alternative to traditional concrete using coal fly ash, a waste product of coal-based electricity generation.The advance tackles two major environmental problems at once by making use of coal production waste and by significantly reducing the environmental impact of concrete production. Researchers in WSU's Department of Civil and Environmental Engineeringhave developed a strong, durable concrete that uses fly ash as a binder and eliminates the use of environmentally intensive cement. Production of traditional concrete, which is made by combining cement with sand and gravel, contributes between five and eight percent of greenhouse gas emissions worldwide. That's because cement, the key ingredient in concrete, requires high temperatures and a tremendous amount of energy to produce.Fly ash, the material that remains after coal dust is burned, meanwhile has become a significant waste management issue. More than 50 percent of fly ash ends up in landfills, where it can easily leach into the nearby environment.While some researchers have used fly ash in concrete, they haven't been able to eliminate the intense heating methods that are traditionally needed to make a strong material. The new production method does not require heating or the use of any cement.This work is also significant because the researchers are using nano-sized materials to engineer concrete at the molecular level.To sustainably advance the construction industry, they needed to utilize the 'bottom-up' capability of nanomaterials.The team used graphene oxide, a recently discovered nanomaterial, to manipulate the reaction of fly ash with water and turn the activated fly ash into a strong cement-like material. The graphene oxide rearranges atoms and molecules in a solution of fly ash and chemical activators like sodium silicate and calcium oxide. The process creates a calcium-aluminate-silicate-hydrate molecule chain with strongly bonded atoms that form an inorganic polymer network more durable than (hydrated) cement.The team designed the fly ash concrete to be pervious, which means water can pass through it to replenish groundwater and to mitigate flooding potential.Researchers have demonstrated the strength and behaviour of the material in test plots on the WSU campus under a variety of load and temperature conditions. They are still conducting infiltration tests and gathering data using sensors buried under the concrete. They eventually hope to commercialize the patented technology.After further testing, they would like to build some structures with this concrete to serve as a proof of concept.

Source https://www.sciencedaily.com/releases/2018/07/180712100513.htm

2. Computer Graphics Research Team Present New Tool for Sketching Faces



Faceshop consists of a web-based user interface (left) that enables a user to specify a region to be edited. Moreover, the user can draw strokes and color scribbles to guide the editing process. The core of the back end (right) is a deep image completion network that takes the user input and the original image to synthesize the edited result.

Across popular social media platforms, users are posting countless images every day. On Instagram alone, there are more than 40 billion uploaded photos -- a figure that's skyrocketing by 95 million daily. This presents a clear need for intuitive yet robust photo-editing tools that allow the average user to perform advanced editing functions. And while there is a definite need for interactive image editing with respect to social media, improved editing tools and systems also remain an important aspect of computer graphics and computer vision. However, there is a lack of tools that feature more complex editing functions for inexperienced users, such as changing the facial expression in a photo. A research team, led by computer scientists from the University of Bern-Switzerland and University of Maryland-College Park, have devised a sketch-based editing framework that enables a user to edit their photos by "sketching" a few strokes on top of them. Their system, called FaceShop, also offers a copy-paste function, which allows users to edit any part of a photo by copying-and-pasting the portion to be edited from another (better) photo, eliminating the need to hand-draw or sketch anything at all. The team's approach is built on machine-learning techniques, which, in the end, give users more control over their desired edits in real-time and produce more realistic results. "Most other approaches rely on more traditional, handcrafted techniques, which impose some limitations. For instance, these systems are either [by design] restricted to limited sets of predefined editing operations, or they are very flexible but hard to use and require experienced users to spend a considerable amount of time to perform rather basic edits," says a researcher at the University of Bern. "In contrast, our system is very flexible and allows untrained users to perform complex edits within minutes using an intuitive interface."In their work, "FaceShop: Deep Sketch-based Face Image Editing," the researchers demonstrate their new system via several examples. In one, a woman's nose is slightly manipulated, and a strand of hair is edited so that it is pushed away from her face, removing a dark shadow that had appeared on just one side of her face in the original photo. Another photo shows how a user is able to enhance a woman's eye make-up and bring out the colour of her eyes. The examples highlighted showcase how the novel system works, intuitively, and produces high-quality, realistic results.The team's method is based on generative adversarial neural networks (GANs), a form of artificial intelligence (AI) that, in recent years, has attracted a lot of research interest for its ability to generate realistic looking images. These GANs consist of two AIs that fight against each other. The first component tries to distinguish the generated images from genuine images, whereas the second component tries to produce images that fool the other AI. During training, the two components learn from each other, eventually resulting in a system that autonomously learned to produce realistic looking images, without any human judgement in the loop.Unlike other AI-driven image editing methods, once the system is trained, users are more in control of the edits to their photos. The system features an optimum degree of control, which makes it very interesting from an application point of view. Other techniques that try to incorporate user control are either limited in the scope of possible edits or have been shown to work well on the data that was used to train the systems but fail to produce convincing results with real user input. The researchers presenta technique that mitigates this issue, resulting in a system that works surprisingly well in practice.In future work, the researchers intend to explore additional user interaction tools to add to their framework and consider how to leverage AI for sketch-based editing of videos.

