

Grazing incidence X-ray diffraction study of products formed on (100) crystal face of pyrite

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Five pyrites with original crystal face of (100) in different tarnish color were selected from one pyrite-bearing ore sample from Tongling multi-metal deposit, Anhui, China. They are blue mottled with violet, yellow mottled with red, yellow, henna mottled with dark violet, and reddish brown in color. They may represent different oxidizing degree of pyrites. The grazing incidence X-ray diffractometry (GIXD) were used to study substances formed or precipitated on the surface of pyrite (100) face during chemical weathering. It can tell us two aspect of information, one is mineral phase, and another is how mineral phase changes from the outermost to body. GIXD measurements were performed on a Bede D1 diffractometer with a micro-source X-ray generator whose beam size is 300 μ m in diameter. The incident angle were fixed at 0.05°, 0.1°, 0.2°, 0.4°, 0.6° up to 2°. The qualitative phase analyses for substances on the outermost surface of pyrites show that the different minerals and/or amorphous substance are present with respect to different tarnish color. Products formed or precipitated on the surface of pyrite (100) face could be put into sulphur-bearing or iron-bearing hydrated oxide mineral group. The gypsum, pyrrhotite, melkicovite, covellite and jalpaite are included in sulphur-bearing group. The goethite, goldichite and fibroferrite may be included into iron-bearing hydrated oxide group. The gypsum and pyrrhotite etc. presented on the surface imply that sulphur were oxidized to sulphate and part of sulfur was brought into surrounded water, or reduced to sulphide and formed a sulphur-poor layer on the pyrite. According to analyzing a series of GIXD patterns obtained at different angle of incidence for a single pyrite, mineral assemblage may differ from surface to body. Taking the reddish brown one as the example, four diffraction profiles at 0.2575, 0.22105, 0.19118 and 0.1613nm are present at the pattern of a 2° incident angle whereas they can not be found at the GIXD angle smaller than 0.6 degree for the reddish brown pyrite. It may suggest that different mineral assemblages formed during different weathering layer from surface to the body.

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