8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)

14–17 October 2016

Seattle, Washington | Hosted by Purdue University

SESSION 2: SOLIDIFICATION AND CASTING, SALON B

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SUNDAY, OCTOBER 16, 2016

The influence of welding parameters on initial instability dynamics during solidification

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ABSTRACT

A computationally efficient quantitative phase field formulation is used to investigate the initial instability dynamics during the solidification of the welding pool of Al–Cu alloy. The initial morphological instability is predicted by using the model, and the effects of welding parameters on the initial instability dynamics are investigated under different transient conditions. The results show that the concentration in the liquid side of interface increases with the increase in welding power, while the solute layer thickness in front of interface decreases with the increase in welding power. The tip velocity increases with the shortening of solidification time. Hence, the relationship between crossover time and welding parameter is positive. By contrast, the wavelength almost remains stable under different welding parameters.

KEYWORDS: welding parameters, phase-field, initial instability, transient conditions, solidification, Al–Cu alloy