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Mineral powder samples for solar wind ion sputtering experiments relevant for Moon and Mercury

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The surfaces of Mercury and Moon are thought to be similar in terms of being rocky, regolith covered planetary bodies, dominated by pyroxene and plagioclase (Taylor et al. 1991, McCoy et al. 2018). Contrary to the Moon, Mercury possesses a global dipole magnetic field, resulting in a highly dynamic magnetosphere that varies surface exposure to solar wind ions and energetic electrons (Winslow et al. 2017, Gershman et al. 2015). The energy of these particles is thereby transferred and material is sputtered from the surface (Sigmund 2012), providing the main contributions to the exospheres of the Moon and Mercury. Parametrizing the underlying sputtering processes is of great interest for successfully linking exosphere observations with surface compositions (e.g. Wurz et al. 2010, Merkel et al. 2018).

The understanding of sputtering from the kinetic energy transfer is sufficient to predict sputter yields of singly charged impinging ions on conducting surfaces (e.g., Stadlmayr et al. 2018). Hijazi et al. (2017) and Szabo et al. (2018) have also made advancements on potential sputtering, investigating the interaction of multiply charged ions with glassy thin films. We expand on their studies and use mineral powder pellets as analogues for sputtering experiments relevant to the surfaces of the Moon and Mercury. The powder pellets include plagioclase, pyroxene, and wollastonite. The latter is a pyroxene-like Ca-rich mineral with Fe contents below detection limits, which allows investigating the effect on reflectivity during sputtering of Fe-free minerals. With these analogues, we strive to supply infrared spectra with a focus on the robust mid infrared (MIR) range for Mercury and sputter yields for both the Moon and Mercury.

First results of irradiated mineral pellets include MIR spectra of the minerals before and after irradiation as well as sputtering yields and visual alteration effects. So far, no relevant changes in the MIR spectra were observed nor any visual alteration of wollastonite. The first irradiation with 4 keV $^{4}He^{+}$ reached a fluence of about 29 E+20 ions per m^2 at an angle of 30°. Presumably, the lack of visual alteration is due to the absence of Fe in wollastonite. Further results are expected to bring clarity in the reaction of pellets to irradiation and if their sputtering characteristics differ from those of glassy thin films.

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