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Mid-infrared optical constants of clinopyroxene and orthoclase derived from oriented single-crystal reflectance spectra

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Abstract

We have determined the mid-IR optical constants of one alkali feldspar and four pyroxene compositions in the range of 250–4000 cm^{-1}. Measured reflectance spectra of oriented single crystals were iteratively fit to modeled spectra derived from classical dispersion analysis. We present the real and imaginary indices of refraction (n and k) along with the oscillator parameters with which they were modeled. While materials of orthorhombic symmetry and higher are well covered by the current literature, optical constants have been derived for only a handful of geologically relevant monoclinic materials, including gypsum and orthoclase. Two input parameters that go into radiative transfer models, the scattering phase function and the single scattering albedo, are functions of a material's optical constants. Pyroxene is a common rock-forming mineral group in terrestrial bodies as well as meteorites and is also detected in cosmic dust. Hence, having a set of pyroxene optical constants will provide additional details about the composition of Solar System bodies and circumstellar materials. We follow the method of Mayerhöfer et al. (2010), which is based on the Berreman 4 × 4 matrix formulation. This approach provides a consistent way to calculate the reflectance coefficients in low-symmetry cases. Additionally, while many models assume normal incidence to simplify the dispersion relations, this more general model applies to reflectance spectra collected at non-normal incidence.

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