

论文

Ni—Ni₃Si系近共晶合金深过冷形核规律

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摘要: 采用大体积液态金属的微观净化技术,在Ni—Ni₃Si合金系中使Ni-(6.07—19.7)%Si和Ni-(20.5—22)%Si两组合金分别获得了最大达344和265K的极限形核过冷度,并使其极限过冷度保持20个循环过热周期不衰减.实验发现,Ni—Ni₃Si系近共晶合金深过冷凝固时,Ni₃Si总是领先于α(Ni)相形核.根据实验数据和表面异质形核速率模型,求得Ni₃Si和α(Ni)相异质形核时的异质形核因子f(θ)分别为0.069和0.28;求得过冷熔体中Ni₃Si和α(Ni)相等形核速率时的温度-成分曲线完全处于共晶点左侧,表明在近共晶成分过冷熔体中,小平面相Ni₃Si易于α(Ni)形核

关键词: Ni—Si合金 深过冷 形核 异质形核因子

THE NUCLEATION OF HIGHLY UNDERCOOLED Ni-Ni₃Si ALLOY CLOSED TO EUTECTIC COMPOSITION

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Abstract: The micro-denucleation technique of bulk melt was applied to Ni-Ni₃Si alloy system. In two composition ranges of Ni-(6.07 - 19.7)%Si and Ni-(20.5 - 22)%Si, the alloys were undercooled up to the highest undercooling of 344 and 265 K respectively. The highest undercooling could be held for 20 melting-superheating-cooling circles. The experimental results indicated that, during the solidification of the alloys with compositions closed to the eutectic composition in Ni-Ni₃Si alloy system, Ni₃Si was always nucleated heterogeneously ahead of α(Ni) phase. The catalytic factors f(θ) of Ni₃Si and α(Ni) were 0.069 and 0.28 respectively,calculated with the experimental data and the kinetic model of heterogeneous surface nucleation.The temperature vs composition curve with the same nucleation rate for Ni₃Si and α(Ni) lay on the left side of eutectic point completely, which indicated that in the undercooled melts closed to the eutectic composition the nucleation of faceted Ni₃Si phase was easier than that of α(Ni)phase.

Keywords: Ni-Si alloy high undercooling nucleation catalytic factor

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