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Depth-resolved chemical mapping of rock coatings using Laser-Induced Breakdown Spectroscopy: Implications for geochemical investigations on Mars

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Abstract

We demonstrate that Laser-Induced Breakdown Spectroscopy (LIBS) is capable of identifying the presence of natural rock coatings, and we define LIBS signatures of complex multi-layered coatings. This is illustrated by detailed LIBS analysis, in Mars-simulated conditions, of a rock collected in the Svalbard Islands, and which is analogous to some altered Martian rocks. The sample is a basaltic rock with sub-mm Ca-Mg-Fe-Si rich mineral coatings. LIBS elemental analysis of several distinct regions on the surface of the rock demonstrates the variability of chemical compositions of the various coatings, which is confirmed by complementary scanning electron microscope (SEM) analysis. Furthermore, the LIBS analysis as a function of the depth at different locations shows chemical variability, indicative of penetration through thin coatings of varying composition. Fine-scale, three-dimensional LIBS analysis is of interest for identifying and characterizing coatings on martian rocks, likely originating from aqueous processes,

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