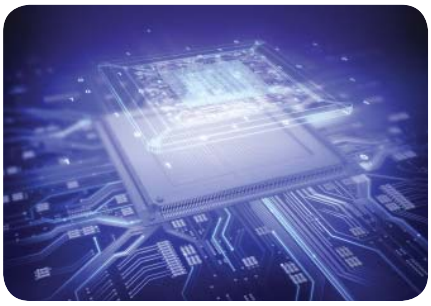
IeMRC Research Portfolio Themes



Challenging environments: New application areas

Research Issues:

- Security
- Low volume DfM
- Thermal management
- Integrated optics
- Reliability
- Test data for reliability
- Qualification strategies
- DfManufacture (DfM)
- Multiphysics tools
- Harsh/new environments

Vision: to provide underpinning research that will enable the UK electronics industry to retain its competitive edge in high added value sectors such as healthcare, aerospace and energy, where there are significant demands for sophisticated electronic products that can operate reliably in new or challenging environments.

Electronics are being embedded in new areas to add value, provide additional or novel functionality or improve safety. The 'Intelligent Environment' is a rapidly developing reality and presents opportunities in low-cost, miniaturised packaging; fault tolerant electronic control and data processing; low-cost manufacture and realisation of robust wireless capabilities and integrated modules with RF, passive and active devices.

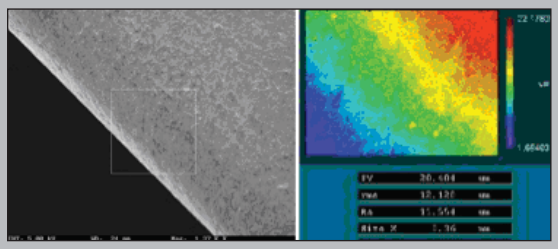
Integration of electronics is also occurring in environments previously considered 'harsh' or into areas where electronics have not been exploited that have unusual survival demands. Examples include: in vivo electronics for diagnosis, therapy and healthcare management and in space and defence systems where compact and highly reliable systems must operate in extreme conditions.

The objectives of this theme are to establish a portfolio of projects that investigate materials, processes, technologies, design methodologies, reliability testing and qualification strategies for key application areas in new or challenging environments, and to provide an applications-led focus for other IeMRC themes.

The drivers for future research into electronics manufacturing for new and challenging environments will come from healthcare, energy management for transport applications and the power generation sector.

Challenges posed by new surface contamination related failure modes in wireless devices

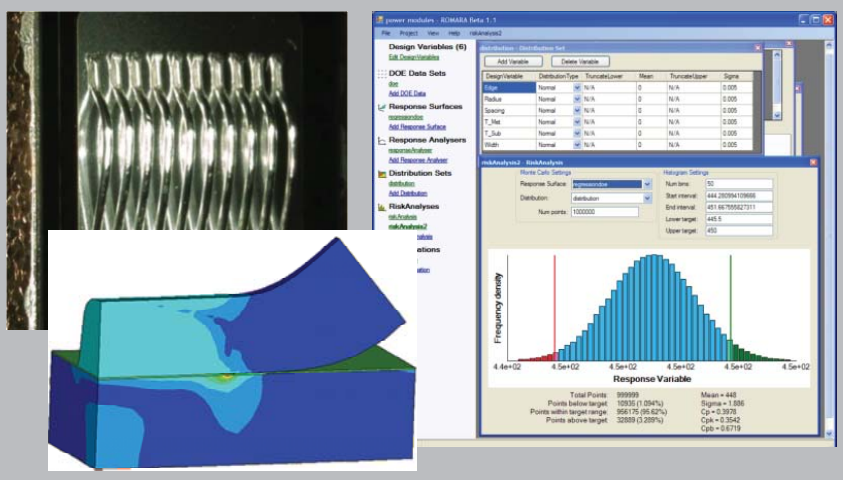
Wireless mobile products demand high impedances but see wider ranges of environments than products designed for fixed locations. Assembly processes using "no-clean" solder pastes adopted to reduce use of cleaning solvents result in failures for wireless products due to trapped ionic contamination. This project is investigating failure mechanisms under controlled conditions to confirm the mechanisms linking failure with combinations of contaminants.



SMT capacitor undergoing surface analysis

Physics-of-Failure (PoF) Models and Risk-Based Design for Reliability of Power Electronics Modules

Working closely with UK industry, the IeMRC Power Electronics flagship project developed a methodology to generate PoF models that predict failure mechanisms in power modules. These, together with reduced order models for stress predictions and Monte-Carlo based risk analysis can provide a six-sigma driven approach to predictive reliability.



Greenwich and Nottingham Universities developed PoF models and Risk-Based software for Power Module Designers.