

Experimental and Numerical Investigation on Deformation Behaviour of Single Crystal Copper

Authors : Suman Paik, P. V. Durgaprasad, Bijan K. Dutta

Abstract : A study combining experimental and numerical investigation on the deformation behaviour of single crystals of copper is presented in this paper. Cylindrical samples were cut in specific orientations from high purity copper single crystal and subjected to uniaxial compression loading at quasi-static strain rate. The stress-strain curves along two different crystallographic orientations were then extracted. In order to study and compare the deformation responses, a single crystal plasticity model incorporating non-Schmid effects was developed assuming cross-slip plays an important role in orientation of the material. By making use of crystal plasticity finite element method, the model was applied to investigate the orientation dependence of the stress-strain behaviour of two crystallographic orientations. Finally, details of slip activities of deformed crystals were investigated by linking the orientation of slip lines with the theoretical traces of possible crystallographic planes. The experimentally determined active slip modes were matched with those determined by simulations.

Keywords : crystal plasticity, modelling, non-Schmid effects, finite elements, finite strain

Conference Title : ICMMPD 2019 : International Conference on Mechanical Metallurgy and Plastic Deformation

Conference Location : Venice, Italy

Conference Dates : November 12-13, 2019