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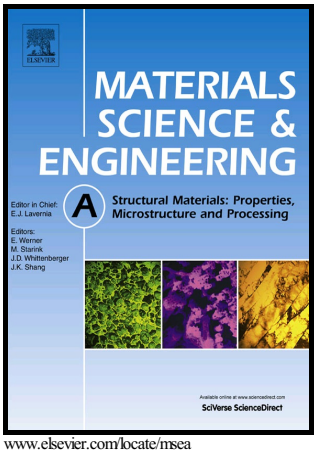

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An investigation of microstructure and mechanical properties during ECAE of commercially pure aluminum

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Abstract:

In the present paper commercially pure Al billets were processed by equal channel angular extrusion (ECAE) up to 8 passes via route B_C at room temperature. Electron back scattered diffraction (EBSD) were used to evaluate the microstructure of the aluminum. Moreover, the mechanical properties of the processed billets were investigated by tensile and hardness tests. The microstructural and microhardness analyses at various locations of the billet thickness, from the top to bottom surfaces, revealed a significant improvement in homogeneity by increasing the number of passes. It was also found that the yield strength and average microhardness of aluminum is increased significantly up to four passes and then it is decreased when more passes are applied.

Keywords: ECAE; Aluminum; UFG; Homogeneity; Grain refinement.

1. Introduction:

Ultrafine grain (UFG) or submicron grain materials processed by severe plastic deformation (SPD) methods has been the subject of intense study in the last decade [1-4]. Although, in general the SPD produces larger grain sizes than those of the most of other techniques of nanomicrostructure generation, but it has some advantages. It is possible to obtain bulk samples without residual porosity, which facilitates mechanical testing. Also, UFG microstructure generated by severe deformation is relatively stable, which is not always the case for nanocrystalline materials [5]. Among all SPD techniques, the equal channel angular extrusion (ECAE) has the opportunity of producing of large samples and the potential for commercialization [6-8]. This process first invented by Segal et al. [9] to achieve high strains and later Valiev et al. [10] developed this method to fabricate materials with superior

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