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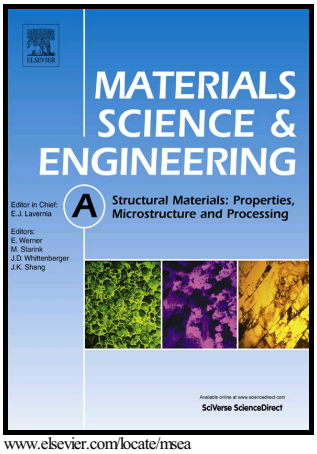

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Effect of pure shear strain on mechanical properties and microstructural evolution

Farhad Rahimi [1], Ali Reza Eivani [1, *], Hamid Reza Jafarian [1], Tilak Bhattacharjee [2]

[1] School of Metallurgy and Materials Engineering, Iran University of Science and Technology (IUST), Tehran, Iran

[2] Department of Materials Science and Engineering, Kyoto University, Kyoto, Japan

Abstract

Strain mode in severe plastic deformation can affect microstructural evolution and mechanical properties of the deformed samples. In the present study, the effect of pure shear deformation on the mechanical properties and microstructural evolution during one cycle of pure shear extrusion (PSE) is investigated. It is observed that imposing pure shear strain via PSE can result in significant grain refinement. Moreover, the mechanical properties of the PSEed sample in terms of hardness and tensile properties are modified. In addition, a grain refinement gradient is also observed from center toward periphery. Finite element analysis is performed to predict the strain distribution pattern during processing and evaluate the homogeneity of deformation. Experimental verification in terms of pressing load and hardness distribution are used to validate the integrity and accuracy of the simulation.

Keywords: grain refinement, pure shear, finite element analysis, severe plastic deformation.

1. Introduction

Nanostructured (NS) and ultrafine-grained (UFG) materials are subjected to lots of scientific research activities due to their superior physical and mechanical properties, among which,

* Corresponding author; Email: aeivani@iust.ac.ir , Tel: +98 (0) 21 77 240 540, Fax: +98 (0) 21 77 240 480.