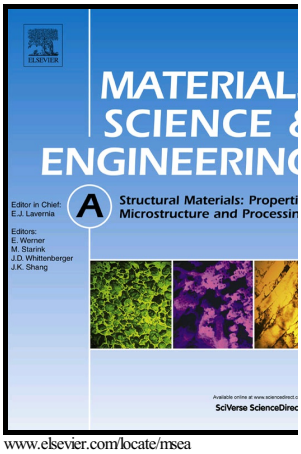
Feasibility of attaining uniform grain structure and enhanced ductility in aluminum alloy by employing a beveled punch in Equal-channel angular pressing

Omid Nejadseyfi, Ali Shokuhfar, Seyedali Sadeghi, Amirreza Dabiri



www.elsevier.com/locate/msea

PII: S0921-5093(15)30296-3
DOI: http://dx.doi.org/10.1016/j.msea.2015.08.050
Reference: MSA32684

To appear in: *Materials Science & Engineering A*

Received date: 11 April 2015
Revised date: 14 June 2015
Accepted date: 14 August 2015

Cite this article as: Omid Nejadseyfi, Ali Shokuhfar, Seyedali Sadeghi and Amirreza Dabiri, Feasibility of attaining uniform grain structure and enhanced ductility in aluminum alloy by employing a beveled punch in Equal-channel angular pressing, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2015.08.050

Feasibility of attaining uniform grain structure and enhanced ductility in aluminum alloy by employing a beveled punch in equal-channel angular pressing

Omid Nejadseyfi[a,*], Ali Shokuhfar[a], Seyedali Sadeghi[b], Amirreza Dabiri[c]

[a] Advanced Materials and Nanotechnology Research Lab, Department of Mechanical Engineering, K.N. Toosi University of Technology, Tehran, Iran.

[b] Department of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran

[c] Abadan Faculty of Petroleum Engineering, Petroleum University of Technology, Abadan, Iran

Abstract

The advantages of using a beveled-edge punch in equal-channel angular pressing are investigated. Lambda angle (λ), the clockwise angle between the theoretical shear plane and punch/billet interface, is used to demonstrate how the punch tip is inclined. Transmission electron microscope is used to assess the microstructure of the samples processed using a beveled-edge punch. In addition, tensile tests at elevated temperature are performed. The results show that using a beveled-edge punch (λ=90°) in the process leads to formation of uniform subgrain structure and increases the tensile ductility for the samples at elevated temperature. In addition, finite element simulations are performed to study the correlation between measured properties and mechanism of material deformation by employing a beveled-edge punch. Numerical simulations confirm the irregular deformation in case of λ=0° and uniform strain distribution for λ=90°, which were the main reasons of variation in mechanical properties.

Keywords: Equal-channel angular pressing; Finite element; Fracture surface; Grain size; Lambda angle; Thermo-mechanical behavior.