

Light Elements: A Niche For Laser-Induced Breakdown Spectroscopy (LIBS)

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ABSTRACT

Recent studies report that more than 76% of senior mining companies are looking for a drill core digitalization solution to enable big data mining using artificial intelligence (AI). Conventional practices involve labor intensive manual drill core logging by a geologist, leaving the door open for human error and intuition driven decisions. The availability of drill core logging services such as hyperspectral imaging (NIR) and X-Ray Fluorescence (XRF) has generated sustained interest for digitalization of drill cores. Nevertheless, until recently, none of the above-mentioned techniques has shown the capability to provide a universal solution for digitalization of drill cores that could eventually be rapidly transferred to an ore-sorting application, especially for lithium bearing ore. Currently the lithium industry does not have rapid means to perform elemental assay, mineralogy and lithology for exploration and exploitation. Laser-Induced Breakdown Spectroscopy (LIBS) is a direct Atomic Emission Spectroscopy (AES) technique based on laser ablation. Since XRF cannot detect lithium (i.e. light element with $Z = 3$), LIBS-AES becomes the only technique able for rapid analysis of the lithium in rocks or on the process flow. Ultra rapid scanning of the rock using LIBS imaging and assay is the only viable solution for the lithium industry for exploration. Furthermore, the knowledge developed in the exploration process using LIBS can be transferred rapidly to exploitation in a conveyor-based LIBS process analyzer as a Process Analytical Technology (PAT). This paper presents the new capabilities of LIBS to perform the multi-elemental mapping (mineralogy and lithology) and assays of lithium bearing geological samples at high resolutions with an unmatched speed of 1000 scan points per seconds. Spodumene, petalite, and lepidolite minerals are the most common commercially viable sources of lithium, and this paper will report their characterization using ultra fast LIBS scanning.