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喷射成形Mg-9Al-xZn合金的微观组织演变

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摘 要: 利用喷射成形技术制备AZ91、AZ92和AZ93镁合金沉积柱坯, 并对其微观组织演变进行观察。结果表明: 铸态普通凝固AZ91合金的晶粒粗大, 脆性 β -Mg₁₇Al₁₂相连续分布成网状结构; 而喷射成形AZ91、AZ92和AZ93合金的组织均匀, 晶粒被充分细化, β -Mg₁₇Al₁₂相的网状结构被打破; 喷射沉积快速凝固条件下高的冷却速率促进了过饱和 α -Mg固溶体组织的形成, 使得偏析相减少, 形态改善; Zn含量的增加降低了Al在Mg中的溶解极限, 促进了 β -Mg₁₇Al₁₂相在晶界的析出及 α -Mg+ β -Mg₁₇Al₁₂离异共晶组织的形成; Zn元素的偏析倾向为激活成分过冷区内的形核质点提供了驱动力, 从而阻碍了晶粒长大。

关键字: 镁合金; 喷射成形; 微观组织

Microstructure evolution of spray-formed Mg-9Al-xZn alloys

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Abstract: The billets of AZ91, AZ92 and AZ93 magnesium alloys were synthesized by the spray-forming (SF) processing. The microstructure evolution of the alloys was observed. The microstructure analysis shows that the microstructure of the conventional as-cast AZ91 alloy consists of coarse grains, and the brittle β -Mg₁₇Al₁₂ phases distribute along the grain boundaries continuously to form network. The grains of the as-sprayed AZ91, AZ92 and AZ93 alloy are homogeneous and refined, and the networks of brittle β -Mg₁₇Al₁₂ phases are broken. The rapid solidification process under a higher supercooling condition can remarkably increase the forming of supersaturated microstructure of α -Mg, which results in the

absence of macrosegregation and the improvement of precipitated phase shape. The solution limitation of Al in Mg decreases with increasing addition of Zn. The high content of Zn accelerates the precipitation of β -Mg₁₇Al₁₂ phases along the grain boundary and formation of α -Mg+ β -Mg₁₇Al₁₂ divorce eutectic structure. The grain growth is limited because the segregation tendentiousness of Zn offers drive force for activation of nucleation sites in the component undercooling area.

Key words: magnesium alloy; spray-forming; microstructure

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