Measurement of the Optical Constants of Gypsum from Mid-Infrared to Visible for Modeling of Martian Deposits

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Recent and on-going remote and in situ observations indicate that sulfates are present in significant abundances at various locations on Mars. Data from both the spectrometers OMEGA (Mars Express) and CRISM (Mars Reconnaissance Orbiter) have pro-vided spectral evidence for the presence of gypsum and various hydrated sulfates on the Martian surface. Thus, the optical properties of sulfates, in general, are of interest to quantitative interpretation of this increasing volume of remotely sensed data. This is because optical constants represent the fundamental values used in radiative transfer calculations describing a variety of physical environments, such as atmospheres where aerosols are present, planetary and satellite regoliths.

Here we focus upon gypsum because of its applicability due to its identification on Mars and, most importantly, there is a general lack of data regarding the optical constants for gypsum at visible and near-infrared wavelengths that are being observed by OMEGA and CRISM.

Optical constants have been retrieved starting from diffuse reflectance measurements and by applying two different scattering theories. We compare the results of these two with each other, and with imaginary indices of gypsum reported in the literature. We find that the scattering theory results are more sensitive in the infrared to weak spectral. However, they provide a poor determination of the optical constants in the regions of relatively strong absorptions. We combine the results of the scattering theories with previous infrared results and calculate average n- and k-values. By comparing these with k-values estimated from transmission measurements we find a remarkably good agreement.

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2nd International Workshop - Exploring Mars and its Earth Analogues
June 19-23, 2007
Centro Congressi Panorama
Trento, Italy