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Laser Assisted Microwave Plasma Spectroscopy

The New Era of LIBS is now LAMPS™ — Laser Assisted Microwave Plasma Spectroscopy

LAMPS (Laser Assisted Microwave Plasma Spectroscopy), developed in conjunction with Envimetrics, represents a huge leap forward in LIBS technology. LAMPS features a specially designed microwave cavity to enhance plasma discharge, thereby increasing sensitivity for most potential analytes. Also enhanced are emission line stability and reproducibility, leading to better quantification results. Applications for a variety of diverse analytes requiring greater sensitivity and less ablative sample imprint are now made possible with LAMPS. Systems available in the fall of 2008.

LAMPS vs. LIBS Technology

Current LIBS technology permits qualitative analysis of a solid or liquid sample by ablating a minute portion of the sample, then analyzing the resulting plasma. LAMPS takes this a step further by employing a special microwave cavity. The plasma is injected into this cavity where it reacts with free electrons, greatly increasing sensitivity and producing better line stability and reproducibility. A lower power 50 mJ laser is used in the LAMPS, resulting in less ablation imprint to the sample and greater sensitivity.

LAMPS Components

The key to LIBS and LAMPS measurements is the ability to acquire high resolution spectra of a transient event over a broad wavelength range. This is accomplished by coupling 7 HR2000+ Spectrometers into one system. Each spectrometer covers ~100-140 nm bandwidth typically starting at 200 nm for the first channel and ending with 980 nm for the last channel

Systems may be configured to start below 200 nm and with fewer channels for element-specific applications. Optical resolution is ~0.01 nm (FWHM). Pixel resolution is ~0.05 nm/pixel. In a 7-channel system, there are 14,336 pixels acquiring synchronous spectra. The detector integration time can be as low as 1 ms, and the maximum data transfer rate to the PC is about 500 spectra (14,336 values) per second over the USB 2.0 port.

Dimensions: LAMPS Sample Chamber Spectrometer System	 72.5 x 35.3 x 43.9 cm 33.4 x 15.0 x 14.0 cm maximum
Weight: LAMPS Sample Chamber Spectrometer System	 22.7 kg 6.4 kg
Wavelength range:	200-980 nm (channel dependent)
Optical resolution:	~0.01 nm (FWHM)
Pixel resolution:	~0.05 nm/pixel
Frame rate:	2 per second (with microwave on)
Integration time:	1-2 ms
Trigger delay:	Programmable in software
Trigger jitter:	20 ns
Trigger level:	+5V TTL
Microwave frequency:	2.45 GHz
Microwave power:	1 KW @ 2.5 ms

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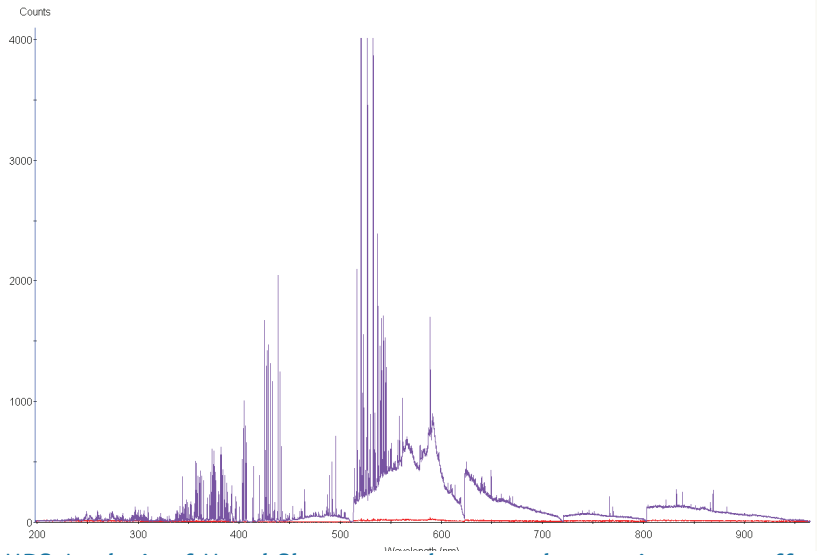

LAMPS Analysis of Metal Slurry: purple trace shows microwave effect.

Sample Chamber

Provides critical eye safety by using laser safety shielding and safety interlocks on the door. The sample stage is a manual x, y and z positioner, with internal LED illumination for sample positioning. A fiber bundle is inserted into the microwave cavity. The bundle's special dielectric (non-conducting) tip ensures no metals are introduced into the cavity.

Laser

We provide Quantel's 50 mJ CFR Pulsed Nd:YAG Laser with our LAMPS system. The CFR design is especially rugged as both resonator mirrors are on the same rigid metal plate. The laser is mounted to the sample chamber and aligned to the focusing optics. A 100 mm lens with manual z-axis control permits focusing or allows defocusing of the laser for better plasma uniformity.

Software

OOILIBS Operating Software provides control of the lasers; has user-programmable delay for the Q switch; acquires, plots and saves spectra; and provides a spectral line library and correlation function for identification of peaks.

Spectra can be exported to Excel. Application-specific libraries of peaks can be loaded. You can zoom into a wavelength range to look for a peak in the library by double-clicking on the line in the table. Or, the correlation routine will match peaks to wavelengths in the library and rank the elements by how many of the emission lines it found. The user can set baseline and peak width filters for the search.

LAMPS