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What Lurks in the Martian Rocks and Soil? Investigations of Sulfates, Phosphates, and Perchlorates

Reflectance spectroscopy and optical functions for hydrated Fe-sulfates†

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Abstract

Visible and near-infrared wavelength (VNIR, $\lambda = 0.35–5$ μm) laboratory diffuse reflectance spectra and corresponding optical functions (real and imaginary refractive indices) for several iron sulfates (natural K- and Na-jarosite, szomolnokite, rhomboclase) are presented. On Mars, jarosite has been identified in Meridiani Planum, Mawrth Vallis, Melas Chasma, and Eridania Basin; szomolnokite has been found as distinct layers at Columbus Crater and as outcrops at Juventae Chasma, and rhomboclase has been identified at Gusev Crater. Constraining the mineralogy and chemistry (Fe- vs. Mg-rich) of the sulfates on Mars may contribute to our understanding of the environmental and aqueous conditions present on Mars during their formation. The data presented here will help to constrain the mineralogy, abundance, and distribution of sulfates on the martian surface, which will lead to improvements in understanding the pressure, temperature, and humidity conditions and how active frost, groundwater, and atmospheric processes once were on Mars.

Keywords: Jarosite, szomolnokite, rhomboclase, optical constants, visible to near-infrared wavelength, laboratory diffuse reflectance spectroscopy