Sourcehttps://www.sciencedaily.com/releases/2018/07/180702120521.htm

3. Closing the Loop for Robotic Grasping

Post Grasp.

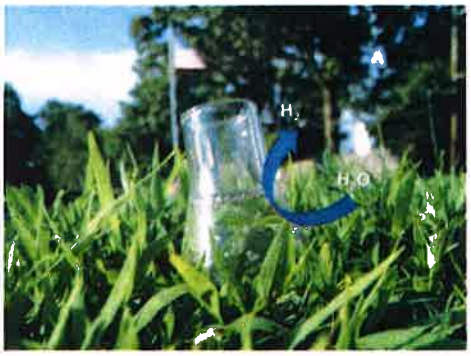
Roboticists at QUT have developed a faster and more accurate way for robots to grasp objects, including in cluttered and changing environments, which has the potential to improve their usefulness in both industrial and domestic settings.

- The new approach allows a robot to quickly scan the environment and map each pixel it captures to its grasp quality using a depth image
- Real world tests have achieved high accuracy rates of up to 88% for dynamic grasping and up to 92% in static experiments.
- The approach is based on a Generative Grasping Convolutional Neural Network

QUT's Dr Jürgen Leitner said while grasping and picking up an object was a basic task for humans, it had proved incredibly difficult for machines."We have been able to program robots, in very controlled environments, to pick up very specific items. However, one of the key shortcomings of current robotic grasping systems is the inability to quickly adapt to change, such as when an object gets moved," Dr Leitner said."The world is not predictable -- things change and move and get mixed up and, often, that happens without warning -- so robots need to be able to adapt and work in very unstructured environments if we want them to be effective," he said.The new method, developed by PhD researcher Douglas Morrison, Dr Leitner and Distinguished Professor Peter Corke from QUT's Science and Engineering Faculty, is a real-time, object-independent grasp synthesis method for closed-loop grasping."The Generative Grasping Convolutional Neural Network approach works by predicting the quality and pose of a two-fingered grasp at every pixel. By mapping what is in front of it using a depth image in a single pass, the robot doesn't need to sample many different possible grasps before making a decision, avoiding long computing times," Mr Morrison said."In our real-world tests, we achieved an 83% grasp success rate on a set of previously unseen objects with adversarial geometry and 88% on a set of household objects that were moved during the grasp attempt. We also achieve 81% accuracy when grasping in dynamic clutter."Dr Leitner said the approach overcame a number of limitations of current deep-learning grasping techniques."Using this new method, we can process images of the objects that a robot views within about 20 milliseconds, which allows the robot to update its decision on where to grasp an object and then do so with much greater purpose. This is particularly important in cluttered spaces," he said.Dr Leitner said the improvements would be valuable for industrial automation and in domestic settings."This line of research enables us to use robotic systems not just in structured settings where the whole factory is built based on robotic capabilities. It also allows us to grasp objects in unstructured environments, where things are not perfectly planned and ordered, and robots are required to adapt to change."This has benefits for industry -- from warehouses for online shopping and sorting, through to fruit picking. It could also be applied in the home, as more intelligent robots are developed to not just vacuum or mop a floor, but also to pick items up and put them away."

