Taking Mercury in the lab – Measurements for MERTIS on the ESA mission BepiColombo

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The MERTIS (Mercury Radiometer and Thermal infrared Imaging Spectrometer) instrument on the ESA mission BepiColombo will study the surface of Mercury in the wavelength range from 7 to 14 µm. The analysis of the MERTIS data will be posing a number of significant challenges. To facilitate the development of analytic tools, support planned ground based observations and facilitate a cross calibration with other instruments on BepiColombo and MESSENGER, a list of Mercury analogue materials was compiled.[1] This set of analogue materials is based on our current knowledge of the surface composition of Mercury and includes plagioclase and potassium feldspars, low Ca and high Ca pyroxenes, olivine, elemental sulfur and as an extraterrestrial analogue a lunar highland soil sample.

Little is known about the grain size distribution of Mercury's regolith. The low spectral contrast observed in TIR spectra of Mercury might indicate a fine grain size on the order of a few tens of microns. Therefore our samples are prepared in four different grain size separates ranging from 0 to 250 µm to cover the expected grain size distribution on the surface of Mercury.

The spectral emission of all size separates between at least 7 and 22 µm (in the future 1-50µm) are acquired using an emissivity chamber attached to a recently acquired the Brucker VERTEX80v FTIR spectrometer (DLR Institute of Planetary Research, Berlin, Germany). The equipment, calibration, and measurement procedure have been described in detail in [2]. Currently a planetary simulation chamber is set up which will allow measuring the samples in vacuum at temperatures up to 700K comparable to Mercury surface temperatures.

Along with the thermal emission measurements of the pure analogue materials, we plan to perform thermal emission spectral studies of several mineral mixtures of various particle sizes. The goal of these studies will be the development of a reliable spectral deconvolution technique, which would enable us to derive mineral modal abundances from the MERTIS thermal emission spectra of the mature Mercury regolith.

References

[1] J. Helbert, L.V. Moroz, A. Maturilli, A. Bischoff, J. Warell, A. Sprague, E. Palomba *AdvSpR*, (2006).
[2] A. Maturilli, J. Helbert, L. Moroz, A. Witzke, *PSS.* **54**, 11 (2006).