The effect of superheat on the nucleation undercooling of metallic melts

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Abstract

Melt superheated treatment can affect the solidification structure, but the direct evidence requires strict experiments. The molecular dynamics simulation method can break the limited experimental conditions, and provide advanced prediction for research. In this study, influences of superheated temperature (Ts) on the nucleation undercooling (ΔT) of metallic melts (Ti, Co, Mg, Al, Ni, Fe, Ag) were studied by the molecular dynamics simulation. The results show that the value of ΔT increases with the rise of Ts until the maximal ΔT approaches. In the curve of ΔT vs. Ts, there is an inflexion region where the nucleus cluster was broken. Above this inflexion region, the number of nucleus clusters decreases with the rise of Ts. Based on the simulated results, a model was proposed for describing the relation of ΔT and Ts, with which the maximal undercooling for metals can be predicted.

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