Full Paper _____ *Thematic Section:* Research into New Technologies.
Reference Object Identifier – ROI: jbc-02/16-47-8-80 *Subsection:* Electrochemistry.
0Publication is available for discussion in the framework of the on-line Internet conference "*Butlerov readings*".
http://butlerov.com/readings/
Submitted on August 26, 2016.

The masstransfer during electrochemical oxidation of copper-nickel sulfide alloy granules

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Keywords: electrolysis, copper sulfide, nickel sulfide, electrochemical oxidation, passivity diffusion flow, masstransfer, voltage.

Abstract

A mechanism of the electrochemical oxidation of granulated sulfide copper-nickel alloys has been firstly described. Granulation of the sulfides results in a formation of fine-dispersive structure and a stabilization of non-equilibrium phases differing higher reactivity during further hydrometallurgical processing. Granulated material has a high reacted surface, which elevates efficiency of electrolysis.

Electrochemical oxidation of the granules is due to stepwise oxidation of sulfide sulfur to intermediate sulfides, to elemental state then and accompanied by a passing of metals ions into solution. As elemental sulfur accumulates and as intermediate products forming sulfur-sulfide mud appear, passivation of surface of the granules and an increase of voltage at the electrolyzer take place. Despite on sulfur is a dielectric, no a complete isolation of the granules occurs, and sulfur layer on the surface of the granules only partially prevents to the passing of electric current. Passing of cations of copper and nickel into solution during electrochemical oxidation of sulfide elevates porosity of passive film consisting of intermediate sulfides and elemental sulfur particles and facilitates supply of electrolyte to initial phases into reaction area.

The estimation both for masstransfer and values of a voltage drop during electrochemical oxidation of a layer of the granules of Ni_3S_2-$Cu_{1/96}S$ system has been performed to justify theoretically the electrolysis of copper-nickel granulated materials. The technique for the estimation of a change in electrical resistivity and diffusion flows during electrochemical dissolution of the granulated alloy complicated by a formation of intermediate layers of reaction products at the anode has been offered. Before and after of the electrolysis the voltage drops in the layer of pellets were calculated. The diffusion flows of cations of copper and nickel both in the layer of granules and in granules directly taking into account the layer of intermediate and final products from electrochemical oxidation have been calculated. The technique of estimations of parameters electrolysis has been defined under conditions of the lab experiment. The data calculated correspond closely to experimental those, which give reliability of the calculations.

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