Source https://www.sciencedaily.com/releases/2018/06/180625192819.htm

4. How Gold Nanoparticles Could Improve Solar Energy Storage



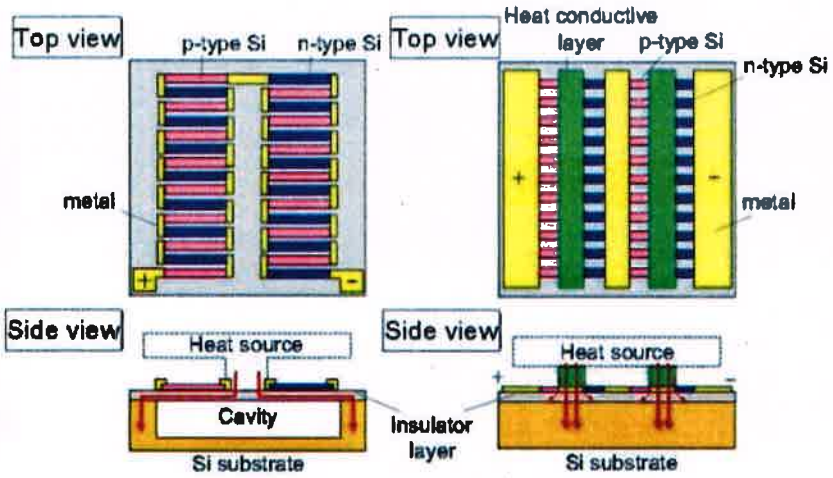
When exposed to sunlight, star-shaped gold nanoparticles coated with a semiconductor allow efficient production of hydrogen from water.

Star-shaped gold nanoparticles, coated with a semiconductor, can produce hydrogen from water over four times more efficiently than other methods -- opening the door to improved storage of solar energy and other advances that could boost renewable energy use and combat climate change, according to Rutgers University-New Brunswick researchers."Instead of using ultraviolet light, which is the standard practice, we leveraged the energy of visible and infrared light to excite electrons in gold nanoparticles," said Laura Fabris, associate professor in the Department of Materials Science and Engineering in the School of Engineering. "Excited electrons in the metal can be transferred more efficiently into the semiconductor, which catalyzes the reaction."The researchers, focused on photocatalysis, which typically means harnessing sunlight to make faster or cheaper reactions.Titanium dioxide illuminated by ultraviolet light is often is used as a catalyst, but using ultraviolet light is inefficient.In the study, Rutgers researchers tapped visible and infrared light that allowed gold nanoparticles to absorb it more quickly and then transfer some of the electrons generated as a result of the light absorption to nearby materials like titanium dioxide.The engineers coated gold nanoparticles with titanium dioxide and exposed the material to UV, visible, and infrared light and studied how electrons jump from gold to the material. The researchers found that the electrons, which trigger reactions, produced hydrogen from water over four times more efficiently than previous efforts demonstrated. Hydrogen can be used to store solar energy and then combusted for energy when the sun is not shining."This was our first foray," a researcher said, "but once we understand the material and how it operates, we can design materials for applications in different fields, such as semiconductors, the solar or chemical industries or converting carbon dioxide into something we can use. In the future, we could greatly broaden the ways we take advantage of sunlight."

Source https://www.sciencedaily.com/releases/2018/07/180712114514.htm

5. High-Power Thermoelectric Generator Utilizes Thermal Difference of Only 5°C

Opening up a pathway to cost-effective, autonomous IoT application



Conventional thermoelectric generator (left) and newly developed thermoelectric generator (right).

Objects in our daily lives, such as speakers, refrigerators, and even cars, are becoming "smarter" day by day as they connect to the internet and exchange data, creating the Internet of Things (IoT), a network among the objects themselves. Toward an IoT-based society, a miniaturized thermoelectric generator is anticipated to charge these objects, especially for those that are portable and wearable.Due to advantages such as its relatively low thermal conductance but high electric conductance, silicon nanowires have emerged as a promising thermoelectric material. Silicon-based thermoelectric generators conventionally employed long, silicon nanowires of about 10-100 nanometers, which were suspended on a cavity to cut-off the bypass of the heat current and secure the temperature difference across the silicon nanowires. However, the cavity structure weakened the mechanical strength of the devices and increased the fabrication cost.To address these problems, a team of Japanese researchers from Waseda University, Osaka University, and Shizuoka University designed and successfully developed a novel silicon-nanowire thermoelectric generator, which experimentally demonstrated a high-power density of 12 microwatts per $1cm^2$, enough to drive sensors or realize intermittent wireless communication, at a small thermal difference of only."Because our generator uses the same technology to manufacture semiconductor integrated circuits, its processing cost could be largely cut through mass production," says Professor Takanobu Watanabe of Waseda University, the leading researcher of this study. "Also, it could open up a pathway to various, autonomously-driven IoT devices utilizing environmental and body heats. For instance, it may be possible to charge your smartwatch during your morning jog someday."The newly developed thermoelectric generator lost the cavity structure but instead shortened the silicon nanowires to 0.25 nanometers, since simulations showed that the thermoelectric performance improved by minimizing the device. Professor Watanabe explains that despite its new structure, the new thermoelectric generator demonstrated the same power density as the conventional devices. More surprisingly, thermal resistance was suppressed, and the power density multiplied by ten times by thinning the generator's silicon substrate from the conventional 750 nanometers to 50 nanometers with backside grinding.Though the research team will need to improve the quality of the generator for stationary power generation in various conditions, Professor Watanabe hopes that the results achieved in this study will serve to support power technology in the IoT-based society.

