EGU21-8701
https://doi.org/10.5194/egusphere-egu21-8701
EGU General Assembly 2021
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Analysis of organic compounds in Mars soil analog samples using SuperCam-Raman of Mars2020

Imanol Torre-Fdez[1], Teresa Fornaro[2], Julene Aramendia[1], Ann Ollila[3], and the Mars2020 SuperCam-Raman Science Group[*]

[1]University of the Basque Country (UPV/EHU), Faculty of Science and Technology, Department of Analytical Chemistry, Leioa, Spain

[2]INAF-Astrophysical Observatory of Arcetri, Florence, Italy

[3]Los Alamos National Laboratory (LANL), Los Alamos, USA

[*]A full list of authors appears at the end of the abstract

One of the main objectives of the Perseverance rover is to find signs of ancient life in the Martian surface, seeking biosignatures and signs of past habitable conditions. This could be achieved with the finding of organic compounds related to life. Raman spectroscopy is among the techniques that the rover is capable of performing, which is able to detect and discern organic molecules. Perseverance carries in its payload two instruments that are able to use this technique, SuperCam for remote sensing and SHERLOC for proximity measurements. SuperCam is a long-distance instrument capable of performing several techniques (Raman, LIBS, luminescence, VISIR, microphone) in order to assess the chemical and molecular composition of rocks (mineral phases and organic molecules) from a distance up to 7 m. Therefore, it could detect organics, or traces of them, from a distance before the rover gets closer.

In this work, a set of Mars soil analog samples were analyzed using the Flying Model-Body Unit / Engineering Qualification Model-Mast Unit (FM-BU/EQM-MU) setup of SuperCam. Specifically, the samples were prepared in the laboratory by adsorbing adenosine 5'-monophosphate, L-glutamic acid, L-phenylalanine, and phthalic acid with different known concentrations (5 wt%, 1 wt% and 0.1 wt%) on the clay mineral montmorillonite doped with 1 wt% of Mg-perchlorate. The preparation and characterization of those samples can be found in literature [1]. The analyses were carried out at a 2 m distance from the targets, with a laser spot size of around 300 µm at that distance. SuperCam showed excellent results for the pure compounds, before adsorption on the clay mineral. At 5 wt% concentration, the Raman signals of the organics were barely visible and at 1 wt% they were no longer visible. This fact means that if the laser of SuperCam hits an organic "hotspot" in a rock from a distance, it will be able to detect it as long as it has a concentration around 5 wt% or greater in the analyzed area, allowing SHERLOC to do further contact analysis afterwards. In addition, the SuperCam results were compared with those obtained with a commercial laboratory instrument (Renishaw inVia), obtaining the same main signals and only missing some minor secondary bands.

[1] T. Fornaro, J. R. Brucato, G. Poggiali, M. A. Corazzi, M. Biczysko, M. Jaber, D. I. Foustoukos, R. M.

Hazen, A. Steele, UV irradiation and Near Infrared characterization of laboratory Mars soil analog samples, Frontiers in Astronomy and Space Sciences, 2020, 7, 1-20

Mars2020 SuperCam-Raman Science Group: I. Torre-Fdez, T. Fornaro, J. Aramendia, A.M. Ollila, K. Castro, J.M. Madariaga, S. Clegg, D. Delap, S.M. Angel, K. Benzerara, S. Bernard, P. Bernardi, O. Beyssac, L. Bonal, B. Bousquet, B. Chide, E. Clavé, C. Fabre, O. Forni, V. Garcia-Baonza, O. Gasnault, C. Legett, G. Lopez-Reyes, J. A. Manrique, S. Maurice, P.-Y. Meslin, A.K. Misra, G. Montagnac, T. Nelson, R. Newell, R. Perez, P. Pilleri, F. Rull, S. Schröder, S. Sharma, M. Veneranda, R. Wiens, P. A. Willis