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Deformation of Solder Joints Under Current Stressing: Experimental Measurement and Numerical Simulation

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In this paper, the in-situ displacements evolutions of lead-free solder joints under electric current stressing are measured with Moire Interferometry technique. Large deformation was observed in solder joint under high density current stressing. The deformations are due to electromigration in the solder joints. An electromigration constitutive model is applied to simulate deformations of the lead-free solder joints under current stressing. The simulations predict reasonably close displacement results to Moire Interferometry experimental results in both spatial distributions and time history evolutions. This indicates that this electromigration model is reasonably good at predicting the mechanical behavior of lead-free solder alloy under electric current stressing. Both the experimental observations and finite element simulation results indicate that, in addition to the current density level, the current density distribution within the solder joint has a great effect on the displacement development in the solder joint under current stressing.

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