Sourcehttps://www.sciencedaily.com/releases/2018/07/180706091717.htm

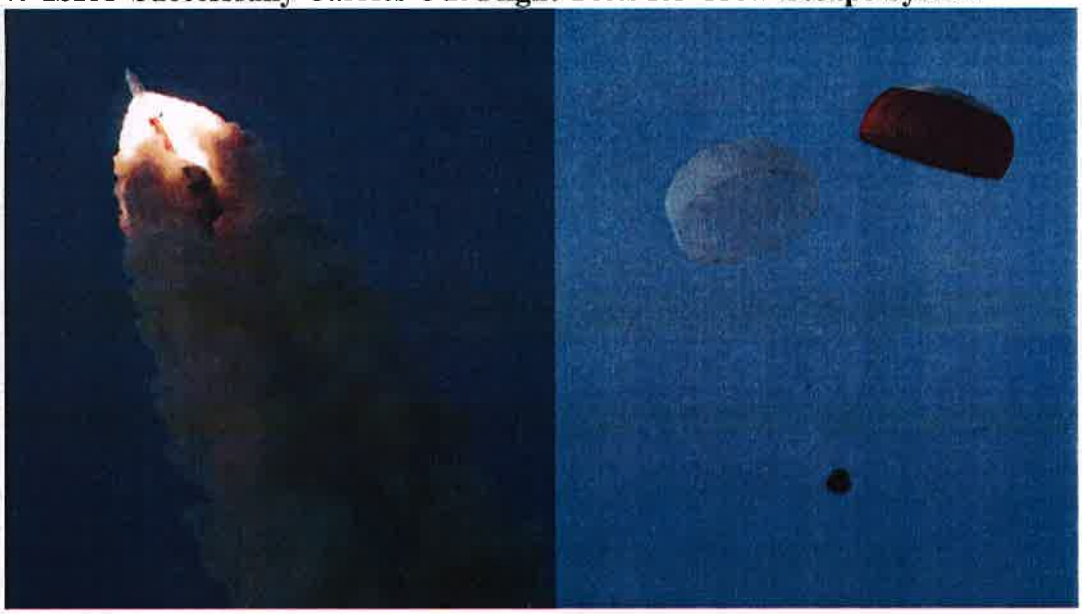
6. Semiconductor Quantum Transistor Opens the Door for Photon-Based Computing

Scientists can use many kinds of quantum particles as qubits, even the photons that make up light.

