Microstructure and Properties of $Zn_{61}Al_{34}M_5$ Alloy Produced by Rapid Solidification and Warm-compacting Sintering Process

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Abstract

Zn-Al alloys are being widely used in mechanical industry due to their good mechanical properties, especially excellent strengthen to specific weight which results in greater fuel saving. Many papers on the properties and application of Zn-Al alloys were published in the past years. However, the plasticity and abradability of these Zn-Al alloys produced by casting are not very good. Otherwise, the composition, hardness and density of the alloys are not homogeneous.

In order to eliminate these disadvantages, mchanical properties of $Zn_{65}Al_{30}M_5$ (M=RE, Cu, B) alloy prepared by a new way were studied in this paper by optical microscopy, SEM, EDS, X-ray diffraction, differential scanning calorimetry (DSC) and Vickers. The new way was called rapid solidification and warm-compacted process, that the alloys were generated from Zn-ingot, Al-ingot, and alloying elements (Cu, Si, RE, et al.)in an induction furnace under inert atmosphere. The master alloy was melted to give ribbons with a width of 15~25 mm and thickness of 16~20 μm by means of single-roller melt-spinning in Ar atmosphere. The as-quenched ribbons were milled into powders using a mill. The powders were put in a mold and warm-compacted at 750~850 K and 26 MPa in N2 atmosphere for 1 h, creating a disk with a diameter of 6 cm and thickness of 8 mm, from which samples to be studied were cut.

The microstructures of the transverse section and longitudinal section of the new alloy Zn61Al34M5 were observed by OM, It can be seen that the microstructure is quite uniform. The more microscopial structure of the alloy was studied using SEM, It revealed that the fine grains in the alloy were basically distributed homogeneously and dispersed. The XRD pattern shows that the new Zn61 Al34M5 alloy mainly contained α-phase and η-phase.As for the mechanical properties of the newly produced alloys, it was found for the first time that the sintered alloy had good plasticity. The hardness of the bulk samples was about 10% ~ 20% higher than that of the casted one. The density was lower than that of the casted alloy by 16%.