

Effect of ECAP Die Angle to the Microstructure and mechanical Properties of Bulk Nanostructured Al-6061

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Abstract.

In this study, the effect of die angle on the microstructure and mechanical properties of industrial aluminium alloy AA6061 produced by severe plastic deformation (SPD) through equal channel angular pressing (ECAP) is examined. The objectives of the present investigation are to evaluate the effect of ECAP die angle on the microstructure and mechanical properties of ECAP-ed AA6061. Heat treated AA6061 were divided to three conditions which is non-ECAP, ECAP-ed by 126° channel angle and ECAP-ed by 120° channel angle. The hardness evaluation and microstructural analysis were done on the samples after ECAP. The grain size of all materials was compared by applying the technique of grain size analysis while the hardness of the materials was compared by performing Vickers hardness calculation. From the hardness test, it found that 120° channel angle gives out an increment of hardness by 43.64% while for 126° channel angle the increment hardness is 40.14% compared to non-ECAP AA6061. Microstructural analysis reveals both ECAPed samples have elongated and refined grain size with smaller precipitate particulate compared to non-ECAP sample however no significant difference between the angles were observed. High strain induced during ECAP process increase dislocation in AA6061 and breaking the precipitate thus causing high hardness due to grain refinement. Varying the ECAP die angle may lower the pressure used during pressing without compromising the benefit of ECAP process in producing materials with improved mechanical properties.