LANTHANIDE SERIES INVESTIGATIONS WITH TSI® LIBS DESKTOP ANALYZER

APPLICATION NOTE LIBS-008

Background
The **lanthanide series** is a series of metallic elements, with atomic numbers 58 through 71, which are—in order of increasing atomic number—cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium. They have numerous commercial uses based on their individual chemical, optical, and nuclear properties. Examples of commercial use include use in control rods in nuclear reactors (gadolinium, dysprosium), as colors in glasses and enamels (praseodymium, neodymium, cerium), and as constituents in laser medium and solid state devices (neodymium and terbium).

Lanthanides are often measured with spectroscopic means such as Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Plasma (ICP) optical emission spectroscopy. These methods involve acid digestion of the matrix prior to analysis. Direct analysis methods such as XRF can be problematic as the \( L \) series transitions used to analyze these elements often overlap the \( K \) series fluorescence from transition elements.

**The TSI® LIBS Desktop Analyzer Solution**
The TSI LIBS Desktop Analyzer uses a technique known as Laser Induced Breakdown Spectroscopy (LIBS) to directly determine the elemental concentrations of lanthanides in materials. The examples below of lanthanide determination in graphite matrix illustrate that determination of dilute concentrations (low ppm) in many matrices is possible.

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