

Mechanical properties of AuGe die-attach solder for electronic applications

Sophie Ryelandt^(a), Audrey Favache^(a), Benoît Dompierre^(b), Arnaud François^(b), Aude Simar^(a)

^(a) Université catholique de Louvain, Institute of Mechanics, Materials and Civil Engineering, IMAP, Place Ste Barbe, 2, B1348 Louvain-la-Neuve, Belgium

^(b) Cenaero ASBL, Metallic Structures and Processes Team, Bâtiment Eole, Rue des Frères Wright, 29, B6041 Gosselies, Belgium

sophie.ryelandt@uclouvain.be

Reliability of electronics modules in high power environment is a key issue, as they are submitted to extreme thermal and power cycling conditions. One of the weak points of the electronic device is the joint between the substrate and the die, i.e. the die-attach. In addition to mechanically attaching the die to the substrate, the die-attach material also conducts the heat away from the base of the die and provides for electrical grounding. Subjected to power cycling, the module infers thermal cycles to the die-attach, giving rise to creep and fatigue strains. Therefore, besides the need of good thermal and electrical conductivities, controlling the microstructure and interfacial reactions of the joining material, as well as its thermo-mechanical properties is of utmost importance. Among various materials, eutectic AuGe is attractive as high temperature solder because of its good wettability and bonding strength with typical substrate materials. The microstructure, intermetallic layer and voiding volume fraction are characterized by scanning electron microscopy and ultra-sound scattering. Elasto-viscoplastic properties of the alloy are studied by nanoindentation between room temperature and 250°C. A FEM model, incorporating the elasto-viscoplastic law defined by the nanoindentation tests, gives good correlation with the results obtained on macroscopic shear tests.