

Kinetics of Pyrite Oxidation in Simulated Mine Tailings Pond Conditions

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Abstract

Pyrite oxidation is the predominant source of acid mine drainage (AMD), which is one of the severe environmental impacts of mining. AMD destroys flora and fauna in the nearby ecosystem, and it causes grave health problems to the people. To further the understanding and help in the mitigation of AMD, this electrochemical study investigates the effect of different parameters on the rate of pyrite oxidation, while simulating the conditions in mine tailings ponds.

Open Cell Potential (OCP) and Electrochemical Impedance Spectroscopy (EIS) analysis were done using a three-electrode cell set-up. Polarization resistance obtained after fitting an electrical circuit to the EIS data was related to the rate of pyrite oxidation, while OCP was used to describe its oxidation mechanism. It was found out that the oxidation of pyrite by dissolved oxygen was the mechanism occurring in all the experiments, except when ferric and chalcopyrite were added. The parameter setting with the lowest relative oxidation rate were: electrolyte at pH 4, with no ferric addition, and with nitrogen purging; RDE at 400 RPM, with 10 % chalcopyrite addition, and 7 hours aging. Reaction orders calculated for the effect of ferric and hydrogen ions were equal to 1, while 0.5 was obtained for oxygen. Presence of chalcopyrite in the RDE caused the preferential oxidation of chalcopyrite instead of the pyrite due to their galvanic interaction. A thickening sulfur product layer as a result of aging resulted in a 9-fold decrease in the oxidation rate of pyrite.

Biography

Geoffrey Ray L. Nablo graduated cum laude in the University of the Philippines – Diliman with a BS Metallurgical Engineering degree. He obtained the top 4th place in the Professional Metallurgical Engineer Licensure Exam held in the Professional Regulation Commission, Manila, Philippines. He worked for three years as an engineer in a flash smelting furnace in the only copper smelting plant in the Philippines before proceeding to postgraduate studies. He finished his MS degree in Metallurgical Engineering at the age of 26 years from the University of the Philippines – Diliman.