

# Temperature-dependent fatigue modeling of a novel Ni, Bi, Sb containing Sn-3.8Ag-0.7Cu lead-free solder alloy

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## Abstract

Low-cycle fatigue testing of a lead-free solder (InnoLot) based on Sn-3.8Ag-0.7Cu (SAC387) with three simultaneous additions of bismuth, nickel and antimony was conducted using miniature-sized fatigue specimens at different temperatures and strain amplitudes. The experiments show a decline of the load capacity of the solder alloy with the number of loading cycles. The fatigue life of the solder is also decreased by the level of imposed temperature. The modified Coffin-Manson and Morrow models were used to analyze the behavior under fatigue and predict lifetime. The parameters in the two fatigue models which were determined by considering different temperatures and total strain amplitudes. Compared to other reference lead-free solders, the InnoLot solder shows much better fatigue strength. The better fatigue strength is found to result from the effect of BiNiSb elements. Also, lifetime predictions were made with both models for the solder alloy under different conditions.

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