Influence of Magnetic Agitation and Bubble Stirring on Electrodeposited Copper in an Acidic CuSO₄ Solution

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Electrochemical reduction is an effective method to transform Cu²⁺ ions into metallic Cu in aqueous solutions. Herein, magnetic agitation and flowing bubbles were introduced into the electrowinning process of Cu²⁺ ions in a CuSO₄-H₂SO₄ electrolyte. The influence of agitation and micron-sized bubbles on the nucleation and growth of Cu electrodeposits was systemically investigated. Additionally, the composition and microstructure of the Cu deposits were analyzed. The migration of Cu²⁺ ions towards the cathode was effectively accelerated by agitation and bubbles. Cu dendrites can be basically eliminated in the product. Primary nucleation and the subsequent growth of the Cu electrodeposits were effectively promoted, while secondary nucleation of Cu was suppressed. Finally, compact and homogeneous Cu electrodeposits were prepared by employing agitation and flowing bubbles to assist the electrowinning of Cu ions.

Keywords: Electrowinning; copper; magnetic agitation; flowing bubble; kinetics

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