Transistors are tiny switches that form the bedrock of modern computing; billions of them route electrical signals around inside a smartphone, for instance.Quantum computers will need analogous hardware to manipulate quantum information. But the design constraints for this new technology are stringent, and today's most advanced processors can't be repurposed as quantum devices. That's because quantum information carriers, dubbed qubits, have to follow different rules laid out by quantum physics.Scientists can use many kinds of quantum particles as qubits, even the photons that make up light. Photons have added appeal because they can swiftly shuttle information over long distances, and they are compatible with fabricated chips. However, making a quantum transistor triggered by light has been challenging because it requires that the photons interact with each other, something that doesn't ordinarily happen on its own.Now, researchers at the University of Maryland's A. James Clark School of Engineering and Joint Quantum Institute (JQI) -- led by Professor of Electrical and Computer Engineering, JQI Fellow, and Institute for Research in Electronics and Applied Physics Affiliate Edo Waks -- have cleared this hurdle and demonstrated the first single-photon transistor using a semiconductor chip. The deviceis compact; roughly one million of these new transistors could fit inside a single grain of salt. It is also fast and able to process 10 billion photonic qubits every second."Using our transistor, we should be able to perform quantum gates between photons," says Waks. "Software running on a quantum computer would use a series of such operations to attain exponential speedup for certain computational problems.The photonic chip is made from a semiconductor with numerous holes in it, making it appear much like a honeycomb. Light entering the chip bounces around and gets trapped by the hole pattern; a small crystal called a quantum dot sits inside the area where the light intensity is strongest. Analogous to conventional computer memory, the dot stores information about photons as they enter the device. The dot can effectively tap into that memory to mediate photon interactions -- meaning that the actions of one photon affect others that later arrive at the chip."In a single-photon transistor the quantum dot memory must persist long enough to interact with each photonic qubit," says Shuo Sun, a postdoctoral research fellow at Stanford University. "This allows a single photon to switch a bigger stream of photons, which is essential for our device to be considered a transistor."To test that the chip operated like a transistor, the researchers examined how the device responded to weak light pulses that usually contained only one photon. In a normal environment, such dim light might barely register. However, in this device, a single photon gets trapped for a long time, registering its presence in the nearby dot.The team observed that a single photon could, by interacting with the dot, control the transmission of a second light pulse through the device. The first light pulse acts like a key, opening the door for the second photon to enter the chip. If the first pulse didn't contain any photons, the dot blocked subsequent photons from getting through. This behaviour is similar to a conventional transistor where a small voltage controls the passage of current through its terminals. Here, the researchers successfully replaced the voltage with a single photon and demonstrated that their quantum transistor could switch a light pulse containing around 30 photons before the quantum dot's memory ran out.Waks says that his team had to test different aspects of the device's performance prior to getting the transistor to work. Sun says that with realistic engineering improvements their approach could allow many quantum light transistors to be linked together. The team hopes that such speedy, highly connected devices will eventually lead to compact quantum computers that process large numbers of photonic qubits.

Source https://www.sciencedaily.com/releases/2018/07/180705143859.htm

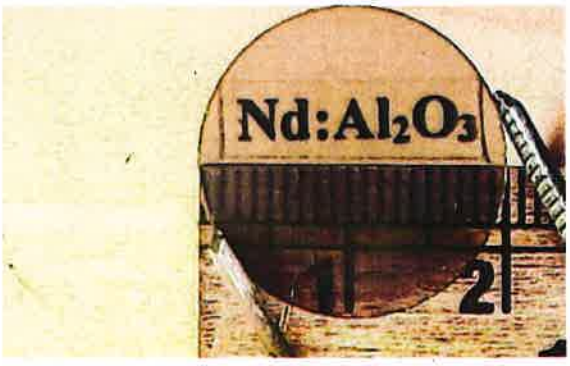
7. ISRO Successfully Carries Out Flight Tests for Crew Escape System



The Indian Space Research Organisation on July 5, 2018 successfully carried out a flight test for a newly-designed Crew Escape System, meant for saving lives of astronauts in an exigency.The space agency said it was the first in a series of tests to ascertain the trustworthiness and efficiency of the Crew Escape System.The system is an emergency measure designed to quickly pull away the crew module along with the astronauts to a safe distance from the launch vehicle if the mission gets aborted.The first 'Pad Abort Test' demonstrated the safe recovery of the crew module in case of any exigency at the launch pad, the Indian Space Research Organisation said in a release.After a smooth five-hour countdown, the Crew Escape System along with the simulated crew module lifted off at 7.00 AM from its pad at the Satish Dhawan Space Centre at Sriharikota today, it said.The test was over in 259 seconds, during which the Escape System and the module soared skyward, before arching out over the Bay of Bengal and floating back to earth using its parachutes, about 2.9 km from Sriharikota, it added.The ISRO has already conducted technology demonstrator tests of indigenously made Reusable Launch Vehicle (RLV), capable of launching satellites into orbit around Earth and then re-entering the atmosphere.The ISRO said the crew module reached an altitude of nearly 2.7 km under the power of its seven specifically designed quick-acting solid motors to take it away to a safe distance without exceeding the safe g-levels.Nearly 300 sensors recorded various mission performance parameters during the test flight, it said, adding that three boats are being readied to retrieve the module as part of the recovery protocol.

