World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:17, No:07, 2023

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

Authors : Jing Ning, Kunyuan Gao

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℃/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 leaded to the formation of Al halo. With the increase of Er content, the blocky primary Al_3Er phase expanded from 200μm 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℃/h, it was obtained the primary Al3Er phase with $L1_2$ structure, whose profile was straight. Meanwhile, the eutectic structure was flocculent. At the quite slow cooling rate of 5℃/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