

## 2.1.62

### Suppression of pyrite oxidation by silicates and bi-layer lipids: Role of iron hydroxy complexes

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Iron hydroxy complexes have long been suspected of contributing to pyrite oxidation inhibition during pyrite surface coating by silicates and other species. A continuous flow porous-bed reactor system was used to determine the influence of pH (2-6) and type of coating (silicates and bi-layer lipids) on the contribution of Fe hydroxy complexes to suppressing pyrite oxidation. Iron released into solution and measured by AA and ICP-MS was used as an indicator of pyrite oxidation. Scanning electron microscopy (SEM) images provided visual observations of the presence or absence of coatings over pyrite.

Results indicate that the relative contribution of Fe hydroxy complexes to the inhibition of pyrite oxidation depends on the pH and nature of the coating agent. At pH values of 3, 4, and 6, silicates formed a coating over pyrite surfaces that inhibited pyrite oxidation more than any Fe hydroxides that may have been formed over pyrite. The degree of suppression of pyrite oxidation by silicates decreases with solution pH such that at pH=2, the silicates played no significant role in suppressing pyrite oxidation. At this low pH, iron hydroxy complexes inhibited pyrite oxidation better than silicates. Results also indicate that the addition, over pyrite surface, of a pH=2 coating solution containing silicates would have the effect of exacerbating the problem of Fe release into the environment. In comparison, the bi-layer lipids showed a strong suppression of pyrite oxidation at all experimental pH values including pH=2. Fe hydroxy complexes contribution to inhibition of pyrite oxidation at pH=2, in the presence of the bi-layer lipids, could not be determined.

**Abbreviations:** Silicates, bi-layer lipids, SEM, Scanning Electron Microscopy, pyrite, XRD, X-ray diffraction, iron hydroxy complex, and pyrite oxidation inhibition.

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### Physical and chemical alteration at mineral-gas interface: A laboratory study of chalcopyrite desulfurization

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Gas fluxes from deep layers of the Earth's crust play an important role in metamorphization processes as well as in forming solid ore-bearing mineral composition and texture. Further evolution of ore minerals is generally considered as relatively stable, undergoing by slow erosion or by an alteration caused by chemically active liquids, supported by water cycle. Gas-mineral chemical interaction is less investigated since it is significant in better understanding the geochemical processes and also in some possible implications in reduction process for a series of metals.

Gas fluxes measured in seismic active zone of Armenia show elevated concentrations of molecular hydrogen, CO, CO<sub>2</sub>, methane, C<sub>2</sub>-C<sub>7</sub> hydrocarbons of different structure. Our recent laboratory study show both low rate and low conversion of reagents at moderate and high temperatures in reduction process of a series of sulfides in the case of a molecular gas flux. It has been shown also that some non-molecular species (e.g. atoms and free radicals) are chemically extremely active and labile in both the gas phase and at a surface, and thus they are able to affect a solid sample more effectively. Such active species can be produced by catalytic dissociation of stable molecules adsorbed on metal surface, e.g. H<sub>2</sub>(ads) → 2H + Q, or by the gas phase oxidation of hydrocarbons, leading to great concentrations of free radicals in gas phase.

To the end of study of geochemical process at moderate and high temperatures, a chalcopyrite powder concentrate from Zod ore-deposit of Armenia was prepared. A continued flow tank reactor with heating was used to study gas-solid interaction. A slow hydrogen atom flux obtained in UHF discharge and diluted in inert gas was used, as well as a mixture of natural gas methane with low content of oxygen. Gas chromatography was used to study kinetics of released H<sub>2</sub>S, SO<sub>2</sub>, CS<sub>2</sub>, H<sub>2</sub>O, CO<sub>2</sub> and higher hydrocarbons in gas phase. EPR-spectrometry was used to measure a concentration of paramagnetic species in gas phase. SEM was used to study surface physical alterations. Standard chemical and atomic-spectral analysis were used to study changes in chemical composition of a sample.

Possible mechanism of desulfurization, as well as some possibilities in pure metal producing by the technique, is discussed.