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Emissivity and reflectance spectra of sulfide-bearing samples: new constraints for the hermean surface composition.

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The spectral characterization of planetary surfaces needs sets of laboratory's experiments to better characterize and model the properties on analogues or extraterrestrial material. Despite the differences in composition, the environmental condition, e.g. temperature and pressure, is also an important variable to consider on those laboratory experiments.
Mercury has an atmosphereless surface with a temperature excursion from 180K to 730K and the MESSENGER mission has revealed some particular characteristics on the elementary composition of the its surface. It has been evidenced that the hermean igneous silicate rocks are Mg-richer and Al, Ca and Fe-poorer than Moon and Earth, and enriched in volatiles and alkalis (e.g. Nittler et al. 2018, and reference therein). Moreover, relatively high volatile abundances has been measured. In particular, the unexpected presence of S, suggests the presence of sulfides (Nittler et al. 2018, and reference therein), with some high concentration in conjunction with high amounts of Ca and Mg.
Helbert et al. (2013) already demonstrated how Visible and Near-Infrared (VNIR) spectral properties of sulfides are modified by the heating at hermean temperatures, and how the temperature acts differently on sulfides with variable chemistry.
We thus propose spectra of reflectance and emissivity of mixtures composed of a Mg-rich silicate and a sulfide component in the VIS-MIR (Visible-Mid Infrared) and in the TIR (Thermal Infrared) ranges acquired at PSL (Planetary Spectroscopy Laboratory) at DLR, Berlin.
Taking into account the MESSENGER results we selected two suitable end-members: a Mg-rich gabbronorite sample (Secchiari et al. 2018) and a Ca-sulfide, both reduced to fine grain size (<63 μm). We prepared mixtures with increasing sulfide abundances (20, 40 and 60 wt% respectively). Emissivity spectra were acquired at four different temperatures, 373K, 473K, 573K and 673K and low pressure enviroment (0.8 mbar); reflectance spectra (i=13°; e=17°) were acquired at room temperatures and low pressure for all the samples before and after heating.
Preliminary results evidence the temperature effect on the emissivity spectra at four different temperatures, showing how spectral features are affected by the sample temperature. Moreover it is evident as Christiansen Features and Reststrahlen Bands are influenced in a different way by the relative abundance of sulfide/silicates. Reflectance spectra show some variations on the samples in the VNIR with a reddening and an absorption weakening after the heating.
This work will help to define indicators useful to analyze remote sensed data for the future Bepicolombo mission where both VNIR reflectance and TIR emittance will be measured by VIHI (Visible and Infrared Hyperspectral Imager) and MERTIS (Mercury Radiometer and Thermal Imaging Spectrometer). Moreover, we will contribute to the creation of a spectral library to compare results from orbit, integrating the information from the two spectral ranges.

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