Source http://zeenews.india.com/india/isro-successfully-carries-out-flight-tests-for-crew-escape-system-2122466.html

8. Materials Processing Tricks Enable Engineers to Create New Laser Material



By doping alumina crystals with neodymium ions, engineers at the University of California San Diego have developed a new laser material that is capable of emitting ultra-short, high-power pulses -- a combination that could potentially yield smaller, more powerful lasers with superior thermal shock resistance, broad tunability and high-duty cycles.

By doping alumina crystals with neodymium ions, engineers at the University of California San Diego have developed a new laser material that is capable of emitting ultra-short, high-power pulses -- a combination that could potentially yield smaller, more powerful lasers with superior thermal shock resistance, broad tunability and high-duty cycles.To achieve this advance, engineers devised new materials processing strategies to dissolve high concentrations of neodymium ions into alumina crystals. The result, a neodymium-alumina laser gain medium, is the first in the field of laser materials research. It has 24 times higher thermal shock resistance than one of the leading solid-state laser gain materials.Neodymium and alumina are two of the most widely used components in today's state-of-the-art solid-state laser materials. Neodymium ions, a type of light-emitting atoms, are used to make high-power lasers. Alumina crystals, a type of host material for light-emitting ions, can yield lasers with ultra-short pulses. Alumina crystals also have the advantage of high thermal shock resistance, meaning they can withstand rapid changes in temperature and high loads of heat.However, combining neodymium and alumina to make a lasing medium is challenging. The problem is that they are incompatible in size. Alumina crystals typically host small ions like titanium or chromium. Neodymium ions are too big -- they are normally hosted inside a crystal called yttrium aluminum garnet (YAG)."Until now, it has been impossible to dope sufficient amounts of neodymium into an alumina matrix. We figured out a way to create a neodymium-alumina laser material that combines the best of both worlds: high power density, ultra-short pulses and superior thermal shock resistance," said Javier Garay, a mechanical engineering professor at the UC San Diego Jacobs School of Engineering.The key to making the neodymium-alumina hybrid was by rapidly heating and cooling the two solids together. Traditionally, researchers dope alumina by melting it with another material and then cooling the mixture slowly so that it crystallizes. "However, this process is too slow to work with neodymium ions as the dopant -- they would essentially get kicked out of the alumina host as it crystallizes," explained Elias Penilla, a postdoctoral researcher in Garay's research group. So, his solution was to speed up the heating and cooling steps fast enough to prevent neodymium ions from escaping.The new process involves rapidly heating a pressurized mixture of alumina and neodymium powders at a rate of 300 C per minute until it reaches 1,260 C. This is hot enough to "dissolve" a high concentration of neodymium into the alumina lattice. The solid solution is held at that temperature for five minutes and then rapidly cooled, also at a rate of 300 C per minute.Researchers characterized the atomic structure of the neodymium-alumina crystals using X-ray diffraction and electron microscopy. To demonstrate lasing capability, researchers optically pumped the crystals with infrared light (806 nm). The material emitted amplified light (gain) at a lower frequency infrared light at 1064 nm.In tests, researchers also showed that neodymium-alumina has 24 times higher thermal shock resistance than one of the leading solid-state laser gain materials, neodymium-YAG. "This means we can pump this material with more energy before it cracks, which is why we can use it to make a more powerful laser," said Garay.The team is working on building a laser with their new material.

Source https://www.sciencedaily.com/releases/2018/07/180718082111.htm

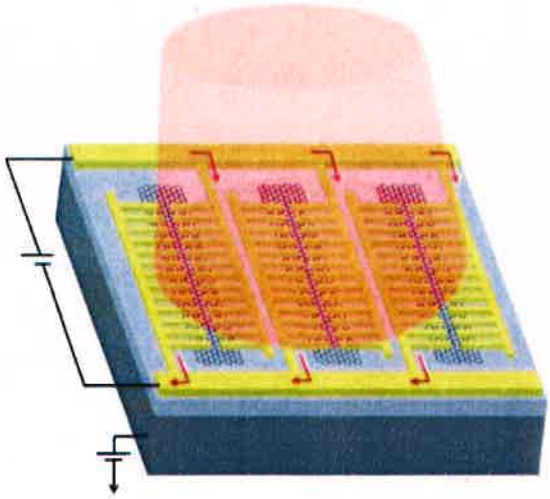
9. Generating Electrical Power from Waste Heat

This tiny silicon-based device developed at Sandia National Laboratories can catch and convert waste heat into electrical power. The rectenna, short for rectifying antenna, is made of common aluminum, silicon and silicon dioxide using standard processes from the integrated circuit industry.

