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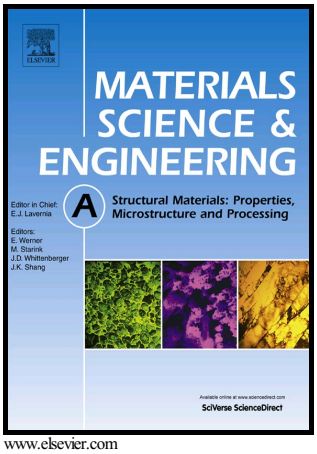

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PII: S0921-5093(15)30477-9
DOI: http://dx.doi.org/10.1016/j.msea.2015.10.014
Reference: MSA32865

To appear in: *Materials Science & Engineering A*

Received date: 15 July 2015
Revised date: 3 October 2015
Accepted date: 5 October 2015

Cite this article as: M. Ebrahimi, H. Gholipour and F. Djavanroodi, A study or the capability of equal channel forward extrusion process, *Materials Science & Engineering A,* http://dx.doi.org/10.1016/j.msea.2015.10.014

A study on the capability of equal channel forward extrusion process

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Abstract

Equal channel forward extrusion process as a severe plastic deformation method has been experimentally and numerically investigated on the 6082 aluminum alloy. Ultrafine grain structure with the average grain size of 465 nm after the fourth pass indicated a considerable improvement of the tensile strength and hardness values. The samples hardness measurements showed higher hardness values in the region close to the longitudinal edges than that of the transversal edges. The numerical results also showed a similar trend in which these regions experience higher amount of plastic strain during the process. The tensile strength and the toughness of the aluminum sample showed a rapid increase after the first pass followed by a gradual increase up to the third pass and slight decrease at the final pass. Furthermore, the impact test results denoted that material with the high strength and brittle characteristic is obtained after the final pass as compared to the initial condition. Moreover, XRD analyses revealed the intense reduction of the crystallite size and increment of the lattice micro-strain. Finally, the numerical outputs showed an imposed effective strain of 0.93 with the standard deviation of 0.36 after the first ECFE pass number.

Keywords: Severe plastic deformation; Equal channel forward extrusion; Mechanical properties; Impact behavior; Microstructural characterization; Finite element analysis

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