

Making Reliable High Temperature Electronics

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Abstract: Today's most challenging applications of electronics technology require operation in the harshest of environments. Electronics have left the desktop and air conditioned computer room to enter environments ranging from the deepest ocean depths to the vastness of space. Applications as diverse as avionics/planetary exploration (Venus surface at 460°C), oil and gas exploration ($T > 150^{\circ}\text{C}$), and underhood automotive propulsion ($T > 165^{\circ}\text{C}$) require new materials and mechanical design solutions that address thermal management, stress management, fatigue resistance, corrosion resistance, durability, reliability, maintainability, and sustainability at these high temperatures and over wide temperature range cycles. In addition, temperatures are rising for many power electronic system as well, with the combination of higher power density modules and the availability of high temperature stable semiconductor devices. This presentation will discuss the latest work going on at CALCE in the areas of wide bandgap semiconductor reliability, high temperature interconnection including copper wire bonding, lead-free attach material synthesis, 3D integrated thermal packaging, and advanced manufacturing of power electronics – all focused on extending the temperature ranges over which electronics can operate reliably. It will also look forward to provide a view of future development in this field and the impacts of that development.

Presenter: Dr. McCluskey is a Professor of Mechanical Engineering in the CALCE center where he has published extensively in the area of packaging and reliability of electronics and microsystems for high power and extreme environments, including editing/co-editing three books and authoring over 150 technical articles and book chapters. He has served as technical program chairman for conferences in these research areas and has consulted for international electronics companies. He is a fellow of IMAPS and a senior member of IEEE. If you are interested in further information on this topic, please email Dr. McCluskey.

