

LIBS analyser: a world-first for carbon content

Z-series hand-held, laser-based analysers from SciAps now include the new Z-200C+, which is also able to identify the carbon content in steels, cast irons and stainless steels – including the L-grades.

Laser-induced Breakdown Spectroscopy (LIBS) is an alternative technique to both handheld X-ray fluorescence (XRF) and spark optical emission spectroscopy (OES) for positive material identification (PMI). PMI is routinely used to confirm the exact percentage composition of steels, stainless steels and metal alloys used in construction.

With LIBS, a plasma is created at the material surface and the spectral lines from the various elements present are measured as the plasma cools. The wavelength of specific lines reveals the presence of each constituent element, while the intensity of the light at each wavelength determines the concentration of that element.

There are three 'must haves' for handheld LIBS analysis: a high energy pulsed laser, for which the Z uses 6.0 mJ/pulse at a 50 Hz repetition rate; a novel 50 Hz cleaning burst to eliminate the pre-sampling need for surface cleaning/grinding; and Opti-Purge™, an on-board argon purge for 10-times or better precision.

The SciAps Z-series offers a number of advantages for FAC compared to traditional handheld XRF analysers. These include faster chromium analysis at low concentrations (0.05%) and, since LIBS analysers are laser based, there is none of the ionising radiation associated with X-ray devices. Also, the Z-series delivers low atomic number performance to enable accurate Li, Be, B, Mg, Al and Si concentrations to be determined, which would previously have needed a mobile OES.

For flow accelerated corrosion (FAC) applications there's a need to quickly measure the chromium content in carbon steels. If the chromium concentration decreases below 0.1% – a typical threshold value – the rate of corrosion in carbon steel flow systems increases rapidly. Handheld XRF units have been used effectively for Cr analysis in carbon steels and the SciAps X is one such analyser. However, LIBS offers several advantages.

- Z-series analysers require about

three seconds to measure 0.05% Cr. XRF typically requires ten seconds or more to reach a suitable precision at the 0.1% concentration range in carbon steels.

- SciAps Z-series instruments are laser-based and therefore not subject to the many regulations required for X-ray-based systems. Many facilities, especially power plants, have restrictive regulations concerning the use of handheld XRF.
- Opti-Purge™, an on-board integrated argon gas purge, enhances detection limits and precision compared to air-based operation.

The Z-series makes a great alternative to XRF. It's a laser based system that can be operated under Class 1 conditions, thus eliminating all the regulatory burden associated with X-ray.

The only analyser to measure carbon

With the recent introduction of the Z200C+ handheld LIBS analyser, SciAps became the first in the world to develop a handheld analyser that can measure carbon content in steels, cast irons and low carbon (L-grade) stainless steels.

When the laser is focused onto the metal surface, it creates a light emitting plasma. The various wavelengths of emitted light are collected by an on-board spectrometer, which applies intensity ratio-based calibrations to quantify the content of carbon and other alloying elements in the metal on the surface.

Because the laser beam is focused down to <100 µm, the volume required for the argon purge is much smaller than spark OES. The argon supply can therefore be stored in the handle of the analyser and is user-replaceable. A single canister yields about 600 tests.

The laser beam in Z-series LIBS analy-



The wavelength of specific lines reveals the presence of each constituent element, while the intensity of the light at each given wavelength is used to determine the concentration of that element. Right: The Z200C+ handheld LIBS analyser from SciAps is the first in the world that can measure carbon content.

zers is only about 50 µm in diameter, which is tiny compared to the size of a spark burn. The laser is also rastered to several locations during testing, since averaging multiple laser spots is critical for the accuracy of an LIBS result.

Since each analysis area is very small – a few hundred mm² – the necessary argon purge volume is also very small. Thus the pre-purge is quick – a second – and between tests the argon can be turned off – unlike OES. The result is that the Z-200C+ uses about 1 000 times less argon than a typical spark OES.

As the world's most advanced handheld LIBS analyser, the Z delivers on the three key requirements for success in field analysis: burst cleaning; argon purge; and beam rastering to guarantee accurate results. This combination provides proven performance on a range of materials – aluminium alloys; red metals; and ferrous, nickel and stainless alloys – and this list now also includes carbon.

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.

SciAps Z-series analysers are available in South Africa through Gammatec.

gfi@gammatecsa.com