EGU21-2704
https://doi.org/10.5194/egusphere-egu21-2704
EGU General Assembly 2021


# The effects of graphite and particles size on reflectance spectra of silicates

**Enrico Bruschini**[1], Cristian Carli[1], Fabrizio Capaccioni[1], Mathieu Vincendon[2], Anne-Cécile Buellet[2], Francesco Vetere[3,4], Arianna Secchiari[5], Marco Ferrari[1], Diego Perugini[4], and Alessandra Montanini[5]
[1]National Institute for Astrophysics, Institute for Space Astrophysics and Planetology, Rome, Italy (enrico.bruschini@inaf.it)
[2]IAS, Bâtiment 121, CNRS / Université Paris-Saclay, Orsay, France
[3]Institute of Mineralogy, Leibniz Universität Hannover, Callinstrasse 3, 30167 Hannover, Germany
[4]Department of Chemistry, Life Sciences and Environmental Sustainability University of Parma, Parco Area delle Scienze 157/a, 43124 Parma, Italy
[5]University of Perugia, Department of Physics and Geology Piazza Università, 06100 Perugia, Italy

Mercury is characterized by a globally low reflectance associated with remarkably low iron contents. Among several proposed hypothesis, to date, the most convincing explanation of the low reflectance of Mercury invokes mixing of an ancient graphite-rich crust with overlying volcanic materials via impact processes and/or assimilation of carbon into rising magmas during secondary crustal formation (e.g. Peplowski et al.2016). Even though until now graphite has not been directly observed, there are strong evidences suggesting its presence on Mercury's surface (e.g. Denevi et al.2009; Peplowski et al.2011). The actual presence of graphite within Mercury soil may have several implications, e.g. on the late accretion history of Mercury (Hyodo et al.2021; Murchie et al.2015) or on hollow formation (Blewett et al.2016). Moreover, silicates are often associated to carbon phases in some achondrites (e.g. ureilite, Nestola et al.2020, and references therein). Evaluating in a systematic way the effect of graphite on visible and near-infrared spectroscopy of mafic mineral absorptions is thus of interest to improve our understanding of Mercury remote sensing data, and to make progress in our capability to associate carbon-rich stony meteorites to their parent bodies. Mixing graphite with silicate materials is thought to basically decrease the contrast of reflectance spectra of these materials (Murchie et al.2015). Nevertheless, systematic works addressing the influence of graphite-silicate mixtures on their reflectance spectra are still lacking. Here we mixed microcrystalline graphite with a suite of silicate materials and measured their VNIR reflectance spectra. We selected three silicate end-member compositions, namely: 1) a synthetic glass with chemical composition close to the one inferred for of the volcanic products emplaced in the Mercury's northern volcanic plains (Vetere et al.2017), 2) a Mg-rich Gabbronorite with FeO < 3% (Secchiari et al.2018) and 3) a hawaiitic basalt (Pasquarè et al.2008). To decouple the effect of granulometry and graphite content, we produced and analyzed different granulometric classes (ranging between <50 μm and 250μm) for each end-member. In a second stage, we selected three granulometric classes (<50 μm, 75-100 μm and 150-180 μm) for each end member and we added graphite producing different samples with graphite – silicate weight ratio between 0-5% (0%, 1%, 2%, 3%, 4% and 5%) in order to encompass the inferred graphite content in

Mercury’s surface (Klima et al.2018). The results of our work confirm that graphite strongly decreases the contrast of the reflectance spectra of the silicate-graphite mixtures and, in most cases, has a negligible effect on the shift of the absorption bands. However the slopes of the reflectance spectra are greatly affected by the graphite content, which tends to decrease the slope of the spectra. Our systematic study will allow to gain a better understanding of the reflectance spectra of materials mixed with opaque phases in meteorites, space-weathered surfaces and rocky planetary bodies. In particular, this investigation is expected to have a strong impact on the interpretation of reflectance measurements of Mercury. Acknowledgments: Part of this research was supported by ASI-INAF Simbio-sys agreement. E.B. and C.C. are supported also by ASI-INAF 2018-16-HH.0 (Ol-BODIES) agreement.