Corrosion Protection of Copper Foil by Ni-W Electrodeposited Coating in Kaolin Slurry

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The electrodeposited Ni-W layer was coated on a Cu substrate, and the plating bath was treated with a nickel sulphate solution. The corrosion resistance of the coating layer was evaluated using a corrod-kote test with 1-20 repetitive cycles, and the SSRT (slow strain rate test) was employed to characterize the mechanical properties of the Ni-W layer on the Cu substrate. In the ambient atmosphere, the tensile strength of the Cu substrate with and without Ni-W coating were 285 MPa and 240 MPa, respectively. Moreover, the strength of Ni-W coating was gradually reduced to the minimum value (250 MPa) over 20 cycles in the corrod-kote environment. The fracture surface was observed by scanning electron microscopy (SEM), and the Ni-W coating demonstrated ductile-type fracture and partial brittle cleavage due to its quasi-cleavage features. As the potentiodynamic polarization, the corrosion current densities of the bare Cu with and without Ni-W coating in the presence of the corrod-kote environment were 8.97×10^{-6} and 1.84×10^{-4} A/cm², respectively. Hence, the Ni-W coating layer significantly decreased the corrosion current density of the Cu substrate by 1 order of magnitude. Consequently, the SSRT results completely corresponded to the polarization test results in the corrod-kote environment. The aim of the work presented in this paper was to investigate the strain effect through the Ni-W coating layer in the corrod-kote environment.

Keywords: Ni-W layer, slow strain rate testing (SSRT), corrod-kote test, fracture surface

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