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激光表面快凝下$Nd_{13.5}Fe_{79.75}B_{6.75}$过包晶合金的组织演化

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摘 要： 利用激光表面快速熔凝技术对$Nd_{13.5}Fe_{79.75}B_{6.75}$过包晶合金的凝固组织及其变化规律进行研究。结果表明：当扫描速度大于2 mm/s时，包晶反应($\gamma+L\rightarrow T_1$)被抑制，包晶T_1相可直接从液相中析出($L\rightarrow T_1$)。根据最高界面生长温度判据及KGT模型计算了T_1相领先析出的临界生长速度为0.34 mm/s，理论预测值略小于实验确定值；另在100~500 mm/s扫描速度范围内观测到粗胞晶→细胞晶→平界面的不同凝固形态的高速带状组织，理论预测此合金形成高速带状组织的速度范围为148~7 800 mm/s，理论预测下限值与实验结果吻合较好。

关键字： $Nd_{13.5}Fe_{79.75}B_{6.75}$；包晶合金；激光表面快凝；相转变；带状组织

Microstructure evolution of $Nd_{13.5}Fe_{79.75}B_{6.75}$ peritectic alloy under laser rapid solidification

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Abstract: Laser rapid solidification experiments were performed on $Nd_{13.5}Fe_{79.75}B_{6.75}$ hyperperitectic alloy to investigate microstructure evolution. The results show that at scanning velocity higher than 2 mm/s, peritectic T_1 phase directly precipitates from the liquid instead of by peritectic reaction. Using KGT model and the maximum growth temperature criterion, critical velocity for the transition from primary γ-Fe phase to T_1 phase is calculated to be 0.34 mm/s, which approaches the experimental value of 2 mm/s. High velocity banding structure, showing oscillatory plane front and cellular microstructures, is firstly detected in $Nd_{13.5}Fe_{79.75}B_{6.75}$ peritectic alloys. The growth velocity for banding structure is deduced to be in the range of 100−500 mm/s. The experimental appearance of the banding structure agrees well with the theoretical prediction.

Key words: $Nd_{13.5}Fe_{79.75}B_{6.75}$; peritectic alloy; laser rapid solidification; phase transition; banded structure

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