



## Unique Solid-State Triple Wavelength Laser Ablation System for High Performance Analysis of Solids

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**The LSX-3000 Nexuss is the world's first and only all solid-state laser ablation system that delivers 193, 213 and 266 nm wavelengths all from the same Nd:YAG laser.**

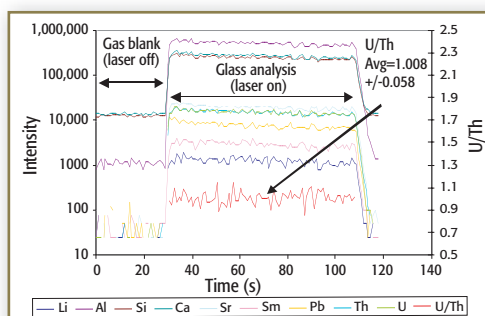
The performance of different UV wavelengths for laser ablation (LA) analysis of samples by inductively coupled plasma techniques has been rigorously studied for the last 15 years. The LSX-3000 Nexuss from CETAC is the first system to deliver the three most commonly used wavelengths for LA — all from the same laser head. The LSX-3000 utilizes the proven technology of an optical parametric oscillator (OPO) to generate the high irradiance 193-nm output. Unlike excimer laser systems that deliver the 193-nm wavelength, the LSX-3000 does not need toxic gases to produce the laser energy. In addition to reduced risk and lower running costs, the Nd:YAG laser incorporated in the LSX-3000 delivers the 193-nm wavelength with a much shorter pulse width than any excimer system. Combined with the powerful 193 nm for microanalysis of the most difficult materials, the LSX-3000 also can deliver high-energy 266- and 213-nm output to the sample all from a single compact platform.

### Instrumental Setup

The CETAC LSX-3000 easily can be configured to deliver to the sample one of the three wavelengths available for ablation. The wavelength switching is accomplished using high precision, computer controlled, motorized optical mounts that are located inside the sealed optics module. For this experiment, the system was configured for 193-nm output. All tabular results are the average of multiple analyses. Concentration data was collected using NIST610 as the primary standard. Laser settings used for all analyses were 60 mm diameter spots, 3.3 Hz, 250 shots and He as the carrier gas. To demonstrate the performance of the system, the NIST glass standard 612 was used. A PerkinElmer ELAN 9000 ICP-MS was used for all analyses.

### Results

The CETAC LSX-3000 Nexuss provides powerful ablation of any solid material. The LSX-3000 delivers fractionation free analyses of materials such as the NIST 612 glass. One indicator of ablation performance is the signal stability of the ICP-MS time-



**Figure 1.** Time resolved ICP-MS spectra for the spot analysis of NIST612 glass.

resolved spectra resulting from ablation. Here the signal profiles show strong, stable signals for a variety of trace elements (Figure 1). Another indicator of LA system performance is the apparent degree of elemental fractionation. The LSX-3000 delivers fractionation free analyses of materials such as the NIST612 glass. An elemental measure of fractionation is the U/Th ratio in NIST612. The resulting ratio of raw signal of U/Th should be equal to 1. Here we see that the LSX-3000 delivers such results (see Figure 1). The accuracy of analyses of NIST612 indicates the excellent performance of the LSX-3000 for standard reference materials (Table I). The LSX-3000 was also tested using natural basaltic glasses from the United States Geological Survey. The results again indicate the accuracy of the system (Table II).

### Conclusions

The LSX-3000 Nexuss is the only system to deliver all three wavelengths commonly used for laser ablation from a single compact system. The LSX-3000 delivers exceptional performance for trace element analysis of all solids. The flexibility, versatility and reliability of the LSX-3000 make this system the premiere choice for the most demanding laser ablation applications.

**Table I. NIST 612 Glass Results**

Element	Analyzed (ppm)	ref. value (ppm)
Li	41.79	41.54
Be	38.65	37.73
B	35.23	34.73
Na	101785	103564
Al	11250	11114
Ca	85875	85121
Fe	53.25	56.33
Rb	32.47	31.63
Sr	76.82	76.15
Y	38.62	38.25
La	36.23	35.77
Ce	38.61	38.40
Sm	37.02	36.72
Dy	35.95	35.97
Yb	40.08	39.95
Pb	38.62	38.96
Th	37.61	37.23
U	37.45	37.15

**Table II. USGS Natural Basalts**

Element	BCR-2G		BIR-1G		BHVO-2G	
	Analyzed	ref. value (ppm)	Analyzed	ref. value (ppm)	Analyzed	ref. value (ppm)
Fe	97018	96900	81155	79200	86967	86300
La	26.863	24.900	0.661	0.630	16.061	15.400
Ce	55.915	52.900	2.006	1.620	39.670	38.100
Pr	6.895	6.570	0.403	0.380	5.329	5.330
Sm	6.936	6.570	1.178	1.010	6.333	6.130
Eu	2.050	1.960	0.473	0.550	2.219	2.100
Gd	6.562	6.750	2.020	2.000	6.215	6.260
Tb	1.063	1.070	0.387	0.420	0.887	0.954
Er	3.646	3.660	1.744	1.700	2.470	2.560
Tm	0.537	0.564	0.225	0.260	0.266	n.d.
Hf	4.776	4.800	0.558	0.550	4.475	4.380
Pb	10.887	11.000	3.066	3.000	2.227	2.500
Th	5.983	6.200	0.044	0.030	1.131	0.900
U	1.588	1.690	0.050	0.030	0.390	0.400

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