SciAps ApNotes
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The Z: Handheld LIBS Analysis for Lithium in Aluminum Alloys.

Laser-induced Breakdown Spectroscopy (LIBS) offers an alternative technique to both handheld XRF and spark OES for the analysis of a broad range of elements and sample types. In the LIBS process, a plasma is created at the material surface, as in spark optical emission spectroscopy (OES). Spectral lines from the various elements present are measured as the plasma cools. The wavelength of specific lines reveals the elements present, and the intensity of the light at a given wavelength is related to the concentration of each element.

SciAps is pleased to introduce the Z, a handheld analyzer utilizing laser induced breakdown spectroscopy (LIBS). There are three "must have's" for handheld LIBS when analyzing most alloys, to obtain precise chemistry critical for reliable alloy identification. Those include a) a high energy pulsed laser - the Z uses 6 mJ/pulse at a 50 Hz rep rate, b) novel 50 Hz burst cleaning to eliminate sample grinding, and c) Opti-Purge™ on-board argon purge for 10x or better precision. **Note the Z can also be equipped for ONLY air-burn analysis for sites with compressed gas canister restrictions.** The Z is laser based, and thus there is no ionizing radiation like X-ray. The elimination of X-rays greatly reduces the regulatory burden. Finally the Z delivers the low atomic number performance (Li, Be, B, Mg, Al, Si) of mobile OES, while maintaining the portability of handheld XRF.

The wide elemental range and high sensitivity of mobile OES units, plus the portability and ease of use of handheld XRF analyzers.

Analyze the ENTIRE periodic table of elements...

including the critical elements you need to detect the most

Li	Mg	Si	Cr	Mn	Cu	Be	B	Al	Zr	Zn

Lithium in Aluminum Alloys:

A growing need, especially in the aluminum re-melting industries, requires the analysis of lithium (Li) in aluminum alloys. If this scrap is mixed with others for re-melting, there is a possibility of an explosion. New 2000 series grades like 2195 for the commercial aerospace industry feature 0.8-1.2% lithium and 0.25-0.5% Ag. Several grades of aluminum alloys manufactured predominantly in Russia for military aircraft, contain between 0.1% and 1.5% lithium. In addition to lithium, some of these grades contain contaminant level beryllium concentrations. Beryllium is a known health hazard to the lungs, caused by exposure to welding fumes or dust from machining Be-containing materials. The Z measures Be down to very low concentrations, typically 0.01% in alloys and 10 ppm in soil.

Elemental Li analysis is yet another benefit of LIBZ technology, in addition to the wrought and foundry aluminum alloys, plus the coppers, high-temps and low alloy steels. A spectrum from an aluminum alloy with 1.03% Li is shown in Figure 1. The large peaks at 610.3 nm and 670.7 nm result from Li in the sample. The 610nm line is used for quantifying Li down to a lower limit of about 0.01%.

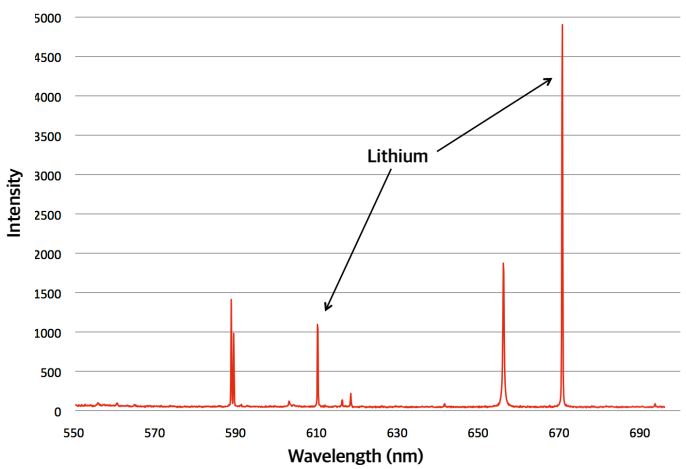

Figure 1: Spectrum from a 1 second test on a Russian manufactured aluminum alloy containing 1.86% lithium.

Summary:

The Z is the world's most advanced handheld LIBS analyzer. The Z possesses the three key requirements for successful, in-field analysis of a range of materials: a) burst cleaning to eliminate sample surface effects and grinding, b) argon purge (optional) for 10x or more precision compared to air-based analysis, and c) beam rastering. This combination provides proven performance on a range of materials – aluminum alloys, red metals, nickel and stainless and ferrous. The novel sample detection system allows the device to be operated under Class 1 conditions, thus eliminating the regulatory requirements of x-ray and class 3b LIBS devices.