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ABSTRACT:

Nano Phase Formation in Rapid Cooling of Mg Alloy AE44

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The impact of cooling rates on the microstructural evolution of Mg alloy AE44 was investigated. Two distinct cooling rates, 0.03 and 77.13 °C/s, were employed during the solidification process. To elucidate the characteristics of phase transformations and microstructural evolution during solidification, thermal analyses were conducted on the recorded cooling curves. Both the first and second derivatives of these curves were examined. At the slower cooling rate, the microstructure predominantly consisted of the primary α -Mg phase, the Ce-containing eutectic phases of Al₁₁Ce₃ and Al₂Ce, and the eutectic Mg₁₇Al₁₂ phase, as identified by scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS). Conversely, at the higher cooling rate of 77.13 °C/s, the very small primary α -Mg phase and the eutectic Al₁₁Ce₃ phase were observed, indicating a significant departure from the equilibrium solidification condition. Additionally, a substantial quantity of nano-sized eutectic Al₁₁Ce₃ particles were detected, resulting in a markedly refined microstruc