

LETTER

Determination of the oxidation state of Cu in substituted Cu-In-Fe-bearing sphalerite via μ -XANES spectroscopy

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ABSTRACT

In situ spatially resolved X-ray absorption near edge structure (μ -XANES) spectra are obtained for natural Cu-In-bearing sphalerite. Copper *K*-edge spectral data show that, in Cu-In-bearing sphalerite, in which an excellent correlation between the Cu and In contents is noted, Cu is present in the Cu⁺ state. This offers indirect proof for the coupled substitution $2\text{Zn}^{2+} \leftrightarrow \text{Cu}^+ + \text{In}^{3+}$, which allows indium to enter the sphalerite structure. The study clearly demonstrates the utility of synchrotron radiation to accurately determine oxidation state in small volumes of mineral in which the concentration of the element of interest is low or very low. The study also demonstrates that good quality μ -XANES spectra can be collected on TEM foils prepared in situ at a chosen position on the surface of a polished sample using the focused ion beam–scanning electron microscope method.

Keywords: Sphalerite, XANES, copper substitution, oxidation state