Modeling the Effect of Surface Energy On Stressed Grain Growth In Cubic Polycrystalline Bodies

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ABSTRACT

A recently-developed constitutive theory of stressed grain growth is augmented to include the effect of excess surface energy via a surface effect state variable. The new constitutive theory is implemented into a coupled finite-element and phase-field computational framework. Through three-dimensional simulations, the new constitutive model is shown to be capable of predicting the experimental data of the annealing-induced texture transition in polycrystalline copper thin films of different thicknesses attached to a polyimide substrate. Our simulations show that the grain growth driving force arising from the through-film thickness grain boundary curvature plays a prominent role in such a transitional behavior.

KEYWORDS: Grain growth; Surface energy; Constitutive theory; Phase-field; Computer simulations

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