Morphological and textural changes during annealing of fine grained AA1050 aluminum alloy

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Abstract

The main aim of the experiment was to analyze the microstructure and texture changes during recrystallization of commercial AA1050 aluminum alloy. The samples were processed by equal channel angular pressing (ECAP) along route A up to six passes and then annealed for 1 hour at selected temperatures (ranging from 100°C to 350°C) to obtain different states of recrystallization. Studies carried out using scanning electron microscopy equipped with high-resolution electron backscattered diffraction facility (EBSD). An additional analysis was made by means of X-ray diffractometer.

The obtained results showed that at lower annealing temperatures, the material retains ultra-fine grain structure formed by ECAP. At higher annealing temperatures rapid grain growth appears and transformation of flattened grains into nearly equiaxed ones was observed. Particular role in the rise of nuclei (at early stages of recrystallization) was attributed to migration of low-angle boundaries and cells coalescence. Later recrystallization stages were attributed to high-angle grain boundaries migration. These processes led to nearly equiaxed grains. It was documented that the length of traces of low- and high- angle boundaries decrease with increasing temperature of annealing. For lower annealing temperatures, the average values of misorientation angle across both types of grain boundaries increases. However, above the temperature of 270°C the value of misorientation angle across the low-angle boundaries decreases. The {111} pole figures showed in the deformed and partially recrystallized states two, nearly complementarily oriented texture components. At the temperature of 270°C these texture components were changed into other two dominant (also complementarily or twin-related) ones.

Keywords: recovery and recrystallization, AA1050 aluminium alloy, ECAP, SEM/EBSD, microstructure, texture.