SPECTROSCOPIC MEASUREMENTS ON ASTEROID ANALOGUES AT THE PLANETARY EMISSIVITY LABORATORY (PEL).

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Introduction: The Hayabusa 2 mission will be the next step in a series of increasingly daring asteroid missions. Spectroscopic measurements of asteroid analogue materials under relevant condition and dedicated laboratory experiments (reproducing asteroid physics and chemistry) can help to increase the scientific return of such missions.

Experiments at PEL: At the Planetary Emissivity Laboratory (PEL) of the German Aerospace Center (DLR) in Berlin we can measure emissivity, reflectance and transmission of solid or powdered samples along the whole extended spectral range that goes from the visible (from 0.4 μm) to the far-infrared (above 100 μm).

In an ongoing effort to build up a spectral library of interest for remote sensing or in situ studies of asteroid surface, we performed a series of reflectance and emissivity measurements in vacuum (for T_{surf}=373K) on 10 commonly considered analogues [1]. Liquid formamide was mixed to meteoritic powder, the mixture heated at 500K to study possible chemical reactions happening on asteroid surfaces: we spectrally detected the early stages of thermal degradation of formamide. The degradation products may then, in suitable conditions, polymerize to give rise to the formation of biomolecules [2]. To simulate the thermal history of the minerals exposed on asteroids surface, we heated in vacuum sulfates, carbonates, and phyllosilicates to 500K, detecting important variations in the emissivity and reflectance spectra of heated materials [2]. Emissivity and reflectance measurements of 2 asteroid analogues, meteorite Millbillillie and a synthetic enstatite, have been measured, in air and in vacuum with emerging angle (e) from 0° to 60°: for all the cases we found that the first important step of spectral changes occur around e=40°, and each successive 10° increment of e shows significant spectral modifications respect to the previous value of emerging angle e [3].

References: [1] Maturilli. A. et al. 2012. Abstract #1906. 45th American Geophysical Union Fall Meeting. [2] Maturilli. A. et al. 2014. Abstract #1341. 45th Lunar & Planetary Science Conference. [3] Maturilli. A. et al. 2014. Abstract #1352. 45th Lunar & Planetary Science Conference.