C112-E014

SHIMADZU

Application News

Optical Emission Spectrometry No.E89

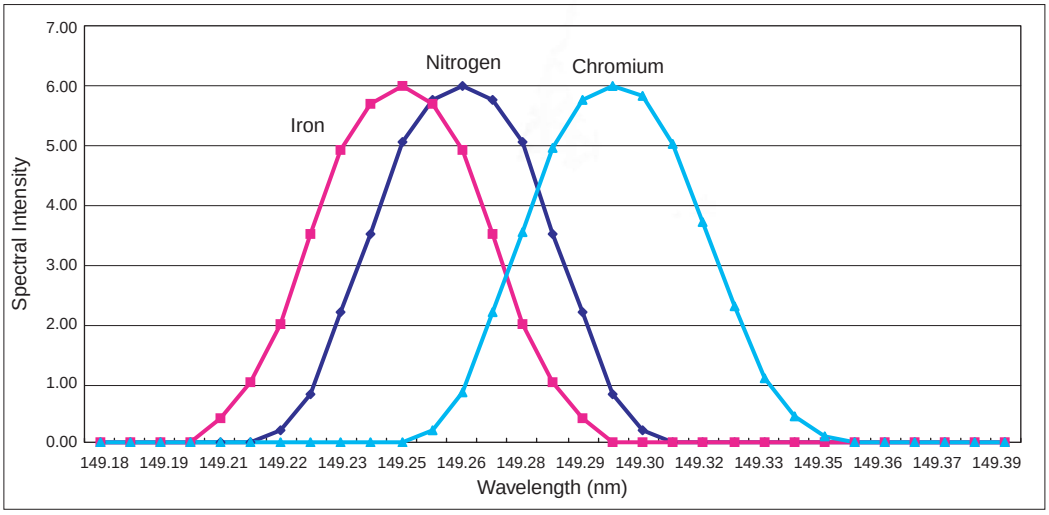
Analysis of Nitrogen in Low Alloy Steel

This article describes using a Shimadzu PDA-7000 Optical Emission Spectrometer to analyze the nitrogen content in steel.

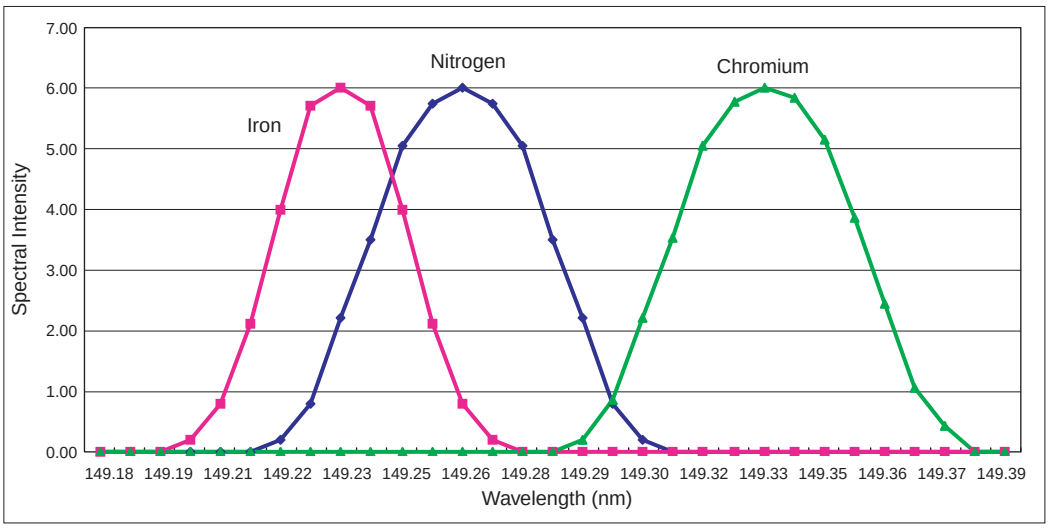
■ Wavelength of Nitrogen Spectrum

The spectral wavelength for nitrogen is 149.262 nm, where the wavelength for iron, at 149.25 nm, and the wavelength for chromium, at 149.298, are located nearby. The figure below shows a plot of the nitrogen spectrum, along with nearby iron and chromium spectra. The first-order spectrum is affected by iron and chromium, because the iron and chromium spectra overlap with the nitrogen spectrum in the middle due to inadequate resolution. In contrast, using the second-order spectrum provides twice the resolution and eliminates the effects of iron and chromium on nitrogen. In addition, continuous spectra of silicon are also known to exist near the nitrogen spectrum. Their effect can approximately be cut in half as well, by using the second-order line.

