MARTIAN ANALOGUES EMISSIVITY SPECTRA FROM THE BERLIN EMISSIVITY DATABASE (BED) IN THE [3-50] µm SPECTRAL REGION. A. Maturilli[1], J. Helbert[1]. [1]German Aerospace Center - Institute for Planetary Research, Rutherfordstr. 2, 12489, Berlin, Germany. alessandro.maturilli@dlr.de

Spectral Library: The Berlin Emissivity Database (BED) is a spectral library containing the emissivity measurements of several planetary analogues. It contains currently entries for plagioclase and potassium feldspars, low Ca and high Ca pyroxenes, olivines, elemental sulphur, common martian analogues (JSC Mars-1, Salten Skov, palagonites, montmorillonite, hematite, goethite) and a lunar highland soil sample measured in the wavelength range from 3 to 50 µm as a function of particle size. For each sample, the spectra of four well defined particle size separates (<25 µm , 25-63 µm, 63-125 µm, 125-250 µm) are measured with a 4 cm^{-1} spectral resolution. These size separates have been selected as typical representations for most of the planetary surfaces [1].

Laboratory set-up: The instrumentation is located in the Planetary Emissivity Laboratory (PEL) at the Institute for Planetary Research (PF) of the German Aerospace Center (DLR) in Berlin, Germany. It consists of a spectrometer attached to an external emissivity device. The Bruker VERTEX 80v spectrometer, has a very high spectral resolution (better then 0.2 cm^{-1}), and a resolving power of better than 300,000:1, and can be operated under vacuum conditions. To cover the entire 1 to 50 µm spectral range, two detectors, a liquid nitrogen cooled MTC and a room temperature DTGS and two beamsplitter, a KBr and a Multilayer are used to measure the same target.

The emissivity device is composed of the sample chamber, a double-walled box with three apertures: a 15 cm squared door used to insert the cup in the box, a 5 cm rounded opening through which the beam is directed to the spectrometer and a 5 cm opening facing the attached blackbody unit. A heater is placed in the chamber and is used to heat the cup with samples from the bottom. The thermal radiation emitted normal to the surface by the sample or the blackbody is collected by an Au-coated parabolic off-axis mirror and reflected to the entrance port of the spectrometer. Figure 1 shows the emissivity device attached to the spectrometer external port: the sample chamber is opened to show the parabolic mirror mounted on a mechanical arm and oriented toward the reference blackbody, the sample heater and the purging system.

A pump circulates water at a constant temperature in the volume between the inner and outer walls of the chamber. The surfaces of the box are painted with black high emissivity paint. The chamber is purged with dry air to remove particulates, water vapour and CO_2. Further details can be found in [2, 3].

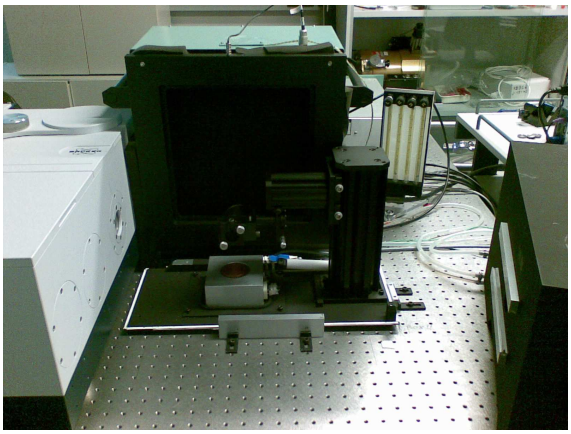

Figure 1. The emissivity device in the PEL laboratory, in Berlin, Germany.

Emissivity spectra: In Figure 2 an example of quartz measurements for two extreme grain sizes is shown, together with analogue measurements extracted from the ASU and ASTER spectral libraries. Complementary to the existing datasets (ASU and ASTER), the BED library sensibly extend both the investigated spectral range and the grain size ranges. The enormous difference between the spectra of the small and large fractions witness the need for such a complete dataset for a correct interpretation of remote sensing data.

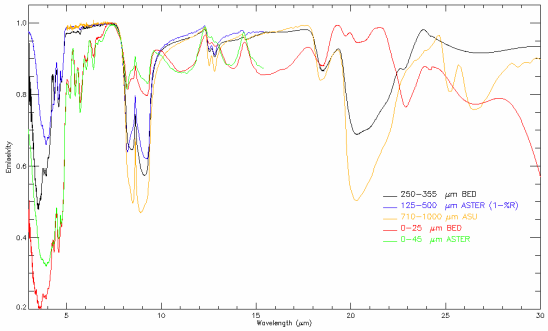

Figure 2. Comparison of quartz emissivity spectra from the BED, ASU, ASTER spectral libraries.

Martian analogues: The emission spectra of standard martian analogue materials like the JSC Mars-1 (a palagonitic tephra from Hawaii, USA), the Salten Skov (a Fe-oxide precipitate from the Midjutland region of Denmark), montmorillonite, hematite, goethite and some palagonites from Hawaii, USA, are shown and discussed in this paper.

References: [1] Helbert, J. et al. (2007), *ASR 40*, DOI:10.1016/j.asr.2006.11.004. [2] Maturilli, A. et al. (2006), *PSS 54*. [3] Maturilli, A. et al. (2007), *in press on PSS*.