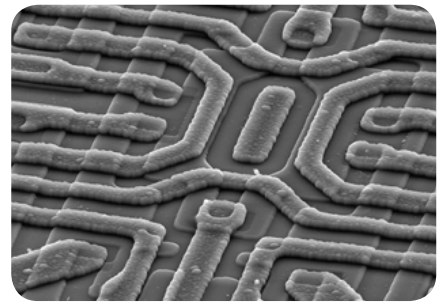


## Materials, manufacturing processes and technology



### Research Issues:

- Qualification strategies
- Packaging power electronics
- Single unit manufacture
- Lead-free
- Direct imaging processes
- Lean technologies
- Integrated optics
- Bio-applications
- Integrated MEMs
- Smart materials

**Vision:** to deliver research in materials, manufacturing processes and technology to secure the future competitiveness of the UK in providing the foundations for new and emerging markets that could be nurtured within the UK electronics community. The objectives of this vision are to:

- Develop a portfolio of research that promotes the adoption of new materials in a manufacturing-led, applications-focused context
- Support research into new and improved manufacturing processes
- Explore the potential of new (potentially disruptive) technologies to deliver step-changes in electronics products
- Provide support for other IeMRC themes

The theme covers a broad range, from materials developments to new ways of optimising production processes for higher variety but lower volume production demands. The growth of pervasive electronics in new environments and the need for sustainable products provides a rich seam of research activity into assembly and disassembly technologies, robust packaging and associated materials developments. There are also issues with the introduction of new materials providing environmental benefits, since these are replacing well understood materials. There is also a need to provide design tools that capture the impact of these disruptive technologies.

Example projects have dealt with a number

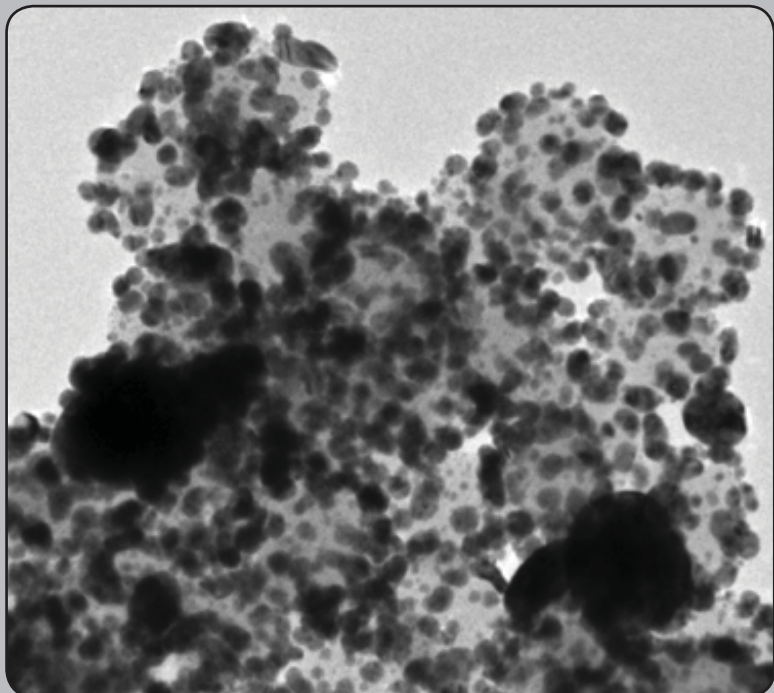
of new and emerging topics in electronics manufacturing including nano-composites applied to solders, conductive polymers and energy storage; printable electronics; laser and microwave processing; sonochemistry; nano-scale lithography; optical interconnections and packaging for power modules. Highlights include:

1. New nano-composite materials, including the project "Nanoparticle Stabilized Solder Materials for High Reliability Applications" which has successfully demonstrated gold- and palladium-coated ceramic nanoparticles for strengthening solders and the project "Development and manufacture of transparent, electrically conductive, flexible plastics" which demonstrated the manufacture of carbon nanotube-polyurethane nanocomposites.

2. New and improved manufacturing process projects dealing with printed electronics and displays, exemplified by the project "Manufacturing Electronic Devices Using Embossing & Microcontact Printing"

which established micro-contact printing as a viable technique for manufacturing reduced-voltage electroluminescent light sources. Two other projects are "The Evaluation of Sonochemical Techniques for Sustainable Surface Modification in Electronic Manufacturing" which has highlighted the versatility of ultrasonically assisted processing and "Chemically Amplified Molecular Resists for Electron Beam Lithography" which developed world-leading high resolution resists for the microelectronic industry.

3. New technologies to deliver step-changes in electronics products as exemplified by the "Power Electronics Flagship", which demonstrated significant mass and volume reductions by the application of direct substrate cooling of power modules and "Novel high energy density, high reliability capacitors", which demonstrated world-leading energy densities from a polymer-ceramic nanocomposite.



*Gold coated nano particles for novel solders, developed at King's College London*