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Infrared and Raman spectroscopy on synthetic glasses as analogues of planetary surfaces.

Iris Weber (1), Andreas Morlok (1), Stephan Klemme (2), Isabelle Dittmer (3), Aleksandra N. Stojic (1), Harald Hiesinger (1), Martin Sohn (3), and Jörn Helbert (4)

(1) Institut für Planetologie, WWU Münster, Germany (sonderm@uni-muenster.de), (2) Institut für Mineralogie, WWU Münster, Germany, (3) Hochschule Emden/Leer, Emden, Germany, (4) DLR, Institut für Planetenforschung, Germany

One of the fundamental aims of space mission is to understand the physical, chemical, and geologic processes and conditions of planetary formation and evolution. For this purpose, it is important to investigate analog material to correctly interpret the returned spacecraft data, including the spectral information from remote planetary surfaces. For example, mid-infrared spectroscopy provides detailed information on the mineralogical compositions of planetary surfaces via remote sensing. Data is affected by numerous factors such as grain size, illumination geometry, space weathering, and temperature. These features need to be systematically investigated on analog material in terrestrial laboratories in order to understand the mineralogy/composition of a planetary surface. In addition, Raman spectroscopy allows non-destructive analyses of planetary surfaces in the case of a landing mission.

Our work at the IRIS (Infrared spectroscopy for Interplanetary Studies) laboratory at the Institut für Planetologie produces spectra for a database of the ESA/JAXA BepiColombo mission to Mercury. Onboard is a mid-infrared spectrometer (MERTIS-Mercury Radiometer and Thermal Infrared Spectrometer). This unique instrument allows us to map spectral features in the 7-14 μm range, with a spatial resolution of $\sim$500 m [1-5].

Comparably, using our Raman spectrometer, we are continuously contributing to the Raman database for upcoming mission, e.g., the Raman Laser Spectrometer (RLS) onboard of ExoMars [6].

Material on the surface of Mercury and the other terrestrial bodies was exposed to heavy impact cratering [4]. Depending on the P/T conditions during the impact, minerals on planetary surfaces can react with the formation of glassy material. Thus, understanding the effects of impact shock and heat on the mineral structure and the resulting corresponding change in the spectral properties is of high interest for the MERTIS project.

Here, we present spectral information on the first glass produced, based on the composition of the Ca- and Mg-rich and Al-poor G1 region identified on Mercury with the X-ray spectrometer on MESSENGER [7]. For in situ mid-IR specular reflectance analyses, a Bruker Hyperion 2000 System with a (1000×1000) μm2 sized aperture was used. A Bruker Vertex 70 IR system with a MCT detector was applied for analyses of areas »1 mm under near vacuum conditions. Raman spectra will be collected with an OceanOptics IDR-Micro-532 spectrometer.

Our results show that the micro-FTIR reflectance data of two glassy regions provide a smooth feature that is typical for amorphous materials. Only very weak sharper crystalline bands occur on top of the feature at 10.1-10.2 μm and 10.5-10.6 μm. These bands are probably resulting from crystalline forsterite within a glassy matrix, because the crystalline bands at 10.1 and 10.5 μm are characteristic for nearly pure forsterite [8]. The Christiansen feature is at 8.2 μm. The spectrum of a larger region is basically a ‘bulk’ spectrum. Achieved under near-vacuum conditions this spectrum displays essentially similar characteristics.

References: [1] Maturilli A. (2006) Planet. Space Sci. 54, 1057–1064. [2] Helbert J. and Maturilli A. (2009) Earth Planet. Sci. Lett. 285, 347-354. [3] Benkhoff, J. et al. (2010) Planet. Space Sci. 58, 2-20. [4] Hiesinger H. et al. (2010) Planet. Space Sci. 58, 144–165. [5] Maturilli J. (2008) Planet. Space Sci. 56, 420–425. [6] Vago et al. (2012) Mars Concepts, Houston. [3] Hamilton V.E. (2010) Chem. Erde, 70, 7-33. [7] Charlier B. et al. (2013) Earth Planet. Sci. Lett. 363, 50–60.