



In-field Sulfur Analysis Using Handheld LIBS

Overview

The latest generation SciAps Z-300 handheld LIBS analyzer is expanding the world of potential applications for field-portable elemental analysis. These new analyzers include extended spectral range, variable detector time gating, high laser pulse energy, and multiple options for purge gas. Data from a high resolution extended spectrometer range handheld LIBS analyzer that covers 190 – 950nm will be presented. This wide range gives near comprehensive coverage of the entire periodic table, including Li, O, F, S, and other elements that have until now had limited options for in-situ analysis.

Sulfur is of great interest to geochemical applications. It is historically analyzed in the field only with handheld XRF. Spark optical emission spectroscopy (OES) requires a conductive surface, and is thus limited to metallic samples. Moreover, the emission lines used for sulfur are traditionally in the deep UV 180-181 nm region, requiring a purge or vacuum spectrometer.

Analyzer Description

Handheld LIBS offers a technology to measure sulfur in the field, in addition to other low atomic number elements H, C, Li, Be, B, F, Na and the transition and heavy metals. The key to sulfur measurements with handheld LIBS is to utilize the sulfur emissions in the infra-red 921-924 nm region. The Z-300 was designed with a spectrometer range of 190 nm – 950 nm. The range was extended to 950 nm in order to measure the sulfur lines in the low 921-924 nm spectral region.

The Z operates in either an air or patented argon purge environment and uses a 5-6 mJ 1064 nm laser (Class 3b, but operable under Class 1 conditions) Testing times are 2-3 seconds. The analyzer has factory calibrations and software to support user-based calibrations and complete test methods. The system runs on an Android operating system, offers WiFi, Bluetooth and GPS, and supports AirWatch for use in secure locations.

Data and Discussion

A Z-300 was calibrated for S measurement using certified reference materials from NIST and other sources. Results are shown in Figure 1. Good agreement with CRM assays is shown, over a range of soil matrix types ranging from sediments and ores to igneous rocks.

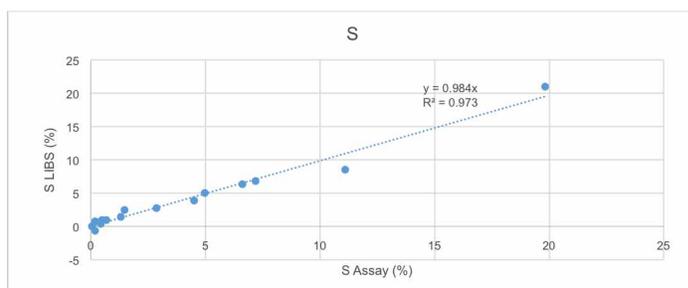


Fig. 1.

Conclusions

Field-portable handheld LIBS has seen great advances in recent years since its introduction earlier in this decade. Newer next-generation handheld analyzers offer superior analytical performance in a smaller and lighter package, while preserving analytical features commonly found in larger laboratory LIBS equipment. Key features of next-generation handheld LIBS analyzers include:

- Pulsed laser with >5mJ/pulse energy
- Fast rep rate of 50Hz Enhanced sample cleaning while preserving detector time-gating
- 2-d x/y laser raster for multiple location averaging and elemental surface mapping
- Wide spectral range 190 – 950nm with no gaps
- Time-gating of CCD to reduce background and improve signal/noise
- Inert gas purge as needed for application (He and Ar most common).