DIFFUSE REFLECTANCE FTIR AND RAMAN SPECTROSCOPY OF SYNTHETIC GLASSES WITH MERCURY SURFACE COMPOSITION FOR THE BEPICOLOMBO MISSION. A. Morlok[1], S. Klemme[2], I. Weber[1], A. N. Stojic[1], M. Sohn[3], H. Hiesinger[1], J. Helbert[4] [1]Institut für Planetologie, Wilhelm-Klemm Strasse 10, 48149, Germany, [2]Institut für Mineralogie, Corrensstraße 24, 48149 Münster, Germany, [3]Hochschule Emden/Leer, Constantiaplatz 4, 26723 Emden, Germany, [4]Institute for Planetary Research, DLR, Rutherfordstrasse 2, 12489 Berlin, Germany

Introduction: At the IRIS (Infrared and Raman for Interplanetary Spectroscopy) lab produced spectra in the mid-infrared contribute to the database in progress for the future ESA/JAXA BepiColombo mission to Mercury. Onboard is a mid-infrared spectrometer (MERTIS - Mercury Radiometer and Thermal Infrared Spectrometer). This unique device allows a mapping of spectral features in the 7-14 µm range, with a spatial resolution of ~ 500 meter [1- 4].

Thereby obtained infrared spectra will help to determine the mineralogical composition of the planetary surface via remote sensing in addition to chemical data. Material on the surface of Mercury was exposed to heavy impact cratering in its history [4]. Glass, produced during these impacts, lacks a long - range ordered microstructure and is thus amorphous. It is a typically occurring phase generated during high shock pressure and temperatures events [5,6]. Using synthetically produced glasses of different chemical composition allows us to produce infrared spectra of analogue materials based on the observed chemical composition of planetary bodies, from which no material in form of meteorites is available so far.

Samples and Techniques: Glasses were synthesized based on the chemical composition for surface areas on Mercury, based on MESSENGER X - ray spectrometer data [e.g., 7]. Mixtures of major oxides (SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MgO) and carbonates ($CaCO_3$) were prepared after the composition from remote sensing observations [7]. The finely ground powder was slowly heated to 1000°C to decarbonate the sample and subsequently vitrified in a vertical furnace at 1500°C for 2h and quenched immediately subsequently.We used chemical data for the Caloris Basin Interior (CBC), areas of Intermediate composition (IC), and the High Magnesium region (HMC) [7, 8].

Infrared Spectroscopy: For the FTIR diffuse reflectance analyses, powder size fractions 0-25 µm, 25-63 µm, 63-125 µm and 125-250 µm were measured.
For mid-infrared analyses from 2-20 µm we used a Bruker Vertex 70 infrared system with a MCT detector. Analyses were conducted under low pressure (3 mbar) to avoid atmospheric bands

*Raman Spectroscopy***:** In order to characterize the glasses and inclusions, Raman analyses were conducted using an Ocean Optics IDR - Micro Raman system. The laser excitation is 532 nm in a range from 200 cm^{-1} to 2000 cm^{-1}. The used 40 x objective results in a spotsize of ~ 5 µm. All measurements were carried out at a laser power of 1.8 mW. Every spectrum is a result of 3 single spectra each integrated over 10 seconds. All investigations were made on polished thick sections, which were first documented with a KEYENCE Digital Microscope VHX-500F for a first overview and classification and to facilitate subsequent orientation on the sample surface.

Results: *Diffuse Reflectance:* SiO_2-rich samples for the IC and CBC regions show spectra typical for highly amorphous material, with only one strong feature dominating in the region of interest (at 9.8 µm for the CBC and 9.9 µm for the IC regions). HMC, with significant higher MgO-contents has already strong, sharp features of a crystalline forsterite component at ~10.1 µm and 10.5 µm [9].The Christiansen-Feature, a reflection - minimum, shifts in relation to the SiO_2 content from 8.3 - 8.4 µm for the SiO_2 poor HMC region to 8.1 µm (IC) and 7.9 - 8.0 µm (CBC) in the SiO_2 enriched parts [10].

Raman: Raman spectra from CBC and IC show typical glass spectra, indicated by two main broad peaks around 400 cm^{-1} - 700 cm^{-1} and 850 cm^{-1} - 1250 cm^{-1} (Fig. 2) [11]. Detailed Raman spectroscopy of HMC confirm the existence of olivine with typical Raman double peak at 823 cm^{-1} and 856 cm^{-1}[12]. In addition, a mixture of ilmenite and magnetite results in a shift at ~ 700 cm^{-1} (Fig. 3) [13]. The glassy matrix, in which the idiomorphic olivine and the mixture of magnetite and ilmenite are located, can not be resolved with Raman spectroscopy.

