

TEMPERATURE-DEPENDENCE OF VISIBLE TO NEAR-INFRARED SPECTRAL PROPERTIES OF MINERALS UNDER SIMULATED AIRLESS BODY CONDITIONS. A. M. Kling¹, K. A. Shirley¹, T. D. Glotch¹ ¹Stony Brook University, (alexander.kling@stonybrook.edu).

Asteroids and other airless bodies within our solar system are increasingly targets for spacecraft remote sensing and sample return missions. Aboard these spacecrafts are a variety of spectroscopic instruments that can analyze these airless bodies across the wavelengths of light, Visible and near-infrared (VNIR) reflectance spectra are useful for detecting Fe-bearing silicates, including olivines and pyroxenes as well as hydrated minerals, including phyllosilicates and sulfates.

The purpose of this study is to observe the temperature dependence of VNIR reflectance spectra under simulated asteroid conditions. This study builds off the work of Hinrichs and Lucey (2002), who demonstrated changes in band shape and position over a wide range of temperatures for major Fe-bearing mineral. In this study, we cover a narrower range of temperatures most relevant to the study of near-Earth asteroids, ~ 0 to 100 °C.

All VNIR spectra were measured under simulated airless body conditions using the Planetary and Asteroid Spectroscopy Environmental Chamber (PARSEC) at Stony Brook University. These conditions consisted of vacuum pressures of ~1E-6 mbar, a cold shield temperature of < -100 °C, and heating from below to reach desired sample temperatures. A borosilicate glass window was also placed in front of the solar lamp to cut off light at > 2.5 microns and prevent heating of the samples from above. Results for coarse grained forsteritic olivine (180-250 μm) are shown in Figure 1. There is a clear trend showing that the band depth of the crystal field bands, spectral features caused by the transition of Fe²⁺ in the mineral structure, tended to increase with increasing temperature. However, over the temperature range measured, the changes to the spectra are minor.

Determining the extent that temperature affects VNIR reflectance spectra could influence the creation of spectral libraries for current and planned missions. The relatively minor changes observed in this work of spectra of coarse grained particulates (180-250 μm) suggest that for temperature ranges relevant to near-Earth asteroids, adjustment to spectral libraries to account for different sample temperatures will not be required. Preliminary data involving fine grained particulates (< 32 μm) are inconclusive but further work will be done to determine if this observed trend with coarse material is also true for fine material.

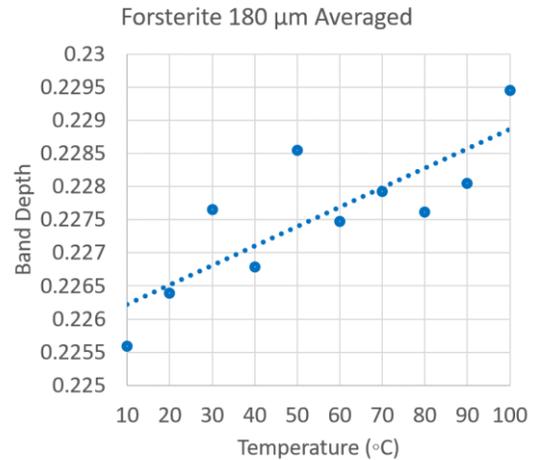


Figure 1. Plot of the band depth of crystal field bands vs. sample temperature of forsteritic olivine.

References:

- Hinrichs, J. L., Lucey, P. G. (2002). Temperature dependent near-infrared spectral properties of minerals, meteorites, and lunar soil. *Icarus*. 155, 169-180. doi:10.1006/icar.2001.6754