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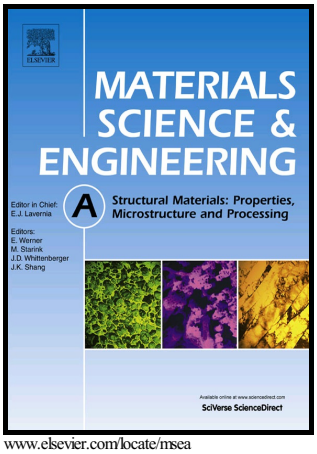

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Influence of multi-channel spiral twist extrusion (MCSTE) processing on structural evolution, crystallographic texture and mechanical properties of AA1100

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Abstract

Recently, several severe plastic deformation (SPD) techniques have been developed with the aim of incorporating grain refinement and strengthening metal forming technology into the industry without dimensional changes. Multi-channel spiral twist extrusion (MCSTE) was innovated and patented in an attempt to provide an effective, cost-saving SPD process that would attract the industrial uptake of the renowned twist extrusion (TE) method. The MCSTE process is based on the use of customized stacked discs that host non-circular cross-sectioned billets extruded through a die with a twist angle (β). Hence, an empirical study was conducted on AA1100 to investigate the influence of 4 successive MCSTE passes on the mechanical behavior and microstructural evolution of the extrudates compared to the as-received (AR) condition. Electron backscatter diffraction (EBSD) was employed for mapping the structural evolution, misorientation angles and the texture developed as a function of the processing passes. Additionally, hardness and tensile properties were evaluated and correlated with the EBSD findings. EBSD analysis revealed the formation of almost equiaxed grains after 1 pass, which were evolved into elongated grains aligned at approximately 45° relative to the extrusion