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Phase field modeling of solidification microstructure evolution during welding

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Abstract

The misorientation angle between the preferred crystalline orientation and the temperature gradient influences both the incubation time and the average wavelength of any initial instability during the planar growth stage, as well as the dendrite growth direction and the primary dendrite arm spacing during the subsequent epitaxial growth stage. The solidification microstructure gradually changes from normal or tilted dendrites to a seaweed-like structure as the misorientation angle increases. The simulation of the initial wavelength, primary dendrite arm spacing and interface morphology are in general agreement with the experimental observations.

Keywords: Preferred crystalline orientation; Morphology evolution; Solidification microstructure; *Al-Cu* Alloy; Phase field method

1 Introduction

The mechanical properties of weld joints are directly dependent on the solidification structures in the fusion zone. Understanding the solidification dynamics could provide useful