



航空学报 » 2006, Vol. 27 » Issue (5) :973-978 DOI:

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半固态金属材料EMS法制备过程中的微观组织相场法模拟

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Phase-field Simulation of Microstructural Evolution During Preparation of Semi-solid Metal Adopting EMS Method

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摘要

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摘要 利用相场法模拟了电磁搅拌法(EMS法)制备半固态金属材料(Al-4Cu-Mg合金)过程中微观组织的演变,分析和讨论了宏观因素,如扰动强度、各向异性强度、固液相中扩散系数比等对微观组织演变的影响。结果表明:界面层厚度的减小,使得固相颗粒的外形轮廓更接近于圆形;固相中扩散系数增加,可以减少微观偏析的程度;扰动强度越大,初生相的微粒越细,其形态越趋向于球形。

关键词: 半固态金属 微观组织 相场法 模拟 电磁搅拌法

Abstract: In the process of preparation of semi-solid metal materials, a variety of factors would influence the prepared time, the morphology of non-dendritic microstructure. The aim of this work is using phase-field method to simulate non-dendritic growth during preparation of Al-4Cu-Mg semi-solid alloy adopting electromagnetic stirring method (EMS method). Several affecting factors such as the disturbance intensity, the anisotropy, the thickness of the interface and the ratio of diffusivity in solid and liquid, etc are considered. It is shown that decreasing the thickness of the interface results in more circular outline perimeter of particles, and increasing the diffusivity in solid can reduce degree of microsegregation. The disturbance intensity in the model can be connected with current intensity of stator or magnetic induction density impressed. Simulation results show that the larger the disturbance intensity or magnetic induction density, the smaller the size and the more globular morphology of original phase in the matrix.

Keywords: semi-solid metal microstructure phase-field method simulation electromagnetic stirring method

Received 2005-05-18; published 2006-10-25

引用本文:

余小鲁;李付国;任远春;李淼泉. 半固态金属材料EMS法制备过程中的微观组织相场法模拟[J]. 航空学报, 2006, 27(5): 973-978.

YU Xiao-lu;LI Fu-guo;REN Yuan-chun;LI Miao-quan. Phase-field Simulation of Microstructural Evolution During Preparation of Semi-solid Metal Adopting EMS Method[J]. Acta Aeronautica et Astronautica Sinica, 2006, 27(5): 973-978.

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