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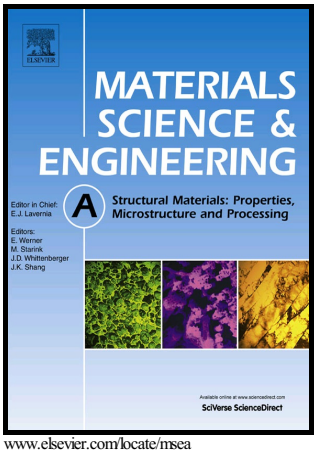

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Microstructure and mechanical properties of ultrafine-grained aluminum consolidated by high-pressure torsion

Mohammad Khajouei Nezhad[a], Mohammad Hossein Paydar[a*], Ramin Ebrahimi[a], Péter Jenei[b], Péter Nagy[b], Jenő Gubicza[b]

[a]Department of Materials Science and Engineering, School of Engineering, Shiraz University, Iran

[b]Department of Materials Physics, Eötvös Loránd University, Budapest, P.O.B. 32, H-1518, Hungary

[*]Corresponding author. Tel/fax: +98 713 2307293; paaydar@shirazu.ac.ir

Abstract

Coarse-grained aluminum powder with 99.5 wt.% purity was consolidated by high-pressure torsion (HPT) technique at room temperature using a low carbon steel powder holder. In this process, the powder experiences a semi-constrained condition because the internal wall of the powder holder can expand under the load applied during HPT. After 4 turns of HPT a relative density of 99.83% was achieved. The microstructure was characterized by electron backscatter diffraction and X-ray line profile analysis. It was found that the grain size decreased while the dislocation density increased with both increasing the distance from the disk center and the number of HPT turns. The smallest grain size and the maximum dislocation density with the values of 0.41 μm and 6.8×10^{14} m^{-2}, respectively, were achieved at the periphery of the disks processed for 4 turns. Tensile tests showed that the consolidation