SPECTRAL CHARACTERIZATION OF ANALOG SAMPLES IN ANTICIPATION OF OSIRIS-REx'S ARRIVAL AT BENNU

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Introduction: NASA's Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer (OSIRIS-REx) mission successfully launched on September 8th, 2016. During its rendezvous with near-Earth asteroid (101955) Bennu beginning in 2018, OSIRIS-REx will characterize the asteroid's physical, mineralogical, and chemical properties in an effort to globally map the properties of Bennu, a primitive carbonaceous asteroid, and choose a sampling location [e.g. 1]. In preparation for these observations, analog samples were spectrally characterized across visible, near- and thermal-infrared wavelengths and were used in initial tests on mineral-phase-detection and abundance-determination software algorithms.

Analog Samples: Analog samples in this study included physical mixtures of minerals and a suite of carbonaceous chondrites. All terrestrial minerals and meteorites were acquired from the Smithsonian Mineral and Meteorite Collections. The terrestrial minerals chosen had the closest practical match in composition to minerals known to be in chondritic meteorites. The chosen suite of carbonaceous chondrites was comprised of low petrologic types that had experienced varying degrees of aqueous alteration.

Experimental Methods: Thermal infrared (TIR) emissivity measurements were made under ambient and simulated asteroid environment (SAE) conditions using the Simulated Lunar Environment Chamber (SLEC) at the University of Oxford. Thomas et al. [2,3] has previously described the experimental setup, environmental conditions, and calibration of SLEC. TIR spectra were collected at a resolution of 4 cm^{-1} from ~400 to 2400 cm^{-1}.

Results: Emissivity spectra in Fig. 1 show the utility of TIR spectral features for distinguishing between meteorite types and samples dominated by primary silicates versus hydrated silicates. Previous laboratory studies have demonstrated the importance of making TIR spectral measurements under the appropriate near-surface conditions [e.g. 2,3]. A comparison of Allende spectra measured under ambient and SAE conditions in Fig. 1 shows a noticeable increase in spectral contrast in diagnostic features in the SAE spectra. Comparisons of SAE and ambient spectra for the other carbonaceous chondrites show that the degree to which the spectral contrast increases correlates with meteorite type. Thus, using spectra measured under ambient conditions to interpret surface compositions could lead to large uncertainties in the estimated modal abundances.

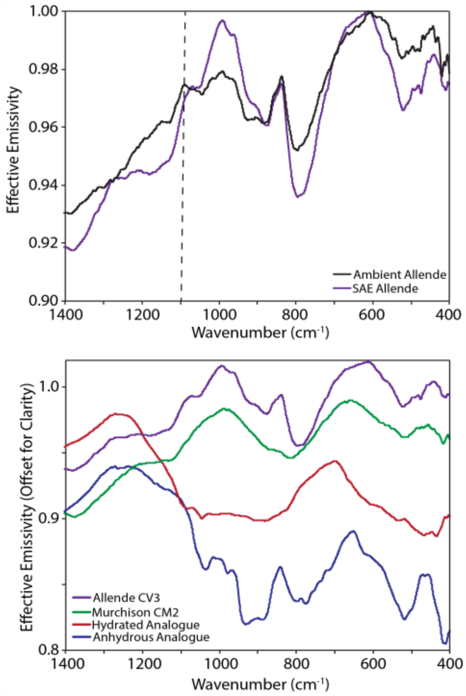

Figure 1. (Top) Ambient and SAE Allende spectra. **(Bottom)** Effective emissivity spectra of two of the physical mixtures and two CM meteorites measured under SAE conditions.

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References: [1] Lauretta D. S. et al. (2015) *Meteoritics & Planet. Sci., 50*, 834-849. [2] Thomas I. R. et al. (2012) *Rev. Sci. Instrum., 83*(12), 124502. [3] Thomas I. R. et al. (2014) *45th LPSC*, Abs. # 1989.