

Tensile and Creep Characteristics of Sputtered Gold-Tin Eutectic Solder Film Evaluated by XRD Tensile Testing

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In this paper, we describe the elastic-inelastic mechanical property measurements of a gold-tin (Au-Sn) eutectic solder film. Dual-source direct-current (dc) magnetron sputtering was employed to deposit a Au-20 weight % (wt.%) Sn film. A uniaxial tensile test with *in situ* X-ray diffraction (XRD) analysis was performed at temperatures ranging from room temperature (RT) to 373 K. The XRD tensile test enabled us to directly measure out-of-plane strain in the Au-Sn film specimen for Poisson's ratio determination. The mean Young's modulus and Poisson's ratio at RT were found to be 51.3 GPa and 0.288, respectively, which were lower than the bulk values. The Young's modulus decreased with an increase in temperature, whereas the Poisson's ratio showed no change with temperature. In addition, a creep test was carried out at various stresses and temperatures. The steady-state creep deformation behavior could be estimated on the basis of Norton's law. Information on the tensile and creep characteristics would be useful in designing Au-Sn-film-bonded microjoints used in micro-electromechanical systems (MEMS).

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