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真空自耗电弧熔炼电流对Ti-10V-2Fe-3Al铸锭 凝固组织的影响

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摘 要: 研究真空自耗电弧熔炼(VAR)条件下熔炼电流对Ti-10V-2Fe-3Al合金凝固组织的影响,分析VAR熔炼中熔池内部的对流类型,基于安培定理,建立VAR熔炼条件下熔池中的洛伦兹力与电流、磁场及铸锭半径的关系。结果表明:熔炼电流较低时,浮力的影响占据主要地位,加速热量的散失,铸锭中组织细小;随着熔炼电流变大,熔池中电磁力(洛伦兹力)的影响逐渐占据主要地位,将表面的热量带入熔池内部,增大了温度梯度,使铸锭组织变得粗大

关键字: Ti-10V-2Fe-3Al; 凝固组织; 真空自耗电弧熔炼; 熔炼电流; 洛伦兹力; 浮力

Influence of arc current on solidification microstructure of Ti-10V-2Fe-3Al under vacuum arc melting

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Abstract: The influence of remelting current on the solidification macrostructure of Ti-10V-2Fe-3Al under vacuum arc remelting was investigated. Based on the Ampere–Maxwell equation, the relationships among the radius of the pool, intensity of magnetic field and electromagnetic (Lorentz) force were established. The results show that the flow is dominated by weaker buoyancy forces at low arc current, in this case, heat dissipation accelerate, the solidification microstructure becomes finer. With increasing arc current, the liquid metal flow is electromagnetically driven by Lorentz force, the heat is taken inside from superstratum of the pool, the temperature gradient in the pool increases, and the solidification microstructure becomes coarser.

Key words: Ti-10V-2Fe-3Al; solidification microstructure; vacuum arc remelting; arc current; Lorentz force; buoyant force

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