LIBS, XRF or OES – a rough guide to choosing the right technology for your metals analyser

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Having trouble deciding which type of elemental analyser best suits your metals analysis needs?

Hitachi High-Tech's Mikko Järvikivi's rough guide looks at the main technologies for metals analysis, what instruments are available, and where they're most effective.

The field of materials analysis has been rapidly changing in recent years. The continued development and application of technologies like optical emission spectroscopy (OES), X-ray fluorescence (XRF) and laser induced breakdown spectroscopy (LIBS) is making it easier for companies across a whole range of industries. Whether it's for quality assurance/quality control processes (QA/QC), material sorting, positive material identification (PMI) or scientific analysis, products are available that enable you to test materials on-site, and on the move.

The question many companies are asking is: which technology is right for us?

OES, XRF and LIBS are all quite versatile, particularly when it comes to identifying metals. However, each of the three technologies work in different ways and have their own strengths and weaknesses. Also there's no one instrument that can cover all the needs from accurate trace element analysis to rapid sorting of alloys, and everything in between.

Laser induced breakdown spectroscopy – LIBS

LIBS is the newest technology and has seen the greatest progress in recent years. The development of laser diodes now makes it possible to emit a small but powerful laser beam onto the surface of a sample. A tiny amount of the matter on the surface of the object is dissipated with the laser to form energised plasma consisting of molecules from the sample. As the plasma cools down, each element in the sample emits its characteristic wavelength and the wavelengths of light are collected through a fibre optic cable.

The key advantage LIBS offers is that it's very fast – a test can be carried out in just one second. The technology is particularly good for measuring aluminium alloys, making it useful in sorting scrap metal. Samples can be conductive or non-conductive but need to have a solid surface that is clear of dirt and contaminants before testing. Although LIBS will leave a small laser burn on the sample object it's usually considered to be surface roughness rather than a defect on the product, meaning that LIBS is a virtually non-destructive technique.

X-ray fluorescence – XRF

Used in portable and later handheld materials analysis for over 40 years, XRF uses X-rays rather than laser energy to excite the molecules at the surface of the sample. Primary X-rays are generated by the source and directed at the sample's surface. When the beam hits the atoms in the sample, they react by generating secondary X-rays that are collected and processed by a detector.

With XRF technology, rather than breaking atoms, ions and electrons away from the material, the sample remains intact. This means that XRF is a non-destructive form of material analysis, which makes it an excellent way to test products, parts and components without damaging the sample, which is critical in some industries like aerospace and automotive. XRF analysers are great for accurate chemical composition, including identifying trace and tramp elements.

Furthermore, XRF can be used to analyse samples that are still hot, such as process components at refineries or power plants. XRF can measure virtually any types of samples including conductive and non-conductive substances, metals and non-metals, as well as samples in granular and liquid forms such as soil and fuel oil.

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Optical emission spectroscopy – OES

With OES, the energy used to excite the molecules in the sample is electricity; there are two forms of electrical discharge generated – an arc, which is an on/off event similar to a lightning strike, or a spark, a series of multi-discharge events where the voltage of the electrode is switched on and off.

Although OES analysis can only be carried out on metals, that doesn't mean it can't measure non-metallic elements. In fact, OES gives superior performance when measuring carbon, boron, phosphorous and nitrogen in steel. OES devices offer the highest levels of accuracy, with very low levels of detection for all the important elements. However, the electric energy will leave a burn mark on the sample. OES devices use more energy than LIBS or XRF and also require argon gas canisters unless using an arc probe.

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What do you need to test?

Knowing a little bit about how each technology works is a useful starting point, but which one you choose will depend on several other factors including what it is you need to analyse, why, how much accuracy and chemistry you require, and where you'll be taking the measurements.

Testing metals

All three technologies are versatile and reliable for general metal testing, and all three come in portable formats.

A popular new solution comes via the Vulcan range of handheld LIBS analysers from Hitachi High-Tech. Similar in size and shape to a cordless drill, the Vulcan is designed for tough environments, like scrapyards and factories and is very effective in general metal identification and sorting. It's extremely fast, taking measurements in one second, and is particularly effective when it comes to aluminium alloys, but can also deliver accurate grade ID of several other alloys such as steels.

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The X-MET8000 is another handheld analyser produced by Hitachi High-Tech, but uses XRF technology. The same shape as the Vulcan, it is equally robust and versatile. The X-MET provides accurate chemistry and grade ID for a wide range of alloys including steels, nickel alloys, coppers, aluminium alloys and much more. With an optional protective Hero window, it can be used to measure samples at up to 400°C. This makes it very handy for spot testing and quality assurance and control on production lines processing hot metals as well as substances such as glass.

