Cheng-Ying Lee et al., J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C2-095

Fabrication of high thermal conductive diamond/copper composites and their joining with substrates

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Diamond/Cu composites for the use of heat spreader were fabricated *via* pressureless liquid phase sintering process. Minor-addition of Zr was added into the matrix to improve the wettability between diamonds and Cu matrix. A high thermal conductivity of 716 W/m·K was obtained for the 50 vol% diamond/Cu composite. Composites fabricated by Cu/Zr flake method can reduce the surface roughness from 35 μm to 1.6 μm, which is suitable for joining with commercial substrates. AlN, Si, and Al_2O_3 substrates were joined with composites by commercial lead-free solder paste and liquid metal. Liquid metal joined packages had great performance opposite to the solder pasted ones with the highest thermal conductivity of 342 W/m·K in the couple of the Si substrate. For AlN, Si and Al_2O_3 substrate joined packages, average thermal conductivity were 299, 322 and 148 W/m·K, respectively. On the reliability of thermal cycle tests for joining packages, the lower thermal cycle (25-85 °C) was to simulate the operating environment and the higher thermal cycle (25-200°C) for fabricating environment. It showed great reliability with above 78% residue thermal conductivity after lower temperature 1000 thermal cycles and 79% after higher temperature 5 thermal cycles.

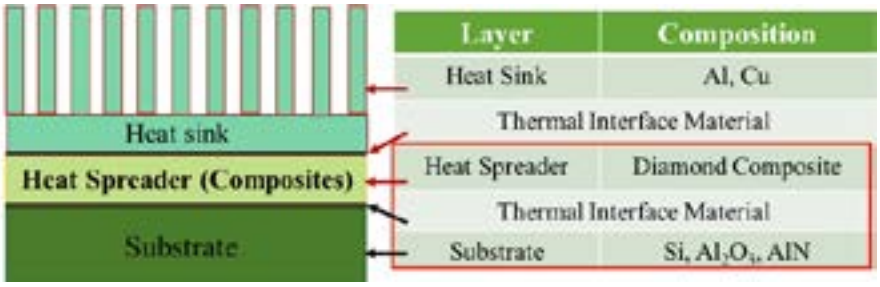

Figure 1: Illustration of electronic packaging

Biography

Cheng-Ying Lee majors in materials science engineering at National Tsing Hua University and specializes in thermal management. At the early stage of her research work was raising the thermal conductivity of Diamond/Cu Composites as heat spreader. In recent days, she focuses developing using low melting point alloy as thermal interface material to increase thermal transfer efficiency. She expects her research result will be more competitive than current commercial products.

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