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Study of the Effects of the Magnetic Field on the Anodic Dissolution of Nickel With In-Line Digital Holography

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Anodic dissolution of nickel in HNO_3+Cl^- solutions was studied with in-line digital holography by observing the dynamic processes at the electrode-electrolyte interface under an applied magnetic field. Although the Lorentz force always enhances the mass-transport processes, the effects of the magnetic field on the anodic dissolution of nickel have been found to be different in different regions. In the active region, because electron transfer rather than mass transfer is the rate-determining step, the magnetic field decreases the current, as confirmed by the decrease in the concentration gradient of the corrosion products at the interface. The convection induced by the magnetic field drives away intermediate ions such as $Ni(ClH^+)_{ads}$ from the surface of the electrode, which can inhibit the formation of the surface film. However, in the prepassive region, since mass transfer is the rate-determining step, the current increases, and the concentration gradient of the corrosion products increases at the interface.

Keywords: Nickel; Anodic dissolution; Magnetic field; Digital holography

FULL TEXT