

IDENTIFICATION OF Fe^{2+} IN THE M(4) SITE IN CALCIC AMPHIBOLES

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The occurrence of Fe^{2+} in the predominantly Ca-filled M(4) site of calcic amphiboles is indicated from the optical spectra of these minerals by absorption bands at 1030 nm mostly in β -polarization and 2470 nm in α -polarization. The greater intensity of the 1030 nm band in most spectra provides the first indication that Fe^{2+} occurs in the highly distorted M(4) site. Although the Fe^{2+} content of this site is not known, electron microprobe and Mössbauer data provide constraints to determine lower limits for the absolute intensity of the 1030 nm band, defined in terms of molar absorptivity, ϵ . An ϵ value of at least 40 is obtained which is similar to the orthopyroxene M(2) site value, but is about an order of magnitude larger than the ortho- and clinopyroxene M(1) site values. A number of calcic amphibole spectra show that the 1030 nm and 2470 nm bands correlate in intensity and therefore have a common Fe^{2+} origin. Their locations are consistent only for an assignment to a large site. Absorption bands due to Fe^{2+} in the large M(2) sites in pyroxenes and M(4) sites in the Mg-Fe amphiboles occur in the 1000 nm and 2000 nm regions. Absorption bands due to Fe^{2+} in the smaller sites in these minerals do not occur at wavelengths greater than 1200 nm. Spectral data show that the Fe^{2+} content of the M(4) site varies among the calcic amphiboles. In particular, Fe^{2+} has been found in the M(4) site in all amphiboles of the actinolite-tremolite series studied in this laboratory.