Microstructural and mechanical characterization of a asymmetric accumulative roll bonded (AARB) of AA1050 aluminum alloy

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All severe plastic deformation (SPD) processes induces a very high yield strength, fatigue life and wear resistance. What distinguishes a particular SPD process from the others is the kind of viscoplastic flow and the deformation path. Thus, those processes that lead to a high level of shear and are characterized by a non - conservative deformation path, will produce a quite random crystallographic distribution and lower anisotropy. Annealing of Al commercial purity (AA1050), which has been processed by equal channel pressing (ECAP) attains better conformability than the same material processed by conventional rolling or ECAP followed by rolling [1]. However, ECAP is poorly suited for producing plate shaped end products, and accumulative roll bonding (ARB) alone induces the same texture as rolling; hence, an alternative can be found in the association of the asymmetric rolling technique to the ARB process, here named AARB (accumulative asymmetric roll bonding) [2]. The deformation was performed in a laboratory rolling mill with different diameters of rolls rotating at the same angular speed. The ratio of the roll diameters was 1.5. The starting material was a fully annealed AA1050 aluminum sheet, 2 mm thickness, which was asymmetric rolled to a initial thickness of 1mm and then annealed at 350oC for 1 h. AARB was performed stacking two sheets and asymmetric rolling to 50 % reduction. This procedure was repeated 4 to 8 times with intermediate annealing treatments at 350 oC for 5 min. The samples were characterized microstructuraly by metallography and electron backscatter diffraction (EBSD) and mechanically by hardness and tensile tests. After 6 passes a homogeneous hardness profile was achieved and the yield strength reached the saturation value. At 8 passes the grains were refined to 1,5 mm, which is the equilibrium size for SPD aluminum. This process yielded shear textures of low intensity.

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