

Laser-Induced Breakdown Spectroscopy – A Unique Analytical Tool for the Geosciences

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Laser-induced breakdown spectroscopy (LIBS) is a straightforward and versatile form of atomic emission spectroscopy that focuses a short-duration, rapidly-pulsed laser beam onto a sample to create a plasma containing its constituent elements and then uses spectral analysis of the emitted light to detect the elements present. LIBS analysis can be performed in the laboratory or outside in the ambient environment for rapid in-situ analysis. LIBS can also be used for microscale compositional imaging and depth profiling at a <100 micron spatial scale. LIBS, which is particularly sensitive to the light elements H, Li, Be, B and C that are difficult to analyze by many other techniques, is capable of either qualitative and quantitative analysis of most elements in the periodic table, depending on their intrinsic limit of detection in a specific material and the broadband LIBS spectrum can be considered a diagnostic geochemical fingerprint. This review presents a description of the LIBS technique and then illustrates how LIBS has recently been used in different mineralogical, petrological, geochemical, and mineral exploration applications. Given the need of analytical instrumentation for the rapid chemical analysis in the field and the capability of LIBS to analyze any type of material (gas, fluid, & solid) in real time with little to no preparation, there is a vast potential for the routine application of LIBS across a broad spectrum of the geosciences that is as yet only minimally realized.