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Pyrite oxidation: a comparative study of chemical and air oxidation

Pyrite oxidation, a common process in nature, is of great concern to many environmentally and economically important topics, including formation and control of acid mine drainage (AMD), ecological cycle of sulfur, beneficiation of sulfide ores and extraction processing of gold. In order to investigate pyrite oxidation related matters in laboratories, numerous artificial oxidation methods have been proposed. Chemical oxidation by hydrogen peroxide solution and air oxidation by exposing pyrite to atmosphere are two commonly used artificial oxidation methods. However, no comparative work has been conducted on these two methods.

In this work, chemical oxidation where fresh pyrite plates are conditioned with hydrogen peroxide solution (0.03% and 3% wt/v) for different time periods and natural air oxidation where fresh pyrite plates are exposed to atmosphere for periods of months (1, 2, 3 and 5 months) at room temperature were tested. The types of oxidation species, their relative contents, and the thickness of the oxidation layer on these two kinds of oxidised pyrite surfaces were characterized and compared using X-ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES). The surface chemistry data extracted from XPS and AES results of these pyrite were also correlated with their hydrophobicity, presented as contact angle.

Primary authors: Mr XU, Shihong (Future Industries Institute, University of South Australia); Prof. SKINNER, William (Future Industries Institute, University of South Australia)

Presenter: Mr XU, Shihong (Future Industries Institute, University of South Australia)

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