

INFLUENCE OF PROCESS ROUTES IN ENHANCING GRAIN REFINEMENT OF AA5052 ALLOY BY EQUAL CHANNEL ANGULAR PRESSING

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ABSTRACT

Severe plastic deformation (SPD), a prominent technology used for transformation of macro grains directly into sub micro and nano level grains. Ultra fine grained materials possess attractive properties like high strength, high toughness and superplasticity which are achieved by one of SPD technique. Equal Channel Angular pressing (ECAP), an attractive method among the various techniques of severe plastic deformation to produce UFG structured material. This process involves introducing a large shear strain in the work piece by passing it through a die, which consists of two channels with the same cross-section that meet at an angle to each other. The present work is aimed to the development of ultrafine grained AA5052 alloy by Equal Channel Angular Pressing process (ECAP). In this experimental investigation, a pre-processed AA5052 aluminium alloy was subjected to ECAP process at room temperature. It has been subjected to two different processing routes such as RBC and RC. The cut samples of AA5052 alloy was subjected to pre-annealing treatment at 420°C for an hour prior to the ECAP process. In order to evaluate the influence of different processing routes, the ECAPed AA5052 alloy was investigated for its enhanced mechanical properties and improved microstructure. The hardness of the ECAPed alloy measuring an improved value than the base alloy, where a maximum value of 120 HV was achieved by route RBC. The tensile test also indicates a strong influence of ECAP process in structural refinement. A maximum tensile strength of 386 MPa was found to be in the processed route RBC. The microstructural evolution of base alloy and ECAP processed alloys were characterized using optical microscope. The optical microstructure reveals a refined equiaxed elongated grains in the processed alloy with an average grain size of 13 μm compared with 25 μm of base AA5052 alloy. The experimental results revealed a significant improvement in grain size refinement, yield tensile strength, ultimate tensile strength and hardness of processed alloy as compared with the base alloy of AA5052 aluminium material.

Keywords: Severe Plastic Deformation, Grain Refinement, Processing Routes, Ultra Fine Grain, ECAP

