Space weathering on Mercury: An integrated TEM, FTIR and Raman study

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Here, we report on the in situ analyses of laser irradiation products obtained from olivine pellets. The experiments were conducted in order to simulate the effects of micrometeoroid impacts (space weathering) on airless planetary bodies in the framework of the BepiColombo mission. Space weathering is expected to be a major factor affecting the surface properties of the planet closest to the Sun, but the results are also of high importance for the interpretation for remote sensing and sample return data for other atmosphere-less planetary bodies (such as the Moon, Vesta, asteroids in general and comets) [1].

A special focus is on processes effective in the MIR range of the onboard Mercury Radiometer and Thermal Infrared Spectrometer (MERTIS). This device will allow to determine the mineralogy of the surface of Mercury directly at high spatial resolution in the wavelength range from 7 to 14 μm [2]. We will present a systematic correlated FIB/TEM, micro-Raman and FTIR study of a series of synthetic and natural (San Carlos) olivine irradiated using a 1064 nm Nd:YAG laser under Mercury conditions. Recondensing vapor was collected on a wafer and on in situ placed TEM grids. First TEM analyses of an irridiated synthetic forsterite grain show that ballistically ejected fragments remain crystalline, but have an amorphous envelope from quenched melt. Among condensed vapor, both crystalline and amorphous phases occur. FTIR studies of spots on the same pellet surface also indicate structural and thus spectral changes between 10 and 11.3 μm. Weakening of characteristic silicate bands and peak broadening may indicate the formation of amorphous phases, or gradual loss of a crystalline structure [3].

Here, we will compare our TEM, FTIR and Raman data for the whole range of experiments with a further series of similar analyses of pyroxenes.

[1]Domingue D. et al. (2014) *Space Sci Rev* (**181**) 121–214 [2]Benkhoff et al. (2010) *Planet Space Sci* (**58**) 1-326. [3]Stojic et al. *LPSC* 2015