

DEVELOPMENT OF A SAMPLE CHAMBER FOR THERMAL INFRARED EMISSION SPECTROSCOPY, D. L. Anderson, J. Carpenter, P. R. Christensen, and P. W. Barbera, Department of Geology, Arizona State University, Tempe, AZ 85287-1404

Remote sensing of planetary surface composition is one of the primary objectives of the Mars Observer mission. The Thermal Emission Spectrometer (TES) is one of the principal experiments through which chemical and mineralogical data will be acquired. As part of the effort to prepare for interpretation of the TES spectra, we have developed a laboratory sample chamber for collection of infrared emission spectra of martian candidate materials.

Much work has been done toward the interpretation of thermal emission spectra from airborne spectrometers [1-4]. This interpretation depends heavily on comparison of the remotely sensed data to laboratory spectra of both rock specimens collected from the study area and monomineralic laboratory samples. Laboratory and remote sensing collection conditions must closely match for successful comparison of the data. The present study has focussed on the laboratory conditions of spectra collection.

A sample chamber, modelled somewhat after Brown and Young[5], has been designed for collection of laboratory spectra. Their chamber was designed for collection of spectra at ambient temperature. The current design focuses on collection of spectra over a range of temperatures which will be seen by TES. The key to any such chamber is the baffling of any incoming energy which will reflect off the surface of the sample. If this energy is reflected into the spectrometer, it will add unwanted spectral characteristics to the collected spectra.

The chamber consists of a canister with a 2 cm diameter aperture on the sample and a 0.2 cm diameter aperture on the spectrometer side through which the field of view is focussed and collimated into the spectrometer. The walls of the chamber are painted with Cadillac black paint and cooled to liquid nitrogen temperatures. The aperture on the sample side is covered by a window and the sample is bathed in dry nitrogen gas at the same temperature as the sample to minimize temperature gradients at the sample surface. The shape of the chamber closely approximates a blackbody cavity. This, combined with the cooling of its walls, minimizes any reflected energy.

The sample chamber is attached to the emission port of a Mattson Cygnus 100 fourier transform infrared spectrometer. The spectrometer contains a KBR beamsplitter and a DTGS detector. Spectra are collected from 6 to 20 μm at 2 wavenumber resolution. Spectral calibration and analysis are performed on a workstation attached to the spectrometer.

The following sample collection and calibration procedure are used for each spectra collected. The sample is heated in an oven to the desired temperature. Spectra of both sample and a calibrated blackbody at the sample temperature are collected. Slight variations between sample and blackbody temperatures are corrected by accounting for the differential blackbody effect in a fourier transform spectrometer. Finally, the temperature corrected sample and blackbody data are ratioed to produce emissivity spectra.

These calibrated emissivity spectra will be shown and compared to infrared microscope single crystal transmission spectra and to airborne spectra collected of the samples in Kelso-Baker region of the Mohave desert.

References. [1] Abrams, M., et al, *J. Geophys Res. B*, in press. [2] Kahle, A., et al (1988) *J. Geophys Res.*, 93, B12, 15,239-15,251. [3] Bartholomew, et al (1989) *Int. J. Remote Sensing*, 10, no. 3, 529-544. [4] Christensen, P. R., and Thliveris, S. (1989), *Lunar Planet. Sci. XX*, 155-156. [5] Brown, R. J. and Young, B. G. (1975) *Appl. Opt.*, 14, 12, 2927-2934.