Accepted Manuscript

Kinetics of Fe(III)-Fe(II) redox half-reactions on sphalerite surface

Saeid Karimi, Ahmad Ghahreman, Fereshteh Rashchi

PII: S0013-4686(18)31178-2

DOI: 10.1016/j.electacta.2018.05.132

Reference: EA 31918

To appear in: *Electrochimica Acta*

Received Date: 1 February 2018

Revised Date: 17 May 2018

Accepted Date: 20 May 2018

Please cite this article as: S. Karimi, A. Ghahreman, F. Rashchi, Kinetics of Fe(III)-Fe(II) redox half-reactions on sphalerite surface, *Electrochimica Acta* (2018), doi: 10.1016/j.electacta.2018.05.132.

Kinetics of Fe(III)-Fe(II) redox half-reactions on sphalerite surface

Saeid Karimi [a,b], Ahmad Ghahreman [b,*], Fereshteh Rashchi [a,+]

[a] School of Metallurgy and Materials Engineering, College of Engineering, University of Tehran, P.O. Box 11155/4563, Tehran, Iran

[b] The Robert M. Buchan Department of Mining, Queen's University, ON, Kingston K7L 3N6, Canada

Abstract

In this research, the kinetics of Fe(III)-Fe(II) redox half-reactions on the sphalerite surface has been investigated in 0.5 M sulfuric acid in the temperature range of 22-65°C. Chronoamperometry and cyclic voltammetry (CV) methods have been used to collect the kinetics data for Fe(III)-Fe(II) redox half-reactions. In Fe-free solutions, the current density of Fe(III)-Fe(II) redox half-reactions is overlapped by sphalerite oxidation and other sulfides present in the working electrode (i.e. sphalerite concentrate). To overcome this problem, the mixed potential theory has been introduced by subtracting the current density of sphalerite oxidation in the Fe-free solution from that in the Fe-containing solution. In addition, electrochemical impedance spectroscopy (EIS) has been used to evaluate the effect of Fe(III)-Fe(II) redox half-reactions at the interface and surface processes of the sphalerite mineral. Results showed the exchange current density increased about 10 times with temperature in the range of 22-65 °C. In addition, the equilibrium potential of Fe(III)-Fe(II) couple gradually increases from 508 mV vs. Ag/AgCl at 22 °C to 582 mV vs. Ag/AgCl at 65 °C. Generally, all

* Corresponding author. Tel: +1 (613) 533-3294, E−mail address: ahmad.g@queensu.ca.
+ Corresponding author. Tel.: +98 (21) 8801-2999, E−mail address: rashchi@ut.ac.ir.