Laser-induced breakdown spectroscopy of samples of astrochemical interest handled as individual particles by means of non-inertial acoustic confinement.

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Abstract

Few words can be added to the advantages of laser-induced breakdown spectroscopy when it comes to quick analysis of solid samples with reduced sample preparation. In the top complexity preparation step, sample cleaning and polishing are all that might be needed to guarantee a smooth and homogeneous sample surface ready to be interrogated by LIBS. In many situations, the sample must be analyzed as it is, not affecting its native roughness, shape, or external alteration layers. In such situations, again, LIBS can be presented as a winning technique because of its non-contact analysis mode. With all these characteristics over the table, it is evident the growing interest for LIBS within the astrochemical community as, by definition, its samples can be properly handled in a pristine environment to avoid compromising data interpretation. A perfect example of the need of exquisite, contamination-free sample manipulation has been recently found in the framework of the Hayabusa2 mission of the Japanese State Space Agency (JAXA) at the C-type asteroid 162173 Ryugu, which brought back to Earth in 2020 about 5.5 kg of samples in the form of particles ranging from 8mm to fine submillimeter dusts, with millimeter-scale particles being the most common.

The present communication will show experiments performed with an acoustic levitator capable of trapping individual solid particles of different sizes (preferably in the range between 0.1 - 5 mm), shapes, and chemical properties in air. The levitator offers significant advantages over conventional handling approaches for particulate matter as it just requires picking up the desired particle, place it in the levitation device, and performing fine adjustment to bring the particle to the focal point of the laser beam. Single-shot or accumulative shots can be performed depending on the laser energy required, allowing the recording of excellent signal-to-noise ratio LIBS spectra.

Keyword 1 LIBS; Keyword 2 astrochemistry; Keyword 3 trapping

Acknowledgements

Research supported by projects UMA18-FEDERJA-272 from the Junta de Andalucía and PID2020-119185GB-I00 from Ministerio de Ciencia e Innovación, Spain. The support of the SIGUE-Mars Research Network from the Ministerio de Ciencia e Innovación, Spain, is also gratefully acknowledged.