Asymmetric Rolling of Aluminum 1050 Alloy Sheet: Improving Formability Properties

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The replacement of steel by aluminum alloys is an actual trend, mainly due their high strain to weight ratio. However, aluminum sheet, produced by rolling, presents a lower formability than steel ones, due to the characteristic anisotropy of rolled face centered cubic (FCC) alloys. Recently it has been shown that the Lankford parameter (*r*) of FCC materials can be improved by the use of shear deformation. Asymmetric rolling (AR), which is a variation conventional rolling process where tangential speeds of the upper and lower roll mils are modified, has been investigated as one of the possible processing methods. In this study we investigated AR at tangential speed ratios of: 2.0 and 1.5, as well as two reductions ratios per pass 10% and 5%. Finite element simulation showed that strain distribution in the samples was heterogeneous and higher shear proportion was imposed on the surface of the samples whereas in the middle a higher proportion of compression in relation to shear was achieved. Experimental reductions were applied until a total of 50% thickness reduction, followed by heat treatment at 350 °C for 05 to 60 minutes. Recrystallization was complete after 5 minutes and after 60 min a homogeneous distribution of equiaxed grains with a mean diameter of 30 μm and hardness of 20HV was achieved. EBSD showed that the intensity of cube orientation diminished with the increment of speed ration and the decrease of reduction ratio per pass. Tensile tests were performed at 0 °, 45 ° and 90 ° in respect to the rolling direction, and planar and normal anisotropies were calculated. The lower planar anisotropy of the AR samples was proportional to the texture intensity.