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Effect of Molybdenum Addition to Aluminum Grain Refined by Titanium Plus Boron on Its Grain Size and Mechanical Characteristics in the Cast and After Pressing by the Equal Channel Angular Pressing Conditions

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Abstract : Aluminum and its alloys solidify in columnar structure with large grain size which tends to reduce their mechanical strength and surface quality. They are, therefore, grain refined by addition of either titanium or titanium plus boron to their melt before solidification. Equal channel angular pressing, ECAP, process is a recent forming method for producing heavy plastic deformation in materials. In this paper, the effect of molybdenum addition to aluminum grain refined by Ti+B on its metallurgical and mechanical characteristics are investigated in the as cast condition and after pressing by the ECAP process. It was found that addition of Mo or Ti+B alone or together to aluminum resulted in grain refining of its microstructure in the as cast condition, as the average grain size was reduced from 139 micron to 46 micron when Mo and Ti+B are added together. Pressing by the ECAP process resulted in further refinement of the microstructure where 32 micron of average grain size was achieved in Al and the Al-Mo microalloy. Regarding the mechanical strength, addition of Mo or Ti+B alone to Al resulted in deterioration of its mechanical behavior but resulted in enhancement of its mechanical behavior when added together, increase of 10% in flow stress was achieved at 20% strain. However, pressing by ECAP addition of Mo or Ti+B alone to Al resulted in enhancement of its mechanical strength but reduced its strength when added together.

Keywords : ECAP, aluminum, cast, mechanical characteristics, Mo grain refiner
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