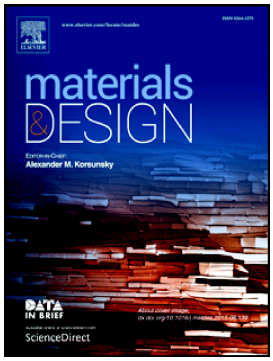

Constrained groove pressing and subsequent annealing of Al-Mn-Si alloy: Microstructure evolutions, crystallographic transformations, mechanical properties, electrical conductivity and corrosion resistance

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Constrained groove pressing and subsequent annealing of Al-Mn-Si alloy: Microstructure evolutions, crystallographic transformations, mechanical properties, electrical conductivity and corrosion resistance

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Abstract

Al-Mn-Si specimens were severe plastic deformed (SPDed) through constrained groove pressing (CGP) by ε_{eff}=1.16, 232, and 3.48. CGPed sheets were subsequently annealed at 150, 250 and 350 °C to investigate complementary treatment route on macro- and microscale properties of heavily strained alloy. Microstructure evolutions in deformed and post-annealed states along with their associated mechanisms such as recovery, recrystallization and strain induced grain boundary migration (SIGBM) were studied and analyzed. SIGBM as an indication for inhomogeneous grain growth was traced by transformations in grains' aspect ratio. Microanalysis of crystallographic characteristics by means of X-ray diffraction (XRD) patterns revealed that (111) planes were the main crystallographic index in CGPed and annealed alloys since preservation up to 350 °C had amplified the (200) and deteriorated the intensity of (311) planes. Dislocation density measurements implied the dynamic recovery occurrence in CGP (ε_{eff}=2.32) which had affected mechanical characteristics, electrical conductivity and corrosion resistance of the utilized alloy. Mechanical properties through tension and hardness tests had been examined since the maximum YS, UTS, and hardness of 118 MPa and 141 MPa, 52 Hv obtained for CGPed specimen (ε_{eff}=3.48) compared with annealed alloy with the values of 85 MPa and 112 MPa, and 29 Hv, respectively.

Keywords: *Constrained groove pressing (CGP); Annealing; Strain induced grain boundary migration (SIGBM); Mechanical properties; Electrical conductivity; Corrosion resistance.*