Investigation of Anodic Behavior of Nickel in H₂SO₄ Solutions Using Galvanostatic Polarization Technique. I. Kinetics and Thermodynamic Approach

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The electrochemical passivation behavior of Ni in H₂SO₄ solutions was studied by the galvanostatic anodic polarization method. The data of the polarization curves relied on the polarizing current, I_{imposed} , acid concentration, C , and the temperature, T . The polarized curve elucidated various characteristic regions confirming various oxidation processes. The 1st region is recognized by a rapid jump in the Ni electrode potential E (zone I), due to the decay of H₂ over-voltage. A large discrete 1st potential arrest, **a**, coincides with the formation of Ni⁺ ions, while the 2nd potential arrest, **b**, matches the electro-oxidation of Ni⁺ ions to Ni²⁺ ions. The second increase in the potential, E (zone II), harmonizes the onset of passivity due to the countenance of Ni₂O₃. The duration time, τ , of the two arrests **a** and **b** decrease with increasing the I_{imposed} , T , and the acid concentration, C . The thermodynamics activation parameters, E_a , ΔH_a , and ΔS_a for the dissolution and passivation processes are deduced and discussed.

Keywords: Nickel; Anodic polarization; Dissolution; Thermodynamic; Oxide film; Passivity; Kinetics.

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