Study of the Electrochemical Passive-Active Transition of Chalcopyrite in Acidic Solution

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The electrochemical behaviors of chalcopyrite in 1.0 M H₂SO₄ were studied by potentiodynamic polarization. The experimental results revealed that chalcopyrite has four different potential ranges: passive for OCP up to 500 mV; trans-passive dissolution/passive from 500 mV to 780 mV; active from 780 mV to 900 mV; and pseudo-passive above 900 mV. When the electrolyte contained 3.0 g/L Fe³⁺, the passive phenomenon weakened markedly, the trans-passive dissolution/passive range became narrower, the active potential sharply decreased, and the electrochemical promoting efficiency increased 34.86-fold. Electrochemical impedance spectroscopy (EIS) confirmed the potentiodynamic results, namely, that chalcopyrite is in a passive state at OCP and its charge transfer resistance R_{SC} and passive film resistance R_p are 816.5 and 18,722 $\Omega \cdot \text{cm}^2$, respectively. At a potential of 800 mV, the chalcopyrite R_{SC} decreased to 42.9 $\Omega \cdot \text{cm}^2$, and an equivalent inductance occurred. Passive film did not observed, which was also consistent with the electrode's active characterization. These results have direct implications for chalcopyrite hydrometallurgy.

Keywords: chalcopyrite; potentiodynamic curve; EIS; electrochemical dissolution

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