TTC/TTV for thermal characterization of materials

The thermal performance of materials is not only affected by thermal conductivity, but also by the interfacial thermal resistance (a very important factor for advanced packaging & heterogeneous integration with an ever increasing number of interfaces).

Thermal test vehicles (TTV), based on Thermal Test Chips (TTC), are a very important tool for characterization & evaluation of a broad range of materials for thermal management:

- Thermal interface materials (polymeric; inorganic; metallic – including liquid metal, PCM, …)
- Die attach (films; adhesives)
- Sintered nano-Ag/Cu
- Diamond, CNT, graphene, graphite, and composites, …

While various TTVs exist (including those using ceramic heaters, Cu heaters, discrete components in an array with a heat spreader, etc.), ***TTC-based TTVs*** have tremendous advantages.

- Real chip in a real package – closely emulating the actual environment
- Chips in any size (1x1mm to >50x50mm)
- Uniform or non-uniform heating – with any number of hot spots (as small as 1x1mm)
- Power density exceeds requirements for HPC and AI chips
- In-situ TSD (temperature sensing diode), smaller than 100um, in every 1x1mm area – *very different from RTD*
- Meets JEDEC JESD51-4a Standard
- Can be packaged in various formats – wire bonding, flip chip on board, LGA, BGA, …, single or multiple chip – to emulate the actual application
- Can easily integrate with various thermal management solutions
- Can interface with commonly available instrumentation

In a configuration that closely emulates the actual application environment, the performance of the materials can be characterized.

- Thermal performance (including the effects of interfacial thermal resistance) at various power levels
- How actual conditions (warpage, BLT, incomplete coverage, voiding, ...) can affect thermal performance
- How reliability testing (thermal shock / power cycling) can affect thermal performance

More info at www.thermengr.net