Superconformal Electrodeposition

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A model of superconformal electrodeposition is presented based on a local growth velocity that is proportional to coverage of a catalytic species at the metal/electrolyte interface. The catalyst accumulates at the interface through reaction with the electrolyte. More importantly, if the concentration of the catalyst precursor in the electrolyte is dilute, then surface coverage within small features can change far more rapidly due to changing interface area. In such a case, the catalyst effectively floats on the interface during deposition with changes in coverage coupled to alterations in arc-length of the moving surface. The local coverage therefore increases during conformal growth on a concave surface; this then results in a corresponding increase in the local deposition rate. The opposite is true for a convex surface. The model is supported by experiments and simulations of superconformal copper electrodeposition in 350-100 nm wide features. More recently, the model has been extended to describe superconformal film growth by iodine catalyzed CVD of copper.