	CBC	IC	HMC
SiO_2	58,18	54,87	50,97
TiO_2	0,55	0,52	0,48
Al_2O_3	16,97	14,06	4,50
Fe_2O_3	0,77	2,20	3,40
MnO	0,14	0,13	0,13
MgO	12,63	19,99	29,63
CaO	5,71	5,74	7,33
Na_2O	3,67	3,46	3,21
	98,62	100,96	99,65

Tab.1: Chemical composition of the surface areas on Mercury, based on MESSENEGR data. Data are given in wt%.

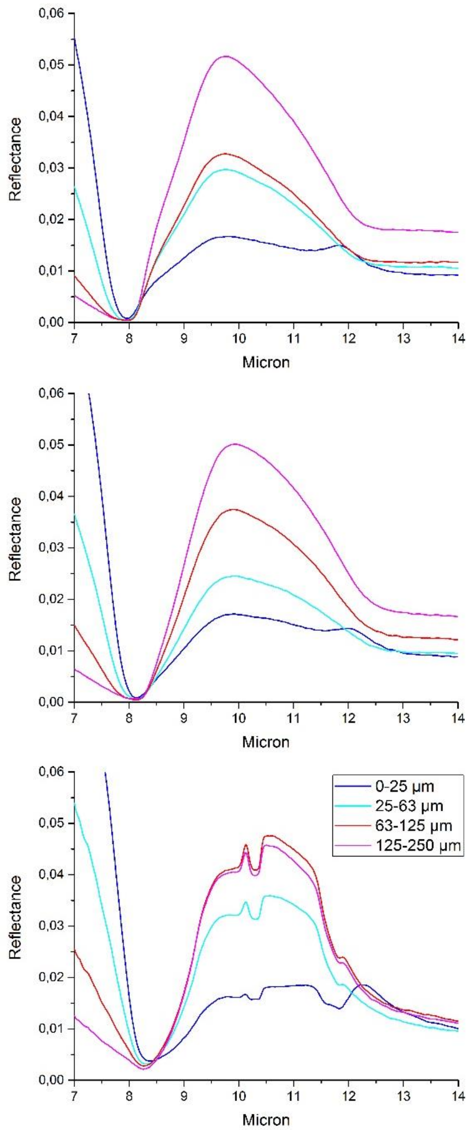

Fig. 1: Mid-infrared diffuse reflectance spectra of the CBC (Top), IC (Middle), HMC (bottom) regions on Mercury [7].

Conclusions: Raman spectra of the two glasses (CBC, IC) show broad peaks, which can be separated in a low wavenumber and high wavenumber type in the Raman data. These peaks and the CF in IR shift in dependence to the SiO_2-content [10,11].

Raman spectra of the HMC sample confirm that it consists mostly of crystalline material. An olivine composition of Fo90 can be inferred from exact peak positions of olivine in Raman and FTIR spectra.

More investigations of samples with varying SiO_2-content will be presented at the meeting.

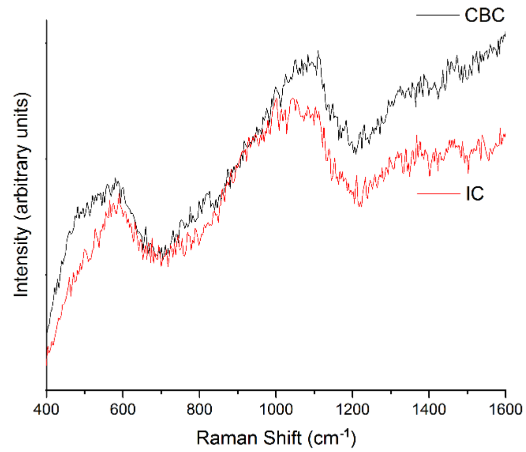

Fig. 2: Raman spectra of glass of CBC and IC.

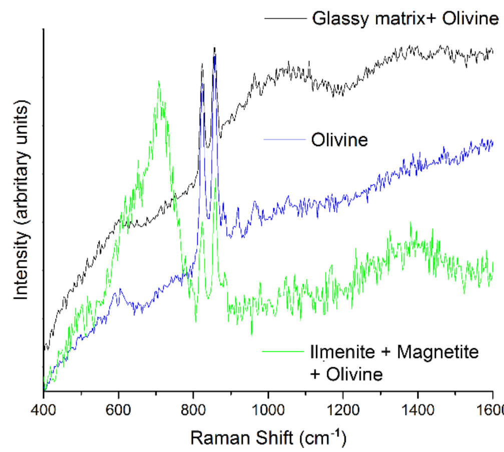

Fig. 3: Raman spectra of the different components of HMC.

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