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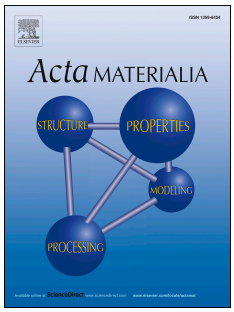

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Phase-field modeling of reactive wetting and growth of the intermetallic Al_2Au phase in the Al-Au system

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Abstract

When an Al-droplet is in contact with an Au-solid substrate, the liquid phase reacts with the substrate and an intermetallic layer is formed at the solid-liquid interface due to diffusion and reaction. This phenomenon has been commonly observed in the soldering process and the wetting is termed as reactive wetting, in contrast to the inert wetting where the droplet does not react with the base materials and the substrate is flat. Young's law can be used to interpret the contact angle in the static state, but is not able to predict the dynamics in the process of reactive wetting. In this work, we present a multi-phase model including phase transition and fluid dynamics to investigate the effect of the formation of the intermetallic Al_2Au phase and capillary flow on the reactive wetting in the Al-Au system. In order to capture phase boundaries of solid-, liquid- and intermetallic-vapor, phase-field simulations are performed based on a ternary (Al-Au-X) phase diagram concept and using experimental data. It has been found that the increase of both the liquid-intermetallic interfacial tension as well as the capillary flow lead to an inhibition effect for the growth of the

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