The Effect of Strain Reversal during High Pressure Torsion on the Evolution of Microstructure and Hardness in Al-2.5wt% Mg alloy

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Abstract

The present work aims to investigate the effect of strain reversal during High Pressure Torsion (HPT) on the evolution of microstructure and hardness properties of Aluminium-Magnesium (Al-2.5%Mg) alloy. For this purpose, Al-2.5%Mg alloy was subjected to monotonically (CW) and strain reversal (CW-CCW) deformation by High Pressure Torsion (HPT). The samples were subjected to a series of rotations in monotonically and strain reversal deformation with same equivalent strains of 1, 4, 12, 24 and 60 under an applied load of 6 GPa and with 1 rpm under quasi-constrained conditions. It was observed that Al-2.5%Mg when subjected to different routes, follows same trend in the evolution of the ultrafine structure, i.e. initial recrystallized microstructure with large grain size throughout the disk, at low strain level sub grains with prominent LAGBs network inside the grains and ultimately at the higher strains ultrafine microstructure throughout the disk characterized by equiaxed grains separated by HAGBs. The only exception to this was observed in case of Al-2.5%Mg during high strains at the centre regions where the fraction of HAGBs was found strikingly less as compared to its counterpart during strain reversal deformation. Hardness homogeneity was not observed for Al-2.5%Mg where the hardness at the centre regions was observed to be lesser than the edge regions with exceptionally less hardness at centre for strain reversal specimens at higher strains.

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