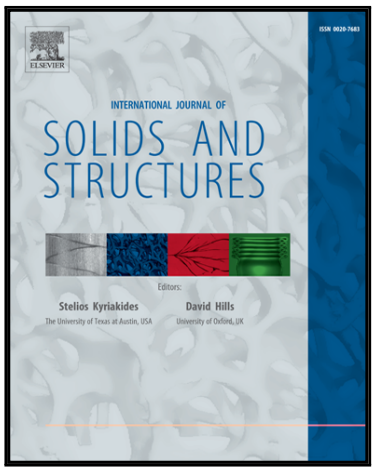

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Modeling the effect of strain reversal on grain refinement and crystallographic texture during simple shear extrusion

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Abstract:

This paper is concerned with the modeling of the effect of strain reversal on crystallographic texture and microstructure evolution in simple shear extrusion (SSE) processing of commercial purity copper. To reach this goal, the evolution of microstructure is predicted by a dislocation density-based constitutive model in which the effect of strain reversal is considered. This dislocation-based model is embedded in a crystal plasticity finite element (CPFE) model. In FE models, a representative volume element of the polycrystal at the central region of the billet is subjected to deformation history experienced by the SSE process with backpressure. By comparison the predicted crystallographic texture with the published data, it is concluded that the CPFEM well predicts a simple shear texture after a complete pass. The predicted results show 5-10 percent increase in the rate of dynamic recovery of the second half of deformation zone in comparison with the first half. The modified dislocation-based model predicts that the cell size of a complete pass is more than that of 0.5 pass sample as much as 27 percent.

Keywords: Simple shear extrusion (SSE), Crystallographic texture, Dislocation density, Strain reversal, Crystal plasticity, Finite element

1. Introduction

Severe plastic deformation (SPD techniques can be used to modify the microstructure and crystallographic textures. Using these processes, the refinement of microstructure occurs and the grains with micrometer scale refines to a few hundred nanometers. The microstructural changes during SPD techniques can improve mechanical and functional properties [1-3]. Grain refinement by SPD is a result of the evolution of subgrains (or dislocation cells) to refined grains [4]; hence the dislocations cell can be considered as the basic aspect of microstructure to study the effect of SPD processes on grain refinement. Considerable distortion of the crystals in the

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