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Insights: Publications

High performance no-flow underfills for low-cost flip-chip applications: material characterization

IEEE Transactions on Components, Packaging, and Manufacturing Technology: Part A, 21, 3, 450-458

SEPTEMBER 1, 1998 Written by

Underfill encapsulant is critical to the reliability of the flip-chip solder joint interconnects. Novel no-flow underfill encapsulant is an attractive flip-chip encapsulant due to the simplification of the no-flow underfilling process. To develop the no-flow underfill material suitable for the no-flow underfilling process of flip-chip solder joint interconnects, we have studied and developed a series of metal chelate latent catalysts for the no-flow underfill formulation. The latent catalyst has minimal reaction with the epoxy resin (cycloaliphatic type epoxy) and the crosslinker (or hardener) at the low temperature (<180/spl deg/C) prior to the solder reflow and then rapid reaction takes place to form the low-cost high performance underfills. The effects of the concentration of the hardener and catalyst on the curing profile and physical properties of the cured formulations were studied. The kinetics and exothermic heat of the curing reactions of these formulations were investigated by differential scanning calorimetry (DSC). Glass transition temperature (T/sub g/) and thermal coefficient of expansion (TCE) of these cured resins were investigated by thermo-mechanical analyzer (TMA). Storage moduli (E',E") and crosslinking density of the cured formulations were measured by dynamic-mechanical analyzer (TMA). Weight loss of these formulations during curing was investigated by thermo-gravimetric analyzer (TGA). Additionally, some comparison results of our successful novel generic underfills with the current commercial experimental no-flow underfills are reported.