# Spectrolaser Lanthanide Series Investigations

## 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.

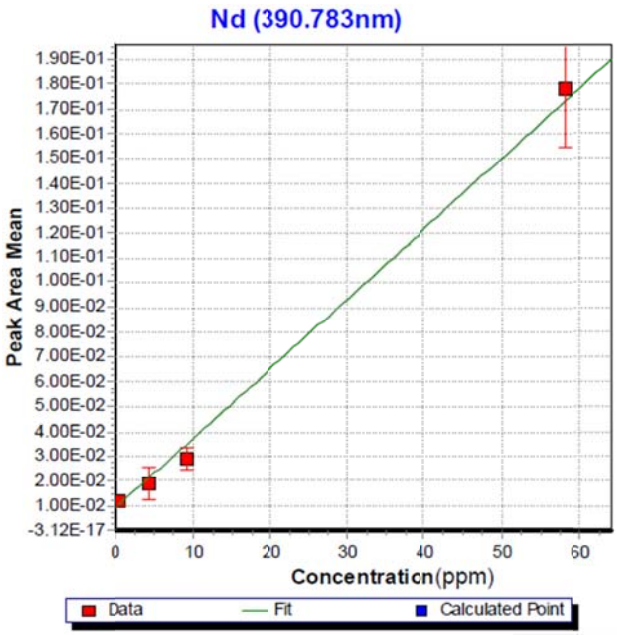
## The Spectrolaser Solution

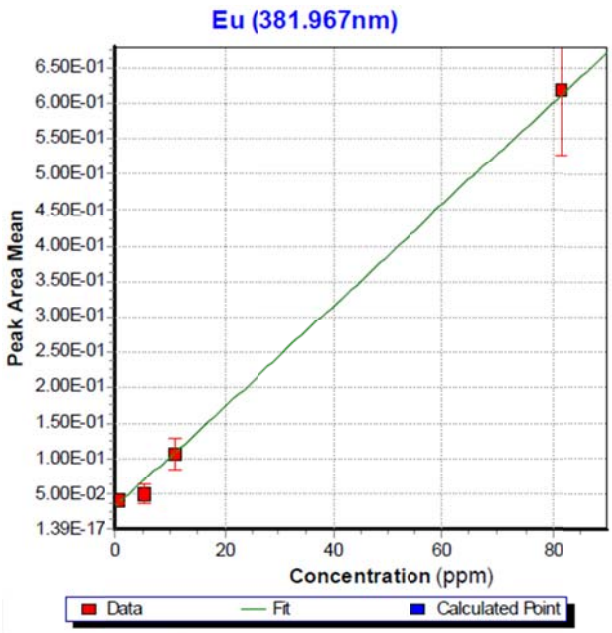
The Spectrolaser uses a technique known as Laser Induced Breakdown Spectroscopy (LIBS) to directly determine the elemental concentrations of lanthanides in materials. The examples below of lanthanide determination in graphite matrix illustrate that determination of dilute concentrations (low ppm) in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

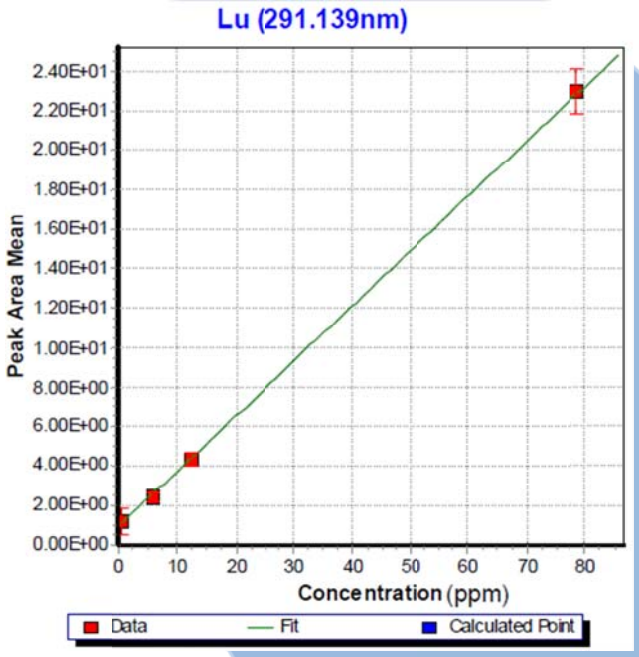
Sodium is an example of a light element that is easily determined by Laser Induced Breakdown Spectroscopy (LIBS) to ppm levels. Largely, sodium levels are determined in refractory materials such as alumina by acid digestion techniques or alternatively XRF (x-ray fluorescence). Acid digestion techniques are laborious and thus the total analysis time is quite long. Even sophisticated XRF instruments can take 20 minutes or more to get reliable Na readings owing to relatively weak fluorescence. In contrast, using the Spectrolaser instrument, multi-element analyses of materials including sodium levels can be obtained in a matter of seconds.

Photon Machines, Inc.
15030 NE 95th Street
Redmond, WA 98052

Web: www.photon-machines.com
Email: info@photon-machines.com
Tel: +1.425.296.6400




Photon Machines, Inc.
15030 NE 95th Street
Redmond, WA 98052

Web: www.photon-machines.com
Email: info@photon-machines.com
Tel: +1.425.296.6400