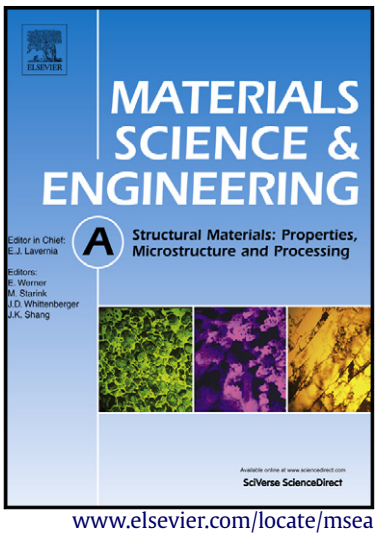

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Microstructure evolution and mechanical properties of pure aluminum deformed by equal channel angular pressing and direct extrusion in one step through an integrated die

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Abstract

In this paper, billets of Al-1080 were successfully processed by ECAP up to 1 pass, and a combination of ECAP + extrusion with extrusion ratios of 2 and 8 through a newly designed integrated die at room temperature. The combination of ECAP + extrusion processes were observed to produce finer grain sizes with greater fractions of high angle grain boundaries (HAGBs) than the ECAP. The average grain size was further decrease and the fraction of high angle grain boundaries (HAGBs) was increase with the increase of the extrusion ratio. Direct extrusion after ECAP enhanced the mechanical properties (tensile strength and hardness) with conserving reasonable degree of ductility (elongation %). ECAP and ECAP + extrusion processed samples, showing large dimple size in the tensile fracture surfaces with clear ductile fracture mode.

Keywords: Equal channel angular pressing, Aluminium , Extrusion, Evolution of microstructure, Microhardness, Tensile properties, Fracture surface mode and morphology.

1. Introduction

METALLIC materials with fine and ultrafine grains have received much attention in the past two decades because of their unique mechanical and physical properties and high performance. Severe plastic deformation (SPD) is one of the most promising techniques of grain refinement processes. Equal channel angular pressing (ECAP) and high pressure torsion (HPT) are two of the most widely