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Abstract

Use of Fourier-transform infrared (FTIR) spectroscopy as an accurate, quantitative method to measure concentrations of hydrous species in minerals requires consideration of the anisotropic interactions of minerals with infrared light. This is normally accomplished by determining the orientation of a crystal in advance and then sectioning it perpendicular to its optic axes. Here we demonstrate a method that uses at least three randomly oriented grains, considered to be multiple samples of a homogeneous population. We explain the theory whereby (1) the orientations of the polarization vectors of measurements taken on these grains are determined by comparison to oriented standards of the same mineral, and (2) the principal-axis spectra of the sample are synthesized from the randomly oriented spectra. By comparison to complementary electron-backscattered diffraction (EBSD) data, we demonstrate that determination of orientations using the silicate overtone bands in FTIR spectra is accurate and precise. We apply the technique to determine the OH concentrations in a population of experimentally hydrated olivine grains.