

Effect of equal channel angular pressing on yield stress and fatigue properties of Al 6063 alloy

ABSTRACT

The present research investigates the effect of Severe Plastic Deformation (SPD) on the mechanical properties (yield and tensile strength) of Al 6063 alloy along with its fatigue behavior. The severe plastic deformation was carried out by using Equal Channel Angular Pressing (ECAP) technique. This technique was used to refine grains into ultrafine grain size of the metal alloy without changing the cross-sectional dimensions of the work piece. Prior to the ECAP deformation process the material was annealed for 2 h at 415°C. The Al 6063 alloy specimens with 12×12 mm cross section and 100 mm length were machined from these annealed bars. They were pressed at room temperature with a speed rate of 10 mm/min through 120° die channel angle using a 100 KN hydraulic press machine. Molybdenum disulfide was used as lubricant for reducing friction between the work piece and ECAP die. The tensile tests were conducted before and after ECAP at room temperature with a fixed cross head displacement rate 1 mm/min using a hydraulic machine. The Fatigue life was tested under axial loading tension-compression with stress ratio $R = -1$. The results showed a significant improvement in mechanical properties of Al 6063 alloy after ECAP technique. Furthermore, the improvement of the fatigue life in the high-cycle fatigue region was substantial compared with low-cycle fatigue region.

Keyword: Al 6063 alloy; ECAP; Mechanical properties; Tensile test; Fatigue