
Beryllium Screening With Laser Induced Breakdown Spectroscopy LIBS

Presented by Applied Spectra Inc.

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Presentation Overview

- **Applied Spectra company overview**
- **What is LIBS**
 - Concept
 - LIBS System
 - Operation
- **Be Swipe Analysis**
 - Sample Holder
 - LLNL Swipes
 - Results
- **Conclusions**

Company Highlights

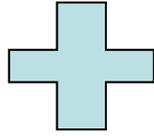
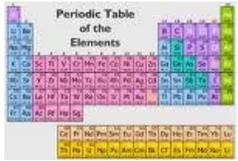
- **A leading analytical instrumentation manufacturer based on laser ablation technology**
 - Core expertise in laser based analytical techniques including Laser Induced Breakdown Spectroscopy (LIBS) & Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)
- **Strong technology research & development connection to Lawrence Berkeley National Laboratory (LBNL)**
 - Founded by Dr. Richard E Russo, a world-renowned scientist with 200+ referred scientific publications, 48 referred conference proceedings, 212 technical presentations & 7 book chapters in laser material interaction and laser ablation based analytical technologies
 - Scientific staff members with 80+ years of fundamental/applied research in laser material interaction from LBNL and other commercial companies
- **USA Locations**
 - Technology Research Center in Fremont, CA
 - Application and Manufacturing in Aberdeen, MD



Conventional Chemistry



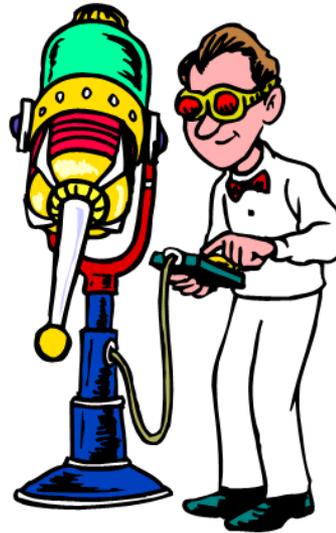
Analysis



Sample



Laser Chemistry



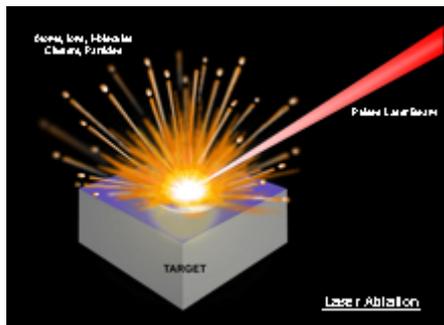
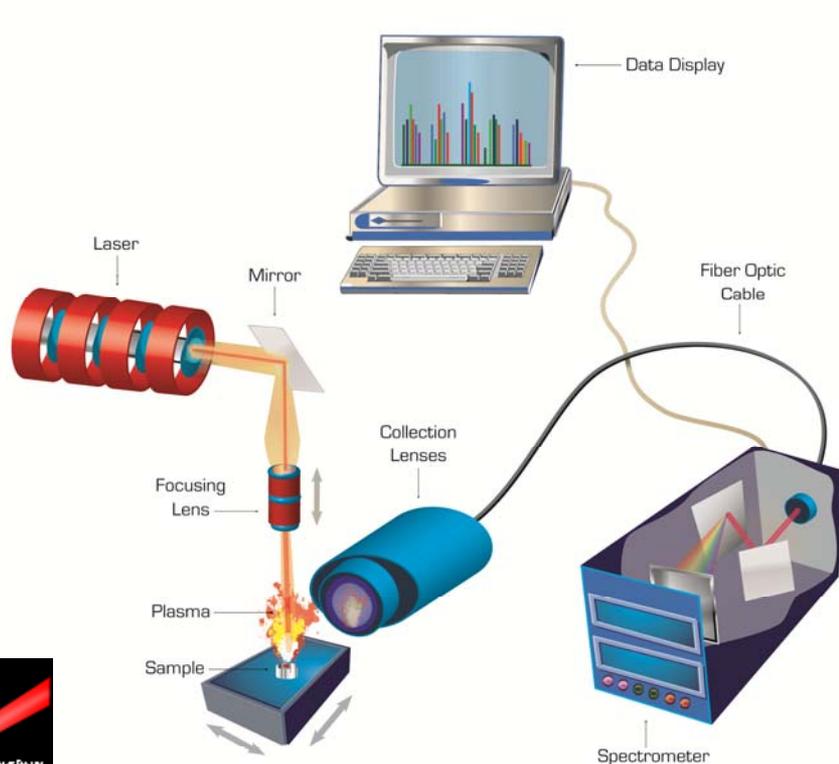
Analysis

Green Technology



LIBS System Components

LIBS Laser Induced Breakdown Spectroscopy



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 **APPLIED SPECTRA**

A laser solutions company

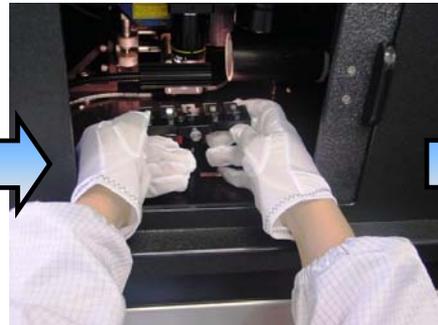
ASI LIBS System Operation



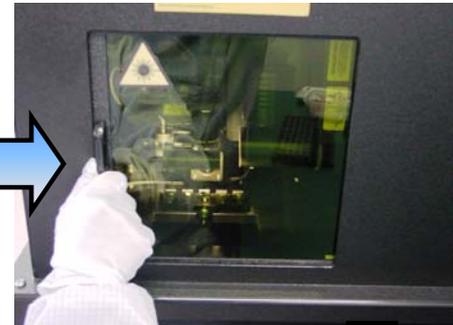
LOAD PRODUCT TO SAMPLE HOLDER



OPEN LIBS DOOR



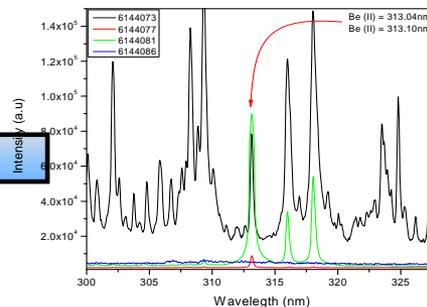
LOAD SAMPLE HOLDER INTO LOAD DOCK



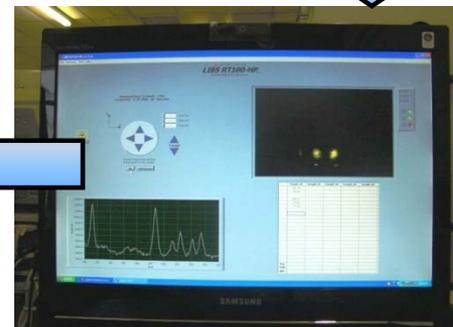
CLOSE LIBS DOOR



UPON COMPLETION, OPEN LIBS DOOR



