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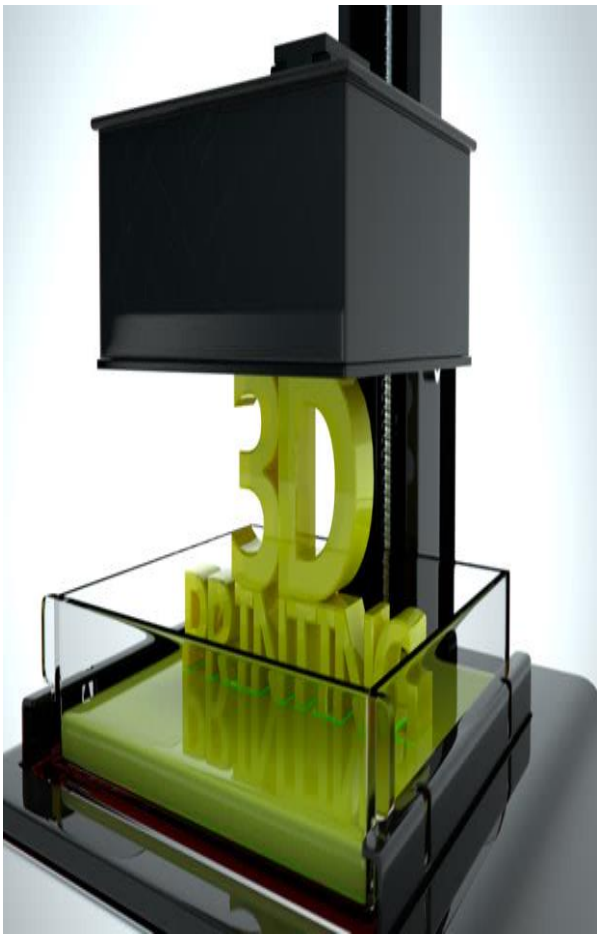

Contents:

Water creates traps in organic electronics (2)

Flexible circuit for 3D printing (3)

Expert Lecture/Seminars/Courses/Industrial Visits Organized (5)

Campus Placement (6)

Telekinesis-2K19 (7)

Project Based Learning (8)

ASPIRE Research Proposal (10)

Water creates traps in organic electronics

The discovery that organic materials, such as polymers, can act as semiconductors led to a Nobel Prize in Chemistry in 2000. Since then, research within organic electronics has truly exploded, not least at Linköping University, which is home to world-leading research in the field.

Organic semiconductors, however, do not conduct current as efficiently as, for example, semiconductors of silicon or other inorganic materials. The scientists have discovered that one of the causes of this is the formation of traps in the organic materials in which the charge carriers get stuck. Several research groups around the world have been working hard to understand not only where the traps are located, but also how they can be eliminated.

"There are traps in all organic semiconductors, but they are probably a greater problem in n-type materials, since these are generally poorer semiconductors than p-type materials," says Martijn Kemerink, professor of applied physics in the Division for Complex Materials and Devices at Linköping University. Materials of p-type have a positive charge and the charge carriers consist of holes, while materials of n-type have charge carriers in the form of electrons, which gives the material a negative charge.

Martijn Kemerink and his colleagues at Linköping University have concluded that water is the villain in the piece. Specifically, the water is thought to sit in nanometre-sized pores in the organic material and is absorbed from the environment.

"In a p-type material the dipoles in the water align with their negative ends towards the holes, which are positively charged, and the energy of the complete system is lowered. You could say that the dipoles embed the charge carriers such that they cannot go anywhere anymore," says Martijn Kemerink.

For n-type materials, the water orients the other way around, but the effect is the same, the charge is trapped.

Experiments have been carried out in which the material is heated, to dry it out and cause the water to disappear. It works fine for a while, but the material subsequently re-absorbs water from the surrounding air, and much of the benefit gained by drying disappears.

"The more water, the more traps. We have also shown that the drier the films can be manufactured, the better conductors they are. The theoretical work by Mathieu Linares quantitatively confirmed our ideas about what was going on, which was very satisfactory. Our article in Nature Materials shows not only how to get the water out, but also how to make sure that the water stays out, in order to produce an organic material with stable conductivity."

In order to prevent the reuptake of water into the material once it has been dried, the scientists have also developed a way to remove the voids into which water molecules otherwise would have penetrated. This method is based on a combination of heating the material in the presence of a suitable organic solvent.

"Materials that were previously believed to be extremely poor semiconductors can instead become good semiconductors, as long as they are manufactured in a dry atmosphere. We have shown that dry-prepared materials tend to remain dry, while materials that are made in the presence of water can be dried. The latter are, however, extremely sensitive to water. This is true of the materials we have tested, but there's nothing to suggest that other organic semiconducting materials behave differently," says Martijn Kemerink.

