Jordan University of Science and Technology

ToF-SIMS and SEM study on the preferential oxidation of chalcopyrite

Authors: Mohammad Al-Harahsheh, Sam Kingman, Frank Rutten, David Briggs

Abstract: Chalcopyrite is known to be slow reacting mineral in hydrometallurgical systems and is considered one of the most inert sulphide minerals with respect to leaching. Such character of chalcopyrite seems to be linked to a formation of a passive layer on its surface. This work reports that freshly fractured chalcopyrite surfaces exhibit highly selective reactivity depending on the exposed fracture planes. ToF-SIMS was used to qualitatively characterize various fracture planes in freshly fractured chalcopyrite particles, prior to and after hydrometallurgical treatment. It was found that, prior to treatment, certain areas exhibited pronounced contamination from atmospheric hydrocarbons; whereas, others were highly unreactive and remarkably free from adventitious hydrocarbon contamination. The positive ion spectra recorded from these areas were found to be dominated by peaks from Fe- and Cu-elements and related compounds. The negative ion spectra for the reactive areas on the other hand showed a high content of oxidized (sulphur) species. The differences between the areas of low and high reactivity, as detected after leaching, were more subtle than prior to leaching; whereas, SEM analysis showed clear evidence for selective attack of ferric sulphate to specific planes. Furthermore, it was shown that, when chalcopyrite is in intimate contact with pyrite, it experiences an enhanced oxidation compared to when there is no electric contact with pyrite. Attempts were made to explain the preferential oxidation observed based on the different chemistry of the fracture surfaces.