



## **IPower3 Conference Report held at the Advanced Propulsion Centre, University of Warwick on 2<sup>nd</sup> December 2021**

**The IMAPS-UK organised iPower3 Conference on Electronics Packaging for Net Zero presented some of the most significant packaging challenges to be faced by a wide range of electrical and electronic based industries in the next decade. Getting reliable and fully functional products to market will require electronic and electrical packaging solutions that can operate at higher currents and voltages, faster frequencies and increased temperatures.**

The Conference Chair, Martin Wickham (NPL) welcomed participants to this first face-to-face event in 2021 with an introduction to IMAPS-UK. The Sponsor of the conference - Inseto (UK) Ltd and the Exhibitors were thanked for their support.

### **Session 1:**

#### ***Keynote Presentation – @FutureBEV- Enabling Powertrain Technologies for BEV – David Bock – BMW Group***

The keynote presentation from David Bock of BMW Group gave an overview of the drive towards the development of an electric vehicle fleet with over half of BMW Group sales predicted to be EV by 2030. It was emphasised that every gram of CO<sub>2</sub> counts and every improvement in efficiency will have a positive impact over the lifetime of the vehicle. For each 1W saved on a vehicle, for a lifetime of 10,000 operating hours, this is equivalent to a saving of 2.68kg of CO<sub>2</sub>. The @FutureBEV project, being supported by the APC, is focusing on the delivery of SiC switch based 800V inverter solutions for BMW, implementing higher levels of integration with cooling systems and interfaces co-designed and power transmission with reduced cables and EMI, whilst considering sustainability and end of life recycling.

#### ***GaNSiC – Direct Dispensing and High and Low Pressure Silver Sinter Materials - John Boston – Custom Interconnect Ltd***

John Boston of Custom Interconnect Ltd explored the issues concerned with the dispensing of silver sinter material for the assembly of wide bandgap semiconductors (GaN and SiC) for power electronics applications. Precise control of the dispense process is required and planarity of the assembled devices is key in achieving high reliability. Modern assembly and inspection equipment assists in the consistent production of components, especially Scanning Acoustic Microscopy which can reveal defects not picked up by other inspection techniques. Demonstration of performance in thermal shock testing remains one of the critical challenges to overcome.

### **Session 2:**

#### ***“Light Bulb Moments” in Packaging of Compound Semiconductors – Geoff Haynes - RAM Innovations***

Geoff Haynes of RAM Innovations explained the significance of packaging for wide bandgap power module performance development, where faster switching speeds meant that inductance and other parasitic effects became more important. He demonstrated that the capability to embed such chips in an embedded form of package will have both cost and performance advantages. An example of a GaN based power amplifier was detailed. Further developments showed the aspects of adapting the package technology to design self-contained switching cells, which enables control of EMI and creating building blocks which can be scaled to operate at high currents.

***Use of High Accuracy Low Force SIP Technology Developments for Power Devices – Simon Broadhurst, Kulicke and Soffa***

Simon Broadhurst from Kulicke and Soffa outlined the growth in demand for Electric Vehicles, which had stimulated demand for new power electronics assembly equipment. In the power module assembly sector significant growth was reported, but was not high enough to justify dedicated equipment design. Kulicke and Soffa has developed in hybrid pick and place equipment with wafer feeding, including enhancements such as unique pocket identification, low force nozzles for thinned die, placement force control and configuration flexibility to address the power module assembly field.

**Session 3:**

***Packaging and Assembly Trends for Next Generation Power Modules – Huub Claassen – Boschman Technologies***

Huub Claassen of Boschman described the multiple interconnection options for the assembly of power modules using sintering technology, including: die attach, topside attach to eliminate wire bonding), package attach and wafer lamination. The application of pressure during sintering was demonstrated to improve the mechanical reliability of die attach joints and dynamic inserts had been developed to enable consistent force to be applied for multi-die assembly. Boschman is also investigating advanced transfer moulding of epoxy materials to produce complex power modules.

***Recent Progress on Copper Sintering for High Power Semiconductor Packaging – Yangang Wang – Dynex Semiconductor***

Yangang Wang of Dynex Semiconductors compared the relative merits and limitations of silver and copper sintering in the assembly of semiconductor power modules. Copper sintering is attractive due to lower costs and better resistance to electro-migration to silver, but a copper or nickel metallisation is recommended for compatibility and processing in an inert or reducing (formic acid) environment is required to avoid oxidation. Promising results had been obtained for die, clip and busbar attach.

**Session 4:**

***Addressing the Needs for EV Design, New Packaging Solutions and Future Challenges – Nikola Kontic, Zuken***

Nikola Kontic of Zuken presented details of software design tools for traditional electronics and explained that power electronics design elements are not well supported at present. Zuken are now developing additional capabilities to reflect the needs of power electronics module design including replacing wire bonds with ribbons and clips and accounting for clearances for high voltage operation. The improved transfer of information to analysis tools such as Ansys was also described.

***Immersion Cooled Power Electronics to Support Net-Zero Transformation – Craig Britton, Supply Design***

Craig Britton of Supply Design described the attributes of liquid cooling for power electronics including reduction of cooling operating and capital costs, an increase in computing power density and product lifetime and energy re-use of the warm coolant. Immersion cooling means that the electronics need to operate in wet conditions and coolants can degrade components such as electrolytic capacitors, with a sealed volume and air pocket for liquid thermal expansion.

***Leadframe Design and Trim/Form Solutions for High Performance Power Modules – Mark Kenny, Rydon Technology***

Mark Kenny of Rydon Technology built upon the assembly processes described by Boschman to focus on the leadframe design for the power module and explore the trimming and forming operations required to

produce the final manufactured product. Rapid prototype tooling and engineering design is available through Trim Form Automation Europe BV (TFA) to support sample and production needs.

### **Exhibitors**

The following organisations exhibited at the Conference:

[Accelonix](#) – Specialist equipment sales and support for Microelectronics, Battery and PCB Assembly

[Alter Technology](#) - Leading provider of micro and optoelectronics services in engineering, procurement, assembly and test in space and harsh environment markets.

[Boschman](#) - Is the one stop shop for highly innovative packaging solutions.

[Carl Zeiss Ltd](#) - Materials characterisation and failure analysis equipment

[Custom Interconnect Ltd](#) - Electronics manufacturing, advanced technologies, design services, power electronics for BEVs/PHEVs, box build and rapid prototypes

[Gen3](#) - Specialist British manufacturer and distributor of test and measurement equipment

[Heraeus Electronics](#) - Materials for power electronics assembly and packaging

[Inseto \(UK\) Ltd](#) - Manufacturing equipment, assembly materials and adhesives

[IPP Group Ltd](#) - Is a technical distributor of manufacturing equipment and consumables to the electronics, pharmaceutical and medical device sectors

[Zuken](#) - Global software company offering advanced design solutions for the creation of electrical and electronic systems

For further information on forthcoming events, please visit the IMAPS-UK website ([www.imaps.org.uk](http://www.imaps.org.uk))