Crystallographical constraints on the leaching of chalcopyrite in hydrochloride acid

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Leaching process has been more and more frequently used to refine copper than traditional smelting process to avoid the release of SO_2. The leaching occurred at th interface of chalcopyrtie and liquid reservior. Iron oxides or/and hydroxides, sulphur-rich layer, sulpuhr, metastable copper sulphide, covellite, digenite, atacamite and antlerite, jarosite were frequently reported in the literature [1-4]. Nantokite was also mentioned as one product during the leaching [5].

Cubic-cut massive chalcopyrite was leached by hydrochloric acid with a temperature no higher than 100°C. The solid residues were observed and/or analyzed by SEM, EPMA, Raman spectroscopy and XRD. Results showed that the chalcopyrite was transformed into chlorine-bearing covellite and CuCl, and the iron was leached out and released into the liquid reservoir or formed new products on the interface of liquid-solid. SEM observation showed that the Cl-bearing covellite (Cl-covellite) was present around the peripheral of cuboid or both side of (micro)-cracks, and CuCl was present around the cuboid or filled in the cracks which freely connected to the liquid reservoir. The Cl-covellite and CuCl was transported out through the major or big cracks from the inner of cubiod. Furthermore, the leaching in hydrochloric acid resulted into three intersected fractures, triangle pits, blurry one-dimensional extending region, and micro-slabs. The fractures followed the [112] of chalcopyrite's structure. Pseudomorphic replacement reaction dominated the Cl-covellite forming reaction in a closed or a (half-) open system in hydrochloric acid. However, the dissolution-transportation- precipitation dominated the forming of CuCl in a (half-) open system in hydrochloric acid. CuCl epitaxially grew by the means of inheriting the crystallographic information from chalcopyrite.

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Structural role of Zr in silicate glasses and melts

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Zirconium is an important component of glasses and melts, with major implications in geochemistry and environmental and materials science. Zr increases the stability of alkali-bearing nuclear glasses, in which Zr occurs in octahedral coordination, a reticulating role confirmed by combining MD-simulations with X-ray Absorption Spectroscopy (XAS) [1, 2]. During glass alteration under silica-saturated conditions, Zr retains its reticulating role in the alteration gel, providing a protective role. By contrast, during alteration under open conditions, this protective role disappears, due to a coordination change of Zr, which destroys the initial glass structure [3].

By contrast, Zr enhances the nucleation of polymerized glasses of cordierite composition, according to a molecular-scale process shown by XAS and TEM. The presence of 7-cooordinated Zr arises from the absence of an appropriate charge compensation needed for a reticulating position. This unusual coordination explains the structural instability of Zr-bearing supercooled melts: *in situ* high-T XAS indicates molecular scale transformations about 30°C below the onset of crystalline nucleation of ZrO_2 [4].

These data about the versatile crystal chemistry of Zr in glasses complement previous information about the modification of Zr-surrounding with glass polymerisation [5]. They provide a structural model for the "zirconium complexing" in magmas and the large variability of zircon saturation in felsic liquids as a function of alkali activity [6].

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