Written by Greg Mann and Michael Porfilio Anderson, Laboratories, Inc.
Friday, 16 November 2012 15:04

A non-destructive form of positive material identification can be a shortcut to uncovering the root cause of bad welds, parts failure and more. It also can be an effective way to verify on-spec conditions in your equipment and systems.

When the maintenance manager at a Midwestern water treatment plant was confronted with a wet floor in the facility's pump room, his crew was perplexed. The team could see that a cracked pump housing was the culprit and knew they could repair it with weld filler material. What they didn't know was the type of material that had been used in the manufacturing of the pump's housing— *key information that would let them select the proper weld filler.* After a brief discussion, the next step was obvious: Contact a materials testing laboratory to determine the material used in the pump.

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A Look Inside X-Ray Fluorescence

X-ray fluorescence (XRF) spectrometry is a technique for the analysis of elements that has broad application in both science and industry. It's based on the principle that individual atoms, when excited by an external energy source, emit X-ray photons of a characteristic energy or wavelength. By counting the number of photons of each energy emitted from a sample, an element may be identified.

XRF technology is an outgrowth of Wilhelm Röntgen's discovery of high-energy radiation, which he dubbed X-rays, in 1895. In 1913, English physicist Henry Moseley advanced the concept when he constructed an X-ray spectrometer to measure the frequency of certain types of X-rays produced from tubes with different electrode materials.

Moseley's results showed that the ordering of the wavelengths of the X-ray emissions of the elements happened to coincide with the ordering of the elements by atomic number. This relationship is now known as Moseley's Law.

X-rays can be used to identify elements because of the characteristic radiation emitted from the inner electronic shells of the atoms. This radiation is comprised of X-ray photons whose specific energies permit the identification of their source atoms. The X-ray photons are emitted during

fluorescence, which is the emission of an X-ray photon that occurs when atoms in a tested material are rearranged by the external energy source. By detecting this photon and measuring its energy, an element can be determined.

While the first commercially pro-duced X-ray spectrometer was developed in the 1950s, modern, handheld XRF instruments have revolutionized the field. Capable of analyzing solid, liquid, and thin-film samples for major and trace components, the analysis is rapid and sample preparation is usually minimal or not required. As noted in the accompanying article, handheld analyzers allow XRF technology to be used onsite to quickly gather key information, offering a low-cost alternative to the more detailed, but time-consuming laboratory techniques that involve fixed machinery and sample destruction. In the industrial maintenance and reliability arena, XRF technology is used most often on metals—*to determine components of alloys in parts, equipment and raw stock* —and on chemicals, especially petrochemicals.

Growth opportunities for these systems were advanced significantly with passage of the European Union's Regulation of Hazardous Substances (RoHS) directive and the Waste Electrical and Electronic Equipment (WEEE) directive, which restrict the use of certain metals in products.

Sources: University of Missouri, National Science Foundation, Northern Arizona University

More About Anderson Laboratories, Inc.

Established in 1939, Anderson Laboratories is an independent materials testing facility located in Greendale, WI. Specialties include chemical analysis, mechanical testing, welding procedure and performance qualification, failure analysis, environmental and corrosion testing, as well as on-site evaluations. Analyses are performed by skilled personnel with a combined experience of more than 70 years, and instrumentation is programmed for the majority of engineering alloys used in modern manufacturing. Anderson's tensile capabilities range from several grams to 200,000 pounds force, both in tension and compression. Computer-controlled testing equipment can determine many properties in both English and Metric units. Compliance to the appropriate ASTM, ASME, EN, JIS and other applicable specifications is considered of vital importance in obtaining accurate mechanical testing results. Anderson Laboratories is accredited to the International Organization for Standardization (ISO) 17025 through the American Association for Laboratory Accreditation (A2LA) and Det Norske Veritas (DNV). Learn more at www.andersonlabs.com .

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