
Introduction: A major result of the MESSENGER mission was to reveal the volcanic hermean surface poor in iron [1], but unexpectedly rich in volatile elements [2]. The high abundance of sulfur on Mercury is particularly interesting, because its sublimation is suggested to trigger the formation of hollows [3]. Laboratory experiments whose aim is to study the evolution of sulfides in the conditions of Mercury's surface are in progress [4]. However, to understand the spectral properties of the surface we need to consider how minerals can be affected by the hermean environment. We present a preliminary study to focus on the effects of these extreme conditions, in particular the strong variations of temperature. The effects of temperature and space weathering on minerals have been already studied [5,6] but rarely at Mercury’s conditions [7].

Samples and Setups: We began our activities measuring a loose powder (75-100 µm) of plagioclase Pl3 and 5 mm diameter pellets made with the same Pl3 powder. To simulate the hermean high T conditions, we used a LINKAM (nitrogen purged) cell to heat and cool our samples which allows to measure VIS-IR (0.4-15 µm) spectra as a function of temperature (298K-623K). Finally, we used two setups for our spectroscopic analyses: 1) a visible-near infrared spectrometer Maya2000 Pro coupled with a microscope through optical fibers; 2) a near to mid infrared spectrometer coupled with an Agilent microscope, installed at the SMIS beamline [9] of the synchrotron SOLEIL.

Analytical Method: In a typical heating experiment, the powder or the pellet was placed inside the purged heating cell and reflectance spectra were recorded every 50K of increasing temperature. The heating ramp was 5K/min, with a 10-20 min plateau to record the spectrum at a given temperature. A similar cooling cycle was then performed and spectra were measured as a function of decreasing temperature from 623K to 302K.

Preliminary Results: Figure 1 shows the thermal infrared where the Christiansen feature (CF) and the Reststrahlen absorption bands (RB) of silicates are studied. A preliminary qualitative analysis showed a shift towards greater wavelengths for several RB peaks (e.g. at ~9.0 and ~10.5 µm) as a function of increasing T, whereas the CF does not shift. A more quantitative analysis will be presented and discussed.

Future activities: In the next future, we plan to perform more heating experiments to study the evolution of natural minerals, as well as synthetic Mercury-like glasses [10] at temperature during day time. In addition, we consider to take measurements in cold conditions as it is the case on the floor of polar craters of Mercury. Finally, we plan to irradiate our samples with 40 keV ion beams with different fluences as a simulation of slow solar wind irradiation of Mercury.

Acknowledgements: This work is partly supported by the Centre National d’Études Spatiales. The microspectroscopy activities are supported by grants from Région Ile-de-France (DIM-ACA V) and SOLEIL. D. Perna received funding from the European Union’s Horizon 2020 research & innovation programm under the Marie Sklodowska-Curie grant agreement n.664931.