First-Order Spectrum



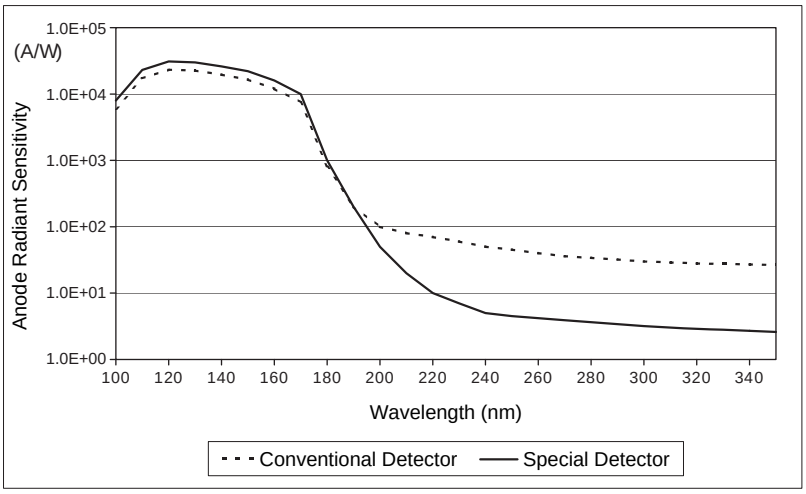
Second-Order Spectrum



■ High Sensitivity Photomultiplier

Since the second-order spectral line for nitrogen at 149.2 nm appears where it overlaps with the first-order spectral line at 298.4 nm, measuring the second-order spectral line also measures the interfering first-order spectral line. Therefore, high sensitivity can be achieved by using a special detector (photomultiplier) that provides lower measurement sensitivity than previous models for first-order spectral lines, but high measurement sensitivity for second-order spectral lines, as shown below.

Over 10,000 times higher 120 nm/300 nm sensitivity ratio

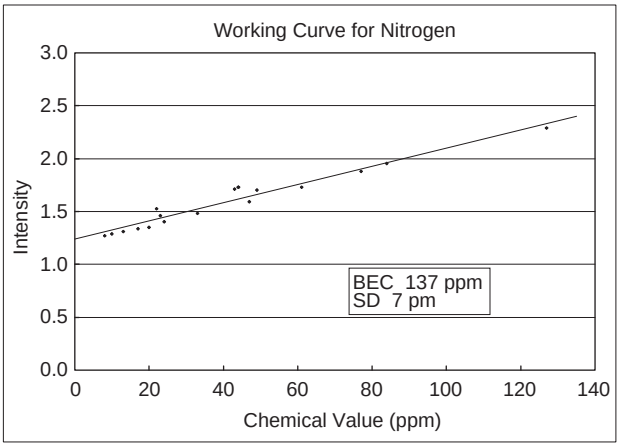


■ High Energy Discharge

Discharge conditions were also considered and sensitivity was increased by using a 5 times higher energy spark discharge than for conventional discharge conditions.

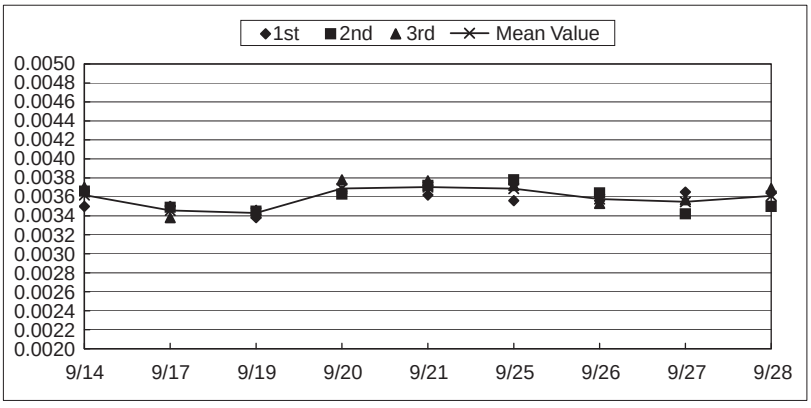
■ Working Curve

The working curve shown to the right was prepared using the above conditions.
(Standard Samples: Iron and Steel Institute of Japan KAPN1 to KAPN10 and NIST1761 to 1768)



■ Stability Data

Stable results were obtained by analyzing standard samples 3 times per day and acquiring data for 9 days.



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