Tanvi Upreti, doctoral student at the Division for Complex Materials and Devices, who carried out the experiments together with the first author, Guangzheng Zuo.
Credit: Charlotte Perhammar

Linköping University

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Flexible circuits for 3D printing

"The aim of this study was to functionalize 3D-printable polymers for different applications," reports Michael Rübhausen from the Center for Free-Electron Laser Science (CFEL), a cooperation between DESY, the University of Hamburg and the Max Planck Society. "With our novel approach, we want to integrate electronics into existing structural units and improve components in terms of space and weight." The physics professor from the University of Hamburg led the project together with DESY researcher Stephan Roth, who is also professor at the Royal Institute of Technology in Stockholm. Using the bright X-ray light from DESY's research light source PETRA III and other measuring methods, the team has precisely analyzed the properties of the nanowires in the polymer.

"At the heart of the technology are silver nanowires, which form a conductive mesh," explains Glier. The silver wires are typically several tens of nanometers (millionths of a millimeter) thick and 10 to 20 micrometers (thousandths of a millimeter) long. The detailed X-ray analysis shows that the structure of the nanowires in the polymer is not changed, but that the conductivity of the mesh even improves thanks to the compression by the polymer, as the polymer contracts during the curing process.

The silver nanowires are applied to a substrate in suspension and dried. "For cost reasons, the aim is to achieve the highest possible conductivity with as few nanowires as possible. This also increases the transparency of the material," explains Roth, head of the P03 measuring station at DESY's X-ray light source PETRA III, where the X-ray investigations took place. "In this way, layer by layer, a conductive path or surface can be produced." A flexible polymer is applied to the conductive tracks, which in turn can be covered with conductive tracks and contacts. Depending on the geometry and material used, various electronic components can be printed in this way.

In this paper, the researchers produced a flexible capacitor. "In the laboratory, we carried out the individual work steps in a layering process, but in practice they can later be completely transferred to a 3D printer," explains Glier. "However, the further development of conventional 3D printing technology, which is usually optimized for individual printing inks, is also essential for this. In inkjet-based processes, the print nozzles could be clogged by the nanostructures," notes Rübhausen.

In the next step, the researchers now want to test how the structure of the conductive paths made of nanowires changes under mechanical stress. "How well does the wire mesh hold together during bending? How stable does the polymer remain," said Roth, referring to typical questions. "X-ray investigation is very suitable for this because it is the only way we can look into the material and analyze the conductive paths and surfaces of the nanowires."

Researchers from the University of Hamburg, the Royal Institute of Technology in Stockholm, the Wallenberg Centre for Wood Science in Stockholm, the Max Planck Institute for the Structure and Dynamics of Matter in Hamburg and DESY were involved in the work.

Deutsches Elektronen-Synchrotron DESY

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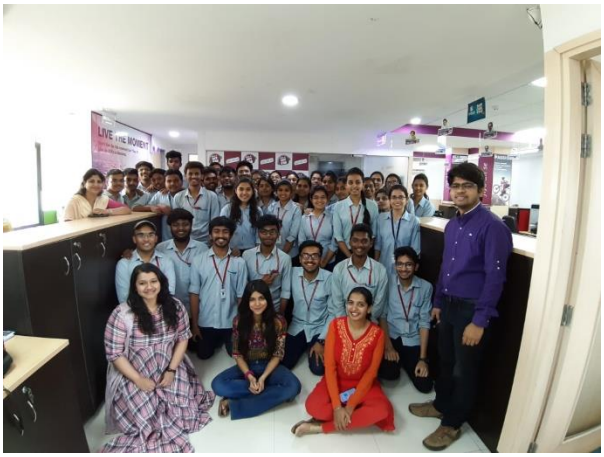
Expert Lecture/Seminars/Courses/Industrial Visits Organized

- An Expert lecture was organized for TE & SE students on "Why you should get an MBA" on 3rd March 2019 under Career Development Cell. Mr. Sagar Nikum (Managing Director, ELC) was the resource person.

- An Expert lecture was organized for TE & BE students on "Applications of Satellite Communication" on 27th March 2019. Mrs. Apurva Jakhadi was the resource person.

- Industrial visit was organized to MyFM on 28th March 2019 for SE students related to Analog Communication subject.



- An Expert lecture was organized for BE students on "Industry 4.0" on 28th March 2019. Mr. Chetan Shimpi (TEF3NaP Manager, BOSCH Limited, Nashik) was the resource person.

- Industrial Visit at ESDM technology pvt.Ltd of TE students was arranged on 29th March 2019.

Campus Placement

Sr. No.	Name of the Company	No. of students Placed
1.	Sunita Engineering, Nashik	1

National Level Technical Event "TELEKINESIS-2K19""

The National Level Technical event "Telekinesis 2019" was organized on 23rd March 2019 at E & TC Department of Karmaveer Kakasaheb Wagh Institute of Engineering Education & research, Nashik. The function was headed by Prof. Dr. D. M. Chandwadkar, HOD, Electronics and Telecommunication department.

Mr. Sallel Raje, CEO of ESDM Technology Pvt Ltd. was present as a chief guest for the event. Mr. Swapnil Joshi, director Joshi's Classes. Mr. Akash Chumbhle, Head of Sales department DNA solutions, the activity was guided and coordinated by Prof. S.V.Shelke , Prof. P.P.Patil and Prof. S. A. Zalte , of E & TC department, Mr. Amar Mundhekar and Mr. Suryakar Hiwale worked as a student coordinators for the event . Program stated by welcome speech given by Prof. Dr. D.M. Chandwadkar. Various technical events like Project competition, poster presentation, technical quiz competition, C programming, recruitment spark were organized under TELEKINESIS 2K19 so as to enhance technical skills among students. Few non-technical events like talent hunt and photography based event 'Click it' was conducted to add fun and excitement in the Telekinesis.

Government of India has decided to commemorate the 150th birth anniversary of Mahatma Gandhi, Father of the Nation, at national and international level. Based on this Sketch competition on Mahatma Gandhi was also organized during Telekinesis 2K19.

Eminent Judges from various Industries and Colleges judged competition and many sponsors like Joshis classes, DNA Solution, ELC Nashik, GATE Forum, YASH Capacitor, Cognifront YASH Technology Nashik etc. assisted TELEKINESIS 2K19.The program was ended with a Prize distribution ceremony and lot hopes for of future. Dr. K. N. Nandurkar, Principal has congratulates all the winners.

Project Based Learning Exhibition

Project based learning exhibition is organized by Electronics & Telecommunication department on 5th April 2019 from 11.00 am to 2.00 pm.

Objectives of project based learning are

1. To improves technical skills in students like Circuit Designing, Circuit testing (Hardware, software), troubleshooting and Programming etc.
2. To improve soft skills in students like Communication skills , Presentation , Report writing etc
3. This approach gives students a relevant learning experience and encourages the transfer of knowledge to new situations.
4. To improve following abilities in students like critical thinking, communication and cooperation in students

Around 32 micro and mini projects done by second and third year students were presented in exhibition. Second year students have done projects under subject Integrated Circuits, Analog Communication and Object oriented Programming. Third year students have done projects under subject Employability Skills and Mini Project. Electronics hobby projects done by students were presented in open category.

Ms. Sawmya Rao, Configurator & Software Tester at FinIQ Nashik, Ms. Mitali Sharma, System Engineer at EMERSON Nashik are the experts from industry who was invited for inauguration and evaluation of projects. Dr. D.M. Chandwadkar H.O.D. E&TC and ELTX motivated students to design more innovative and application specific projects. Ms. Sawmya Rao, who was university topper, explained importance of technical skills in industry and how these activities are useful to develop those skills. Ms. Mitali Sharma Congratulated winners and wish them success and best wishes for their future.

Research Proposal Sactioned

Research Grant Scheme: ASPIRE by Savitribai Phule Pune University

Proposal Number: 18TEC001353

Project Title: Prediction and Detection of Obstacle for Vehicle Door Opening using Millimeter Wave Radar System

Principal Investigator: Mr. Dipankar Dharmrakshit Khartad

Co-Investigator: Mr. Kiran Sudam Navale

Area of Specialization: Automotive Embedded System

Budget Approved: 2,32,000/-

Definition of the Problem:

This project aims to implement the prediction and detection of obstacle for vehicle door opening using automotive radar sensor. The project will detect the obstacle in 3D space by transmitting millimeter wave (mmWave) signals that objects in their path and then reflect. By capturing reflected signal, a radar system can determine the range, velocity and angle of the objects.

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E-mail: ddkhartad@kkwagh.edu.in

Vision

Provide quality education to create engineering professionals of global standards by keeping pace with rapidly changing technologies to serve the society.

Mission

M1: To educate the students with the state-of-the-art technologies and value based education to meet the growing challenges of industry.

M2: To provide scholarly ambience & environment for creating competent professionals.

M3: To inculcate awareness towards societal needs.