LIBS: Universal core digitization

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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.

Laser-induced breakdown spectroscopy (LIBS) is a form of atomic emission spectroscopy (AES) involving laser-generated plasma which combines all the required processes for atomic spectrometry (sample vaporization, atomization and excitation) in a simultaneous process. LIBS is inherently attractive and useful because of its capability to detect, identify, and quantify the chemical composition of any material in any form (e.g. gas, liquid, solid, conductive or non-conductive). Basically, a LIBS measurement is carried out by forming a plasma on the sample and then collecting and spectrally analyzing the plasma's light. Since the plasma is formed by optical means, the LIBS technique offers unique features compared to conventional techniques that use an adjacent physical device. Among these attributes is its ability to interrogate samples in situ and remotely, to clean the surface of the sample (if required), and to realize fast analysis with the capability to detect nearly all of the periodic table elements.

This paper will present a universal solution for digitalizing for the mining industry based on LIBS technology. The LIBS core analyzer can produce high-fidelity elemental assays with an unprecedent drill hole depth resolution (few mm), in real-time. By controlling the analysis' resolution with artificial intelligence and automation features, the LIBS core analyzer can scan several hundreds of metres of drill core samples per day. Moreover, it can provide the drill core's elemental fingerprint of the different minerals present in the rock to deduce the lithology. Once this data is processed by a potent artificial intelligence algorithm, the knowledge about the mineral deposit can be easily transferred to a conveyor-based LIBS sensor that can scan and identify the same minerals in rocks for sorting purposes.

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