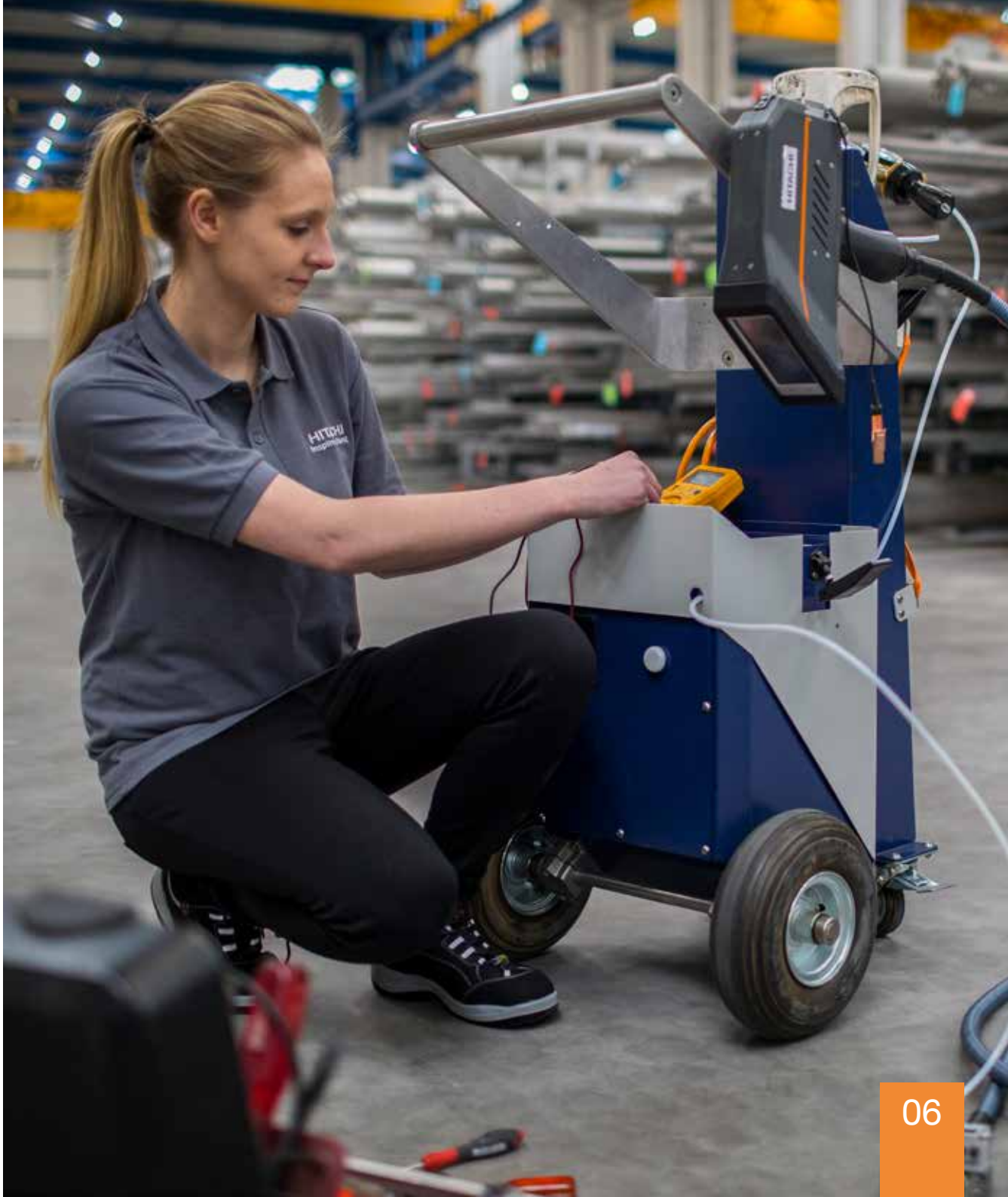
However, when analysing elements below magnesium on the periodic table, OES technology is needed and a popular choice is the PMI-Master Smart, Hitachi High-Tech's portable OES solution. With very low levels of detection for elements like carbon and nitrogen, which are used to improve the hardness and other physical factors in steel, it's ideal for highly accurate PMI in the metals industry. It's also the instrument of choice when certifying metal components, such as compression and storage tanks, pipes and tubing for chemical, petrochemical and power plants. Where materials must be resistant to high temperatures and pressures, as well as corrosive substances, 100% PMI is essential and PMI-Master Smart is designed to deliver.

The Hitachi High-Tech range

As smaller and more powerful components are developed, and new needs arise in industry, Hitachi High-Tech continues to innovate in the application of LIBS, XRF and OES technologies. From handheld analysers that make testing quick and easy, through to powerful and versatile static devices delivering the highest degrees of accuracy across multiple samples, our product lines include instruments to suit companies of all sizes across a range of industries.

Often, there might be more than one solution that meets your needs. In other cases, you might want to combine the advantages of portability and extreme accuracy, and select complementary products using LIBS, XRF and/or OES respectively. What makes Hitachi High-Tech different is that we offer solutions that use all three technologies, which can be used together to cover all your metals analysis requirements. We're here to help you find a product that matches your business needs.

The rough guide provided here is just a start. For more help choosing the right analysers for your business, contact us today to arrange your expert demo.



What next?

Contact one of our experts today at
contact@hitachi-hightech-as.com
to arrange a demo.

MORE INFORMATION

To find out more about our range of analysers, visit

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