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相场法模拟球形和盘形第二相粒子对晶粒长大的影响

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摘要: 利用相场法模型, 模拟研究含不同尺寸和面积分数的球形和盘形粒子的二维系统中晶粒的长大特征, 揭示第二相粒子对晶粒长大的影响规律。结果表明: 初始阶段晶粒长大符合长大指数 n 为0.3-0.4的指数长大规律, 其 n 与系统单位面积所含的粒子数量密切相关; 晶粒长大过程中绝大多数粒子位于晶界处, 其最终的平均晶粒半径可以用Zener关系表示; 当粒子尺寸和面积分数一定时, 粒子的形状对晶粒的长大过程没有明显影响。

关键字: 第二相粒子; 晶粒长大; 相场法模型; Zener钉扎; 模拟

Phase field modeling for effects of spherical and discal second-phase particles on grain growth

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Abstract: The grain growth behaviors of two-dimensional systems containing dispersed spherical and discal second-phases particles with different sizes and area fractions were simulated, and their effect law on the grain growth was revealed using a phase field model. The results show that initially the grain growth follows the power growth law with the growth index n ranging between 0.3 and 0.4, and n strongly correlates to the amounts of particles per area. Most particles are located at the grain boundaries during grain growth and the final mean grain radius is predicted by Zener-relation. The shape of particles has little effect on the grain growth when these particles are of the same size and area fraction.

Key words: second-phase particles; grain growth; phase field model; Zener-pinning; simulation

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