

Enhancing Microelectronics Reliability Through Comprehensive Outgassing Testing

Jayeshkumar Das
Oneida Research Services, Inc.
JDas@orslabs.com

Outgassing testing is essential in the microelectronics industry to ensure the reliability and performance of components, particularly in high vacuum environments. Oneida Research Services (ORS) has developed a wide range of capabilities to support outgassing testing, which serves as a powerful tool in both product design and failure analysis of hermetic packages. This presentation focuses on four unique techniques and discusses case studies for each.

ASTM E595 testing evaluates materials for total mass loss and volatile condensable materials, ensuring compliance with stringent standards for space and high vacuum applications. Thermogravimetric Analysis coupled with Mass Spectrometry (TGA-MS) provides detailed insights into the thermal stability and decomposition of materials, identifying potential outgassing issues along with weight loss usually associated with chemical and physical changes when materials are exposed to elevated temperatures.

In addition to these commercially available techniques, ORS has developed two exclusive outgassing methods: the Ultra-High Vacuum Evolved Gas Analyzer (UHV-EGA) and the ampoule study. The UHV-EGA identifies gases released from materials under high vacuum conditions at elevated temperatures, helping to detect contaminants that could compromise device functionality. This technique provides outgassing profiles with respect to sample temperature, making it ideal for simulating processes such as the baking and curing of adhesives. The ampoule study assesses the outgassing behavior of materials in sealed environments. Materials sealed in ampoules can be exposed to specific temperatures, and the resultant outgassing is analyzed using traditional internal gas analysis (IGA) and GC-MS to identify inorganic and organic gas species that may have outgassed from the material.

Each case study will highlight the strengths and limitations of these techniques.