REACT – Responsible Electronics and Circular Technologies

1st International Conference, Technology and Innovation Centre, University of Strathclyde, Glasgow – 11-12 November 2025

This Conference was organised by the **REACT** (www.react.ac.uk), a 5 year UKRI supported project which is being run by the University of Glasgow, with the University of Edinburgh, Heriot Watt University and the CSA Catapult as research partners. REACT is a £6M+ Green Economy Centre supporting the electronic, ICT, semiconductor, quantum and photonics industries in transitioning to a circular economy and reducing emissions.

The Conference was attended by 126 delegates, approximately 75% of which were academic based, with 2 days of presentations including 2 Keynotes, 5 Technical Sessions, 1 Panel Discussion and 40 posters submitted.

Keynote Presentation: Computing after Carbon, Professor Melissa Gregg, University of Bristol

The first keynote address was made by Melissa Gregg of the University of Bristol who reviewed the landscape for high performance computing and consumer usage with the increase in energy usage as AI becomes more widely adopted. The traditional business model employed by the high tech manufacturers of computing equipment is based on encouraging regular refreshment of products, where recycling and re-use is difficult to achieve.

Keynote Presentation: Strategic Importance of Sustainable Electronic Packaging by Professor Matt Boyle, NMIS/NASPIC, University of Strathclyde

The second keynote address was made by Matt Boyle, the NMIS Director of Electrification at the University of Strathclyde. The importance of designing for the full life cycle of an electronic

product was highlighted covering raw material selection, process optimization to improve efficiency and minimise waste, design for disassembly and end-of-life recovery/re-use. The NMIS facility at the University of Strathclyde has been established to address these ambitious goals and it was recognised that several major challenges need to be overcome including cross-disciplinary collaboration, funding of infrastructure and reconfiguration of the entire supply chain.

Technical Session: System Applications

The session opened with a talk from Manuel Thesen, of Forschungsfabrik Microelectronik in Germany who are leading a Resource Conscious Green ICT programme, where several examples of energy savings and waste reduction in semiconductor processing were demonstrated.

This was followed by a presentation from Kiran Crawford of Jaguar Land Rover (JLR) on their sustainability goals, for example, net zero emissions by 2039. The advent of full electric vehicles is changing the sustainability picture where batteries and electronics plays a more significant role in governing environmental impact. Draft WEEE legislation is in development, which proposes removal of electronics and electrical products from vehicles at the end-of-life for processing.

Benjamin King of the University of Glasgow described a programme of work on component recycling in chipless temperature sensors, where coil based sensors could be removed from flexible pcbs and replaced with a new sensors or re-purposed for other applications. The University of Oxford provided a systems perspective based on a holistic approach covering the entire product lifecycle involving the use of causal loop diagrams. Further details are available at www.circulareeeproject.com . Johanna Zikulnig of Silicon Austria Labs has investigated the use of biodegradable inks and substrates in sensor applications.

Technical Session: Recycling and Recovery

Dr Jayakrishnan Chandrappan of the CSA Catapult introduced the session of recycling and recovery by emphasising the significant amount of energy and water used in the manufacturing of semiconductors. The importance of electronics packaging in providing the electrical connections, thermal management and environmental protection was also highlighted, Sustainability efforts through the REACT project are being focused on reducing power consumption, miniaturisation of size and weight and extending product lifetimes. The goal of introducing recycling of products within an established supply chain for existing products was recognised as being very difficult to achieve and efforts to implement products capable of being recycled would require a major system design review at the initial concept stage.

Panagiota Angeli of University College London (UCL) explained research work being carried out to enhance metal recycling through novel solvents and chemical separation. Luis Naverro of IBC Advanced Technologies presented on the application of solvents and acid leaching for recovery of various selective metals from waste and Ryan Conner of ElectraMet described a route based on electrochemistry to recover metals in low concentrations from waste liquids.

CEA-Leti described a hot air gun system that can be used to remove packaged ICs and passive components (e.g. tantalum capacitors) from PCBs for re-use in other applications.

The recovery of metals from e-waste enhanced with ultrasound was explored by the University of Leicester, where applications included disassembly of fuel cells and recovery of gold from PCBs. Iron based catalysts are used to dissolve copper, leaving precious metals that can be recovered. The University of Leicester is also developing debondable adhesives.

Technical Session: Manufacturing and Materials

Alun Morgan of the European Institute of Printed Circuits (EIPC) presented some global use figures on the market size and location for Printed Circuit Board (PCB) manufacture, where the vast majority of circuit boards are being produced in the Far East and the supply chain is now established locally to service this market. The contribution of the PCB to overall e-waste was estimated at 8% and some UK based developments based on biodegradable materials to create sustainable circuit boards through Jiva Materials were described, which are gaining some market traction for consumer electronics.

Francisco Ruiz of the University of Granada reported on the development of printed inks based on hydrogel materials. Jon Harwell of the University of Glasgow presented work on the creation of functioning circuits on paper substrates using Zn as the interconnect material. Mathilde Billaud of CEA – Leti described work carried out to develop ferroelectric capacitors for memory applications.

Technical Session: Life-Cycle Aware Semiconductors

Julia Hess of Global Chip Dynamics gave some updates on the strategic relevance of semiconductors through the analysis of the global supply chain including its ecological footprint and dynamic geopolitical realities.

Research presentations on several Life Cycle Assessments (LCA) were reported by the following authors:

- Beyond FR4: A Comparative LCA of Traditional and Green PCB substrates by Moupali Chakraborty, Kingston University London
- LCA on the Epitaxy of GaN-on-SiC High-Electron-Mobility Transistors for Advanced Radiofrequency Applications by Max Mosig, University of Freiburg
- LCA of an Electronic Grade Silicon Wafer: A review and update of data by Enola Fidon, CEA-Leti

Panel Session: Product Value Retention through Re-Use and Re-Manufacturing

Jeff Kettle of the University of Glasgow compered a panel session on Product Value Retention; the panel personnel included Justine Scullion of WEEE Scotland, Stephen Fitzpatrick of NMIS, Diego Bermidez of the DICE+ Network and David Howe of Jordisk.

The topics covered included the need to increase the focus on disassembly and re-use rather than recovery and recycling at the end of life and the change in regulations required to make manufacturers more responsible for the complete lifetime of their products through extended product responsibility (EPR).

It is likely that the 2nd International REACT Conference will be held in November 2026 in Glasgow again.