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论文

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晶体生长方向对亚快速凝固结晶形貌的影响

蒋成保<sup>1</sup>, 胡汉起<sup>1</sup>, 王佩君<sup>1</sup>, 李建国<sup>2</sup>

1. 北京科技大学铸造教研室,北京,100083; 2. 西北工业大学铸造教研室,西安,710072

THE INFLUENCE OF THE CRYSTAL GROWTH ORIENTATION ON THE MICROSTRUCTURE IN HYPORAPID SOLIDIFICATION

Jiang Chengbao<sup>1</sup>, Hu Hanqi<sup>1</sup>, Wang Peijun<sup>1</sup>

1. Cast Faculty, Beijing University of Science and Technology, Beijing, 100083; 2. Cast Faculty, Northwestern Polytechnical University, Xi'an, 710072

摘要

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摘要 采用区域熔化定向凝固装置,对冷却速度在 $13 \sim 130 \text{ K/s}$ 范围内Ni-5%Cu合金的结晶形貌研究表明:在温度梯度 $G_L = 300 \text{ K/cm}$ 条件下,晶体生长速度 $u$ 为 $500 \mu\text{m/s}$ 时,不同结晶取向的晶粒其结晶形貌不同。以 $\langle 100 \rangle$ 方向生长的晶粒为树枝晶组织;以 $\langle 120 \rangle$ 方向生长的晶粒为细胞晶组织。当 $u$ 为 $800 \mu\text{m/s}$ 时,不同结晶取向的细胞晶间距不同。以 $\langle 100 \rangle$ 方向生长的细胞晶间距是 $28 \mu\text{m}$ ;以 $\langle 211 \rangle$ 方向生长的细胞晶间距是 $16.5 \mu\text{m}$ 。相同凝固条件下,同一晶粒内不同取向的分枝,结晶形貌不同。亚快速凝固条件下,树枝晶生长的生长方向已不完全按 $\langle 100 \rangle$ 方向择优取向,细胞晶生长的择优取向性被抑制。

关键词: 晶体生长 方位 冷却 速度 晶粒 结晶 形状

Abstract: The solidified microstructure of Ni-5wt% Cu alloy is researched at the cooling velocity range of  $13 \sim 130 \text{ K/s}$  with zone melting unidirectional solidification apparatus. It indicates that the crystals with different crystal growth orientations have different solidified microstructures in the condition of  $G_L = 1300 \text{ K/cm}, u = 500 \mu\text{m/s}$ : the crystal with solidified orientation  $\langle 100 \rangle$  is dendrite; the crystal with solidified orientation  $\langle 120 \rangle$  is superfine cell. The crystals have different superfine cellular spacing due to the crystal growth orientation with  $G_L = 1300 \text{ K/cm}, u = 800 \mu\text{m/s}$ : superfine cellular spacing of the crystal with solidified orientation  $\langle 100 \rangle$  is  $28 \mu\text{m}$ , and that of the crystal with solidified orientation  $\langle 211 \rangle$  is  $16.5 \mu\text{m}$ . In a grain, two parts have different microstructures due to the different orientations under the same solidification parameters. In hyporapid solidification, dendritic solidified orientation isn't the preferential direction  $\langle 100 \rangle$ ; the preferential orientation is disposed in the superfine cellular growth process.

Keywords: crystal growth bearing cooling velocity crystallites crystallization shapes

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