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ABSTRACT:

Formation of Kirkendall Porosity during Interdiffusion in Multi-Component Alloys

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Porosity in multi-component alloys was studied using the combination of the phase-field model and the vacancy diffusion model. The standard phase-field modeling of solidification is based on the phase diagrams which are widely used to determine the composition and temperature conditions of alloy crystallization. A similar method can be applied to pore formation. The vacancy flux in diffusion couples, which is responsible for the formation and growth of of pores, is included in the equations of the phase-field model. The microstructural features from the experiment, such as pore size distribution, pore shape, distance to the Matano plane, are used to determine the time scale and mechanisms of pore nucleation and growth in diffusion couples. As a result, calculations can predict not only the composition of the alloy and pore fraction, but also the size, the position and shape of specific pores. Here we will show examples of modeling of such processes in multi-component systems, e.g. in a Ni-base superalloy. The comparison simulation results with experimental data of X-ray tomography shows a good agreement including the shape of the pores and their distance to the center of a diffusion couple.