New solid-state silicon device may one day power space missions.Directly converting electrical power to heat is easy. The opposite, converting heat into electrical power, isn't so easy. Researchers from Sandia National Laboratories have developed a tiny silicon-based device that can harness what was previously called waste heat and turn it into DC power. In the short term the team is looking to make a compact infrared power supply, perhaps to replace radioisotope thermoelectric generators. Called RTGs, the generators are used for such tasks as powering sensors for space missions that don't get enough direct sunlight to power solar panels. The device is made of common and abundant materials, such as aluminum, silicon and silicon dioxide -- or glass -- combined in very uncommon ways. The device is about 1/8 inch by 1/8 inch and metallically shiny. The top is aluminum that is etched with stripes roughly 20 times smaller than the width of a human hair. This pattern, though far too small to be seen by eye, serves as an antenna to catch the infrared radiation.Between the aluminum top and the silicon bottom is a very thin layer of silicon dioxide. This layer is about 20 silicon atoms thick, or 16,000 times thinner than a human hair. The patterned and etched aluminum antenna channels the infrared radiation into this thin layer.The infrared radiation trapped in the silicon dioxide creates very fast electrical oscillations, about 50 trillion times a second. This pushes electrons back and forth between the aluminum and the silicon in an asymmetric manner. This process, called rectification, generates net DC electrical current.The team calls its device an infrared rectenna, a portmanteau of rectifying antenna. It is a solid-state device with no moving parts to jam, bend or break, and doesn't have to directly touch the heat source, which can cause thermal stress.Because the team makes the infrared rectenna with the same processes used by the integrated circuit industry, it's readily scalable, said a researcher who tested the devices and modeled the underlying physics.That isn't to say creating the current device was easy. One of the biggest fabrication challenges was inserting small amounts of other elements into the silicon, or doping it, so that it would reflect infrared light like a metal, said a researcher. The devices were made at Sandia's Microsystems Engineering, Science and Applications Complex. The version of the infrared rectenna produces 8 nanowatts of power per square centimeter from a specialized heat lamp at 840 degrees. For context, a typical solar-powered calculator uses about 5 microwatts, so they would need a sheet of infrared rectennas slightly larger than a standard piece of paper to power a calculator. So, the team has many ideas for future improvements to make the infrared rectenna more efficient.These ideas include making the rectenna's top pattern 2D x's instead of 1D stripes, in order to absorb infrared light over all polarizations; redesigning the rectifying layer to be a full-wave rectifier instead of the current half-wave rectifier; and making the infrared rectenna on a thinner silicon wafer to minimize power loss due to resistance.Through improved design and greater conversion efficiency, the power output per unit area will increase. A lead researcher said, "We need to continue to improve in order to be comparable to RTGs, but the rectennas will be useful for any application where you need something to work reliably for a long time and where you can't go in and just change the battery. However, we're not going to be an alternative for solar panels as a source of grid-scale power, at least not in the near term." He added, "We've been whittling away at the problem and now we're beginning to get to the point where we're seeing relatively large gains in power conversion, and I think that there's a path forward as an alternative to thermoelectrics. It feels good to get to this point. It would be great if we could scale it up and change the world."

Sourcehttps://www.sciencedaily.com/releases/2018/07/180709120135.htm

10. New Photodetector Could Improve Night Vision, Thermal Sensing and Medical Imaging



The photodetector operates across a broad range of light, processes images more quickly and is more sensitive to low levels of light than current technology.

