Creep Behavior of Eutectic Sn-Cu Lead-Free Solder Alloy*

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Due to a typographical error incorporated during the editing process, the following is a correction of that error.

Tensile creep behavior of precipitation-strengthened tin-based eutectic Sn-0.7Cu alloy was investigated at three temperatures ranging from 303 to 393 K. The steady-state creep rates cover six orders of magnitude (10^{-3} s^{-1} to 10^{-8} s^{-1}) under the stress range of $\sigma/E = 10^{-4}$ to 10^{-3} . The initial microstructure reveals that intermetallic compound Cu_6Sn_5 is finely dispersed in the matrix of β -Sn. By incorporating a threshold stress, σ_{th} , into the analysis, the creep data of eutectic Sn-Cu at all temperatures can be fitted by a single straight line with a slope of 7 after normalizing the steady-state creep rate and the effective stress, indicating that the creep rates are controlled by the dislocation pipe diffusion in tin matrix. So the steady-state creep rate, $\dot{\epsilon}$, can be expressed as $\dot{\epsilon} = A \frac{Gb}{RT} \left(\frac{\sigma - \sigma_{\text{th}}}{G} \right)^7 \exp \left(\frac{-Q_C}{RT} \right)$, where Q_C is the active energy for creep, G is the temperature-dependent shear modulus, b is the Burgers vector, R is the universal gas constant, T is the temperature, σ is the applied stress, A is a material-dependent constant, and $\sigma_{\text{th}} = \sigma_{\text{OB}} \sqrt{1 - k_R^2}$, in which σ_{OB} is the Orowan bowing stress and k_R is the relaxation factor.

Key words: Creep, eutectic Sn-Cu, lead-free solder alloy, precipitation strengthening, activation energy

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