Dislocation density-based modeling of a lead-free solder under different strain rates

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Résumé

In this work a dislocation density-based model is used to describe viscoplastic behavior of lead-free solder alloy containing small additions. This micromechanical model can predict dislocation densities and grain sizes evolutions during loading. The model assumes the dislocation densities as a sum of cell interior dislocation density and wall dislocation density. The latter is a superposition of statistical dislocation density and geometrically necessary dislocation. The model has been implemented into the finite element code Abaqus/Explicit throughout a Fortran coded user-defined subroutine and is used to simulate tensile tests of solder alloy specimens under different temperature and strain rates. Good agreement were found between numerical predictions and experimental results.

Mots-Clés: Dislocation density, Viscolplastic behavior, Solder alloy, Finite element implementation

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