

Categorization, Developments, and Selection for Thermal Interface Materials

Abstract

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Introduction and Outline

This presentation will include these topics:

- A categorization methodology for thermal interface materials (TIMs) that is standardized for the thermal materials industry, with a number of very recent TIM developments identified by type and category. There are thousands of TIM materials offered by manufacturers and resellers and understanding how the major categories are identified – and specific performance characteristics and intended function – is important to creating a short selection menu for evaluation.
- Identification of specific functional areas within the broad TIM range, followed by separating out polymers, graphitic, and metallic materials. Certain categories of TIMs have been designed to meet specific functional requirements and are not appropriate for all applications.
- Description of very recent developments in hybrid liquid metal formulations, metallic pastes and gallium-containing materials, phase-change metal alloys, graphene-enhanced graphitic TIM types, and liquid metal encapsulated polymeric TIM types that are either currently in late-stage development or which have been very recently released to production.

Thermal interface materials are available from hundreds of vendors and in thousands of different P/Ns, creating a challenging test, evaluation, and selection procedure. This tutorial is intended to address these facets with an organized approach.

Developments continue at a rapid pace for a variety of different and innovative thermal interface materials that are designed specifically for specific semiconductor application types, semiconductor test, and primarily for power semiconductors.

This abstract is intended to be complementary to a second technical session presentation on TIM testing methodologies and the uses of thermal test vehicles (TTVs), comparing the functions and purpose for each type of test methodology and commercially-available equipment.

Dave Saums, Principal, DS&A LLC:

Dave has forty-five years' experience in many aspects of electronics thermal management, for manufacturers and developers of military/aerospace high-reliability precision fans, high-volume heat sinks and liquid cold plates, advanced thermal interface materials, CTE-matched rigid thermal materials and substrates, and two-phase pumped dielectric liquid cooling systems. Dave operates a full-time consulting business addressing these products and markets, working with vendors, test equipment manufacturers, and system OEMs.

Dave has previously conducted a tutorials and given technical session presentations on a variety of thermal management topics, including TIMs, rigid CTE-matched composites and thermal materials, pumped two-phase dielectric liquid cooling for electronic systems, and fluids used for liquid immersion and for two-phase systems.

He has served as general chair for an electronics thermal management workshop in California and Washington for twenty-three years, chaired four thermal management workshops in Germany and The Netherlands, given tutorials at vehicle electrification conferences and at universities in Asia, The Netherlands, and the US, and is a member of the board of directors and the technical committee for SEMI-THERM Educational Foundation, Inc.