Using graphene, one of science's most versatile materials, engineers from the UCLA Samueli School of Engineering have invented a new type of photodetector that can work with more types of light than its current state-of-the-art counterparts. The device also has superior sensing and imaging capabilities.Photodetectors are light sensors; in cameras and other imaging devices, they sense patterns of elementary particles called photons, and create images from those patterns. Different photodetectors are built to sense different parts of the light spectrum. For example, photodetectors are used in night vision goggles to sense thermal radiation that is invisible to the naked eye. Others are used in cameras that identify chemicals in the environment by how they reflect light.How versatile and useful photodetectors are depends largely on three factors: their operating speed, their sensitivity to lower levels of light, and how much of the spectrum they can sense. Typically, when engineers have improved a photodetector's capabilities in any one of those areas, at least one of the two other capabilities has been diminished.The photodetector designed by the UCLA team has major improvements in all three areas -- it operates across a broad range of light, processes images more quickly and is more sensitive to low levels of light than current technology."Our photodetector could extend the scope and potential uses of photodetectors in imaging and sensing systems," said Mona Jarrahi, a professor of electrical and computer engineering, who led the study. "It could dramatically improve thermal imaging in night vision or in medical diagnosis applications where subtle differences in temperatures can give doctors a lot of information on their patients. It could also be used in environmental sensing technologies to more accurately identify the concentration of pollutants."The new photodetector takes advantage of the unique properties of graphene, a super-thin material made up of a single layer of carbon atoms. Graphene is an excellent material for detecting photons because it can absorb energy from a broad swath of the electromagnetic spectrum -- from ultraviolet light to visible light to the infrared and microwave bands. Graphene is also a very good conductor of electrical current -- electrons can flow through it unimpeded.To form the photodetector, the researchers laid strips of graphene over a silicon dioxide layer, which itself covers a base of silicon. Then, they created a series of comb-like nanoscale patterns, made of gold, with "teeth" about 100 nanometers wide. The graphene acts as a net to catch incoming photons and then convert them into an electrical signal. The gold comb-shaped nanopatterns quickly transfer that information into a processor, which in turn produces a corresponding high-quality image, even under low-light conditions."We specifically designed the dimensions of the graphene nanostripes and their metal patches such that incoming visible and infrared light is tightly confined inside them," said a researcher. "This design efficiently produces an electrical signal that follows ultrafast and subtle variations in the light's intensity over the entire spectral range, from visible to infrared."

Source https://www.sciencedaily.com/releases/2018/06/180628105105.htm

Engineering Innovation in India

IIT Roorkee Develops Technology for Indian Railway Track Health Monitoring Using Drones
Researchers from Indian Institute of Technology Roorkee have developed computer vision approach for monitoring of railway track using a drone. The technology is a fusion of drone and satellite data. The aim of the project is to provide some automated techniques for track inspection. Railway track health monitoring is one of the major tasks in railway inspection and monitoring system which is performed in order to maintain safety and security.

More about the track-monitoring task:

- The track-monitoring task involves inspection of various railroad components such as loose rail fasteners, defect in clips and switches, broken and misplaced crossties, cracks in various components of track and gauge measurement between the rails.
- Due to the course of time, rail track component come across various defects like: loose rail fasteners, rail cracks, rail burns, misplaced crossties, broken crossties, a problem with the joints, and defect at switches as well as less visually evident defects like shifting from the mathematical model of track geometry over time.
- In particular, a common problem in the railroad industry is the tendency of rails to deviate from their proper gauge.
- The existing system is expensive, time-consuming, involves human inspection, and automated vehicle-based system that needs proper track engagement for inspection. Researchers from IIT Roorkee are using computer vision for railroad component analysis to improve efficiency, objectivity and accuracy in the inspection system.
- This system helps to achieve cost-effective solutions with a higher level of performance, which is often unattainable through human inspection.
- The inspection of rail track is done by applying Image processing, Computer Vision techniques on the images sent by drone. Images and generated data obtained from the drone is analysed which gives useful information about the health of the rail tracks.

The Objectives of the technology are:

- Pre-processing of the data collected using a drone.
- Creation of reasonable, simple, and fast computer vision algorithm that is capable of processing the experimental field data and finding railroad defects reliably.
- Comparative evaluation of the performance of different algorithms and design schematics uncovering their better and worse features.
- Automated gauge Inspection through data provides by drone to see whether the gauge is constant throughout, and tracks are aligned or not.
- Finding the localisation of defect in a particular area using latitude and longitude.
- Automated computer vision mechanism for railway inspection system.
- Provides a fast, accurate and cost-effective way of detecting various anomalies present in the railway track.
- Drone data has proven much more effective as it provides high-quality images that contain large information for monitoring and analysis.
- Inspection through drone does not require dedicated track for inspection, hence, it does not affect the smooth running of trains. The calculation of gauge gives highly accurate results.

Source https://www.indiatoday.in/education-today/news/story/iit-roorkee-develops-technology-for-railway-track-inspection-1276310-2018-07-03