

Effect of Composition and Cooling Rate on the Solidification Structure of Al-Er Alloy

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Abstract : The microstructure and phase structure of Al-Er alloys with Er content of 10, 20, 30wt% at cooling rate of 60, 40 and 5°C/h were analyzed using scanning electron microscope (SEM) and X-ray diffraction (XRD). Experimental results showed that for solidification of the hypereutectic Al-Er alloys at different conditions, a halo of α -Al appeared around the primary Al_3Er phase. Analysis of the solidification process indicated that after the primary Al_3Er phase formed, the composition of supercooled liquid phase located outside the coupled zone of eutectic growth below the eutectic line, which led to the formation of Al halo. With the increase of Er content, the blocky primary Al_3Er phase expanded from 200 μm to 1mm in size. With the decrease of cooling rate, the morphology and phase structure of alloy were different. At the cooling rate of 60°C/h, it was obtained the primary Al_3Er phase with L1_2 structure, whose profile was straight. Meanwhile, the eutectic structure was flocculent. At the quite slow cooling rate of 5°C/h, it was obtained the primary Al_3Er phase with hR20 structure with irregular jagged profile, and the eutectic structure was approximately strip-shaped. These characteristics were closely related to the cooling rate of solidification. The XRD analysis showed that for Al_3Er phase, the lattice constant a of L1_2 structure was 4.2158Å, and a , c of hR20 structure were 6.0321Å and 35.6290Å, respectively.

Keywords : Al-Er alloy, composition, cooling rate, microstructure

Conference Title : ICMMP 2023 : International Conference on Materials and Materials Processing

Conference Location : Prague, Czechia

Conference Dates : July 03-04, 2023