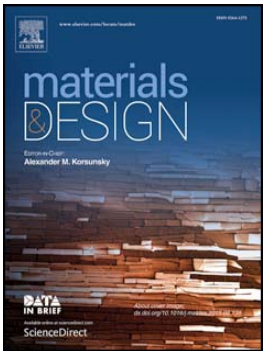

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Mechanism of grain refinement of aluminium alloy in shear spinning under different deviation ratios

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Abstract

To investigate the grain refinement and its mechanism in shear spinning, microstructures of shear spun parts made by aluminium alloy under different deformation conditions, induced by different shear spinning deviation ratios, are studied. The results show that, after shear spinning, the microstructure is distributed symmetrically about a zone in sheet thickness defined as the neutral zone which is located between the inner surface and the middle plane of spun sheet thickness. Various deviation ratios in shear spinning can lead to grain refinement in different regions along thickness direction of the spun part. The microstructure characteristics indicate that the mechanism of grain refinement is due to the formation of deformation bands (DBs). It is observed that in DBs, parallel geometrically necessary boundaries (GNBs) formed by a zero deviation ratio and crossed GNBs formed by positive and negative deviation ratios are due to the different stress states induced by various deviation ratios in shear spinning. Due to the influence of grain refinement, micro hardness increases with the decreasing of the deviation ratio. The average value is increased by 16.04% under a negative deviation ratio compared to the initial micro