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SCR技术制备A2017合金半固态材料组织演化

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摘要: 采用SCR(shearing-cooling-roll)技术制备了A2017半固态合金, 对合金液在不同温度下进行浇注, 且对辊-靴型腔中合金组织的演化过程进行了跟踪, 分析了SCR过程中凝固形核的热力学条件以及层流剪切特性。结果表明: 随着合金液浇注温度的降低, 坯料内部组织从粗大的枝晶或菊花晶转化为细小的近球形晶。合金液首先在轧辊和靴子表面结晶形核, 在液流冲击及剪切的作用下, 晶核从型壁上脱落进入残余液相形成游离晶; 随着辊-靴型腔内合金固相率的增加, 游离晶在以枝晶方式生长过程中受到层流剪切作用, 二次枝晶臂断裂破碎形成自由晶; 自由晶在层流剪切作用下进一步发生碰撞和摩擦, 最后逐渐趋于球形或椭球形。

关键字: 材料合成与加工工艺; 半固态; 剪切与冷却; A2017合金; 组织演化**Microstructural evolution of A2017 semi-solid alloys produced by SCR process****WANG Shun-cheng, WEN Jing-lin, CHEN Yan-bo,
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Abstract: SCR(shearing-cooling-roll) process was adopted to manufacture A2017 semi-solid alloys. Molten alloy was poured at different temperatures. The microstructural evolution of the alloy in the roll-shoe gap was studied. The thermodynamics of nucleation and the laminar shear of molten alloy were analyzed. The results show that microstructures are transformed from dendritic or rosette-shaped to fine net-globular as decreasing pouring temperature of molten alloy. Nuclei form at the surface of roll-shoe firstly and then these nuclei are broken and enter the liquid region to form free nuclei under the impact of liquid flow and laminar shearing and grow into dendrites. Under the laminar shearing caused by the roller, the arms of the original dendrites are then broken and distributed dispersedly into residual alloy liquid and form free grains. Free grains move and grow freely continuously and are ground under the laminar shearing and cooling then become spherical or ellipsoidal.

Key words: synthesizing and process technology; semi-solid; shearing and cooling; A2017 alloy; microstructure evolution

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