Some Aspects of Mechanism of Electropolishing of Copper in Phosphoric Acid

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In this study, electrochemical impedance spectroscopy (EIS) and electron spectroscopy for chemical analysis (ESCA) were used to investigate copper electropolishing in phosphoric acid. The experimental results indicate that a bright and smooth surface can be obtained using 85 wt% phosphoric acid at the applied potential, which leads to a limiting current. The surface treated using 30 wt% phosphoric acid was not glossy, and conventional electropolishing models could not adequately explain the results. Based on the results of EIS and ESCA analyses, a dual-layer model was proposed in this study. The two layers consist of a passive precipitate because of anodic polarization and a diffusion layer because of lack of water near the copper surface. Therefore, the dual layers limited the mass transfer rate. In addition, the polymeric characteristic of concentrated phosphoric acid enhanced the formation of dual layers, which significantly limited mass transfer and thus produced a glossy surface. Consequently, concentrated phosphoric acid demonstrates better electropolishing performance than low-concentration phosphoric acid.

Keywords: copper, phosphoric acid, electropolishing, dual-layer model, electrochemical impedance spectroscopy.

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