Winter 2025

Advanced Technology Institute Newsletter
Faculty of Engineering and Physical Sciences

News

ATI RESEARCHERS DEVELOP FULL-COLOUR ARTIFICIAL RETINA WITH SUPPORT FROM ULVERSCROFT FOUNDATION

Researchers from the University of Surrey's Advanced Technology Institute (ATI) have secured funding from the Ulverscroft Foundation to advance the development of a full-colour artificial retina. The project aims to demonstrate the feasibility of an ultra-flexible prosthetic device capable of replacing damaged human photoreceptors.

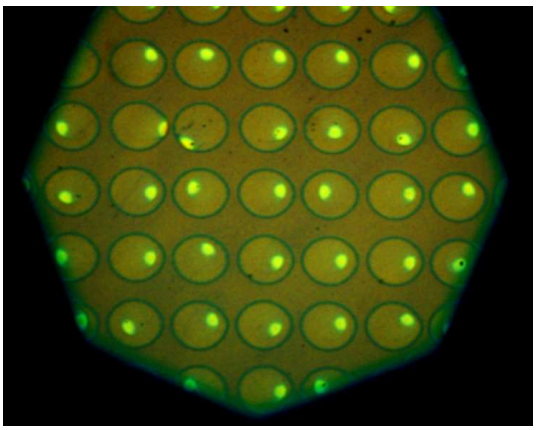


Figure: Printed conjugated molecules pixels imitating cone cells for future sub-retinal prostheses, observed under an optical microscope.

Project lead, Dr Maxim Shkunov, explains: "We employ carbon-based semiconductors, which are compatible with human tissues, to replicate the spectral response of the rods and cones in the retina — the light-sensitive cells responsible for colour perception from deep blue to dark red. These semiconductors, known as conjugated molecules, offer a threefold advantage: colour-specific response across blue, green, and red spectral regions due to their distinct bandgaps; the ability to generate photoresponses—both photovoltage and photocurrent—from miniature devices resembling organic solar cells, enabling stimulation of the retinal circuitry in patients' eyes; crucially, biocompatibility, allowing the devices to operate effectively in biological electrolytes."

Postdoctoral researcher Dr Hashini Perera, working on the project, adds: "We are currently studying the stability of these opto-electronic devices in a laboratory environment that mimics conditions in the human eye — including aqueous solutions with physiological salinity, body temperature, and oxygen levels."

The University of Surrey has achieved high rankings in sustainability metrics, including being ranked 113th globally in the QS Sustainability Rankings 2026, a significant jump from previous years.

IN THIS ISSUE

ADVANCED ION-BEAM ANALYSIS REVEALS AGE VARIATIONS IN DISPUTED JORDAN CODICES

Scientists have delivered the most detailed assessment yet of a set of disputed lead books known as the Jordan codices. With debate centred on whether they could date back to the early Christian period, a study led by the University of Surrey's Ion Beam Centre has now shed new light on their origin.

The study, published in Elsevier's Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms, finds that while some of the external pages of one of the books have been found to be contaminated by interactions with the environment, giving ambiguous age determination, inside pages are less contaminated and give clear scientific readings showing they are at least 200 years old, and possibly older.

Working in collaboration with the University of Glasgow, the Scottish Universities Environmental Research Centre and the University of Vienna, researchers applied four analytical techniques to samples from the books. These included trace-element analysis, lead-isotope measurements, alpha-particle tests and radiogenic helium analysis to assess the composition and likely age of the lead. No single method could determine a definitive age, but together they provide a more detailed picture of how different parts of the codices were made.

Tests run to date do not allow for a definitive date older than 200 years, but do not rule out that possibility, opening the door to further analysis with even more accurate future testing. Although the study could not determine that the codices were created in the early Christian period, it was also not possible to show that they were of modern origin. However, a truly definitive test to determine the true age of the manufacture of the books requires further investigation due to substantial non-uniformity of the samples and a much higher degree of background contamination than was expected.

The study was funded by the European Union's Horizon 2020 research and innovation programme and by the EPSRC National Research Facility.

VICE-CHANCELLOR'S VISIT TO THE SURREY ION BEAM CENTRE

The Surrey Ion Beam Centre was pleased to host our Vice-Chancellor, Prof. Stephen Jarvis, on Tuesday the 28th of October!

Stephen met with the team, toured the facility, and joined several insightful discussions around key strategic areas and future directions. It was an engaging and inspiring visit, and we're looking forward to following up on the key points raised.

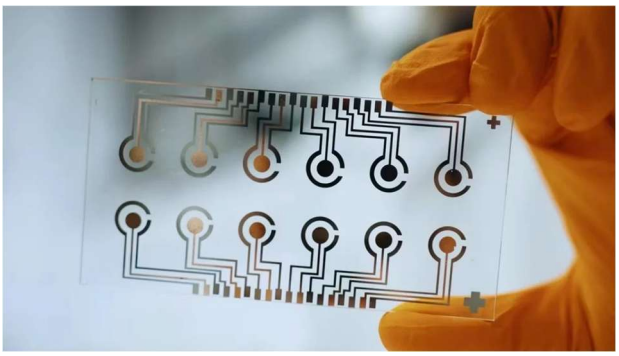
Many thanks to Stephen for taking the time to visit and for his continued support of our work at the Centre.

Vice-Chancellor, Prof. Stephen Jarvis, Prof Satheesh Krishnamurthy, and the IBC team

ADVANCED TOOLS COULD HELP BUILD SAFER, LONGER-LASTING AND FASTER-CHARGING BATTERIES

Researchers from the University of Surrey's Advanced Technology Institute (ATI) have secured funding from the Ulverscroft Foundation to advance the development of a full-colour artificial retina. The project aims to demonstrate the feasibility of an ultra-flexible prosthetic device capable of replacing damaged human photoreceptors.

New microdevices developed at the University of Surrey give researchers their first-ever look inside a battery while it is running – opening the door to safer, smarter and more sustainable energy storage.



Battery chip design

These advanced tools allow scientists to observe chemical and structural changes in real-time as the battery operates, helping them better understand why batteries lose power, overheat or fail. For example, they can monitor the nanoscale surface morphology – the tiny structural features on a battery's surface that change as it charges and discharges – analyse the interfacial composition, detect the atomic-level mass changes, and identify gas formation.

The research team has also built a series of "mini lab-on-a-chip" systems that can rapidly test new battery materials and designs, improving the safety, lifetime and charging speed of batteries used in electric vehicles, public transport and large-scale renewable energy storage.

The Surrey team is now working closely with other academic groups and industrial partners, including Merrow Scientific, LinkZill and R3V Tech, to bring the research beyond the lab and into wider use in green chemical processing and environmental detection.

ATI Viva voce examinations in 2025

Our research students who have passed their PhD viva voce examinations in 2025

Dr Gianluc Romulus Lui (Supervisors: Prof Marian Florescu, Dr Izabela Jurewicz)
Project: Photonic Band Gaps in Ordered and Disordered Materials: Fundamentals and Applications

Dr Surajit Kar (Supervisors: Dr Yunlong Zhao, Prof Ravi Silva, Prof John Joe McFadden)
Project: Free-Standing Microelectrode Probes for High-Resolution Interrogation of Living Cells

Dr Patryk Golec (Supervisors: Dr Radu Sporea, Prof Marian Florescu)
Project: Compact Modelling of Source Gated and Multimodal Thin Film Transistors

Dr Shaoyin Li (Supervisors: Prof Qiong Cai, Dr Tan Sui)
Project: UV-Micro-Patternable Ionogel Electrolytes: Design, Preparation, and Applications in Energy Storage Devices

Dr Alexander Rubinstein (Supervisors: Prof Roger Webb, Prof Jonathan England)
Project: Computer Simulation of Energetic Ion-Solid Interactions

Dr Md Delowar Hussain (Supervisors: Prof Ravi Silva, Dr Jae Yun)
Project: Integration of Mechanical Energy Harvesters with the Internet of Things

Events

2025 UKNIBC User Day

We look forward to welcoming you to the 2025 UKNIBC User Day on Monday 8th December at the University of Surrey which is home to 4 Ion implanters, 2 Single Ion Implanters, 2 Focused Ion Beams and a bespoke Ion Beam Analysis facility.

The focus will be on presentations by our wide-ranging user community but we also warmly welcome those whose projects are ongoing and prospective users who are looking to explore the possibilities. This will be an excellent opportunity to share your research and to discover the potential offered by the UKNIBC with fellow users and the operators of the facilities within the centre.

Registration is free. We will be inviting talks directly from our user community but you are also highly encouraged to get in-touch if you wish to present. You are also very welcome to bring posters to be displayed during the lunchtime session – just let us know if you plan to do this when you register.

Please direct any enquiries related to the event to r.webb@surrey.ac.uk

See more on our website: https://ionbeamcentre.com/wp/2025/10/22/uknibc-user-day-2025/

Institute for Sustainability's Third Annual Showcase Wed. 3*rd* Dec. 2pm - 5:30pm in AP2

We'd love for colleagues from the ATI to join us for this year's Institute for Sustainability Showcase. It's a great opportunity to see how our Research and Innovation Programmes are driving real-world impact—including exciting developments in sustainable energy, transport systems, and technology that align closely with ATI's own work, through a series of lightning talks, including presentations from our Practitioner Doctorate Students in Sustainability (PDS).

Hear from partners as they present their challenges for the Innovation Contest, browse the exhibition stands, or take part in the Conserving Forests after COP30 workshop, hosted in parallel, by Surrey Law colleagues.

Refreshments will be served from 1:30pm with opening remarks at 2pm from President and Vice-Chancellor, Professor Stephen Jarvis. The provisional agenda is here.