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Electrochemical Deposition of Samarium Cobalt

Investigating effects of organic additives to lower reduction potentials and control oxygen incorporation in the electrochemical deposition of Samarium Cobalt. Using linear and cyclic voltammetry, along with electrochemical impedance spectroscopy, to explore how different organic additives directly affect charge transfer resistance, reaction kinetics, and mass transport properties. Previous literature has failed to address the relationship between this complex chemistry and the advantages of using various additives for successful electroformed $SmCo_5$ features. Cyclic voltammetry was used in this experiment to measure the change in reduction potential and mechanism of Samarium alongside different additives. Linear sweep voltammetry was used in this experiment to extract curves for kinetic and diffusion relationships of the different additives in solution. Electrochemical impedance spectroscopy was used to calculate the change in charge transfer resistance at different additive concentrations. The successful electrochemical deposition of SmCo strong permanent magnetic material from an aqueous chemistry, has been mostly unexplored in the past. Due to its high Currie temperature and high coercivity it has a high potential for a wide range of micromachining applications. The mapping of charge transfer resistance, reaction kinetics, and mass transport properties with different additives can bring the successful electroforming of this rare alloy closer to reality.

Keywords: Electroplating, electrodeposition, pulse plating, magnetic materials, potentiostatic plating, galvanic plating, film growth, deposition, bottom up processing, additive manufacturing.