



Micro-Electronics Packaging for Harsh Environments Conference and Exhibition (MfHE)

28th November 2019 at Satellite Applications Catapult Centre, Harwell, Oxfordshire

This IMAPS-UK organised Micro-Electronics Packaging for Harsh Environments Conference and Exhibition covered the state of the art in electronic device assemblies used in Space, Defence, Aerospace & Transport, Medical, Energy & Exploration applications. The event provided a forum for the attendees to meet and learn about the latest developments in electronic packaging technologies and discover new supply chain opportunities.

The conference was hosted at Satellite Applications Catapult Centre, Harwell, Oxfordshire which supports UK industry in accelerating growth in satellite applications.

This conference was attended by 63 people and covered a wide range of themes in the field of harsh environment electronics, including:

- Applications and Requirements
- Components and Materials
- Design, Manufacturing and Processes
- Reliability and Ruggedisation



The attendees had the opportunity to discuss their particular requirements with the following exhibiting companies:

- Alter Technology (Optocap)
- API Technologies
- Filtronic
- Industrial Production Processes (IPP)
- Inseto (UK) Ltd
- Micross Components
- Nordson Dage
- Plasma-Therm



Applications and Requirements

Mike Curtis-Rouse of the Satellite Applications Catapult provided the keynote presentation on **Small Satellites – Long Lives, The Challenges for Space 2.0**, which described the main challenges facing the space industry in gearing up for the expansion in the use of small space satellites; including time to market (faster, cheaper with no loss of quality), validation and test (but without compromise in reliability) and collaboration (to share resources, whilst maintaining a competitive position).

Simon Johnson of CPI presented on **Embedded Electronics for Harsh Environments**, which gave an overview of the possible applications in thermoforming of electronic circuits (Circuits can be printed and assembled on flexible polymer sheets and then thermoformed to create conformal surfaces) followed by over-moulding using injection moulding or lamination to provide finish and protection. Wireless power and data communication circuits fabricated on flexible substrates have been shown to operate within carbon fibre composites

Components and Materials

Sergei Belyakov of Imperial College London described some recent research work on 3rd generation SAC solders in a talk entitled **“Beyond SAC Solders: Understanding Microstructure Stability in Alloys for Harsher Environments”**, which examined the additions of antimony (Sb) and bismuth (Bi) to SAC solders to

improve thermal cycling performance in harsh environments (-55°C to +125°C), but came with the warning that the solders may overage even at room temperature.

Ikram Beauvisage of Egide presented on **HTCC Hermetic Packages and RF Transitions** which described the HTCC packaging technology as a solution to high frequency applications. In order to design a fully reliable transition in high frequency, it is essential to integrate the external elements to the simulations at an early stage. Egide is looking to extend the range of high frequency performance through additive manufacturing to reduce the widths/gaps of the traces (30 µm) and integrate passive circuits into RF packages.

Mark Walmsley of Micross Components gave a talk on **Enhancing Bottom Terminated Components for use in harsh environments**, which uses solder or solder clad copper balls/pillars to improve reliability to CTE mismatch by increasing stand-off between the packaged device and circuit board. The technique also reduces the possibility of gold embrittlement in the solder joint and holds the solder into the solder fillet for pads which are not resist defined. A wide range of package types can be adapted using this process.

Design, Manufacturing and Processes

Piers Tremlett of Microchip Technology Inc presented a talk on **Origami for Tight Spaces - 3D 250°C PCB Assemblies for Control Systems**, which summarised the results from an Innovate UK project called NEMICA, that aimed to develop a control system for a jet engine fuel valve actuator operating at 175°C and a 300°C MEMS based non-volatile memory. The work demonstrated a better design solution for high temp electronics, with lower NRE, faster manufacturing and more shape flexibility.

Callum Middleton of the Compound Semiconductor Applications Catapult described **Heat Spreading in High Power Density Electronics**, which reviewed the use of compound semiconductors to allow higher operation temperatures. Effective thermal management can give improvements in device performance and reliability and interfaces are large contributor to temperature increase. The significance of this was illustrated through an example of heat spreading using GaN on diamond devices.

Reliability and Ruggedisation

Juan Bevan of Micross Components presented a talk on **Ruggedisation of a commercial of the shelf plastic moulded QFN for Space through package redesign, electrical test and characterisation of an ASIC for a high frequency application** When ruggedising a commercial package for space applications is it necessary to achieve good thermo-mechanical properties and signal integrity and that the deployment of a comprehensive test strategy is required to ensure the device is appropriately screened and qualified for its intended harsh environment operational use.

Suzanne Costello of MCS described the state of the art in materials failure analysis techniques in a talk on **Advanced Materials Analysis for Microelectronics Reliability in Harsh Environments**, which included a deformation free micro-sectioning technique (entitled MCS Perfect Edge™). This technique can reveal the true nature of failure in micro-electronics components, which are sometimes masked using conventional sectioning and polishing processes

Keith Bryant (Consultant) gave an overview of **Advances in 2D & 3D (CT) X-Ray Inspection for Microelectronics in Harsh Environments**. Equipment developments (for example; True X-Ray Intensity Control and advanced detector technology) have enabled the level of feature recognition to be reduced to <0.5µm, allowing enhanced detection of flaws in micro-electronic components.

The attendees also had the chance to network and interact with the exhibitors during the refreshment and lunch breaks. This conference was very well received and another similar event will be planned in the future.

For further information on forthcoming events, please visit IMAPS-UK (www.imaps.org.uk)