

The Effect of Addition of Some Rare Earth Materials to Zinc Aluminum Alloy ZA-22

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Abstract : Zinc aluminum alloys are versatile materials which are widely used in manufacturing several parts in the automobile and aircraft industries. The effect of grain refinement of these alloys by rare earth elements on their mechanical characteristics is scarce. The equal channel angular pressing is relatively recent method for producing severe plastic deformation in materials subjected to it resulting in refinement of their structure and enhancement of their mechanical characteristics. The phase diagram of these alloys indicates that large dendrites of large grain size can be formed during their solidification of the cast which tends to deteriorate their mechanical strength and surface quality. To overcome this problem they are normally grain refined by either titanium or titanium + boron to their melt prior to solidification. In this paper, comparison between the effect of adding either titanium, (Ti), titanium+boron, (Ti+B), or Molybdenum, Mo, to zinc-aluminum22, alloy, (ZA22) on its metallurgical and mechanical characteristics in the cast condition and after pressing by the ECAP process is investigated. It was found that addition of either Ti, Ti+B, or Mo to the ZA22 alloy in the cast condition resulted in refining of their structure being more refined by the addition of Mo, then .Ti+B and less refining by Ti addition. Furthermore, the ECAP process resulted in further refinement of the alloy micro structure except in case of Ti+B addition where poisoning i.e. coarsening of the grains has occurred. Regarding the addition of these element on the mechanical behavior; it was found that addition of Ti Or Ti+B resulted in little enhancement of the alloy strength factor and its flow stress at 20% true strain; whereas, the addition of resulted in deteriorating of its mechanical behavior as % decrease in the strength factor and % in its flow stress of 20%. As for the strain hardening index; addition of any of these elements resulted in decreasing the strain hardening index.

Keywords : addition, grain refinement, mechanical characteristics, microstructure, rare earth elements, ZA-22, Zinc-aluminum alloy

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