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**Modeling of metastable phase formation diagrams for sputtered thin films**

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A method to model the metastable phase formation in the Cu–W system based on the critical surface diffusion distance has been developed. The driver for the formation of a second phase is the critical diffusion distance which is dependent on the solubility of W in Fcc-Cu and on the solubility of Cu in Bcc-W. Based on comparative theoretical and experimental data, we describe the relationship between the solubilities and the critical diffusion distances to model the metastable phase formation. Metastable phase formation diagrams for Cu–W and Cu–V thin films are predicted and validated by combinatorial magnetron sputtering experiments. The here adopted correlative experimental and theoretical research strategy enables the efficient description of the relationship between the solubilities and the critical diffusion distances to model the metastable phase formation during magnetron sputtering.

**Keywords**

combinatorial magnetron sputtering  
metastable phase formation diagram  
thin film growth  
surface diffusion distance  
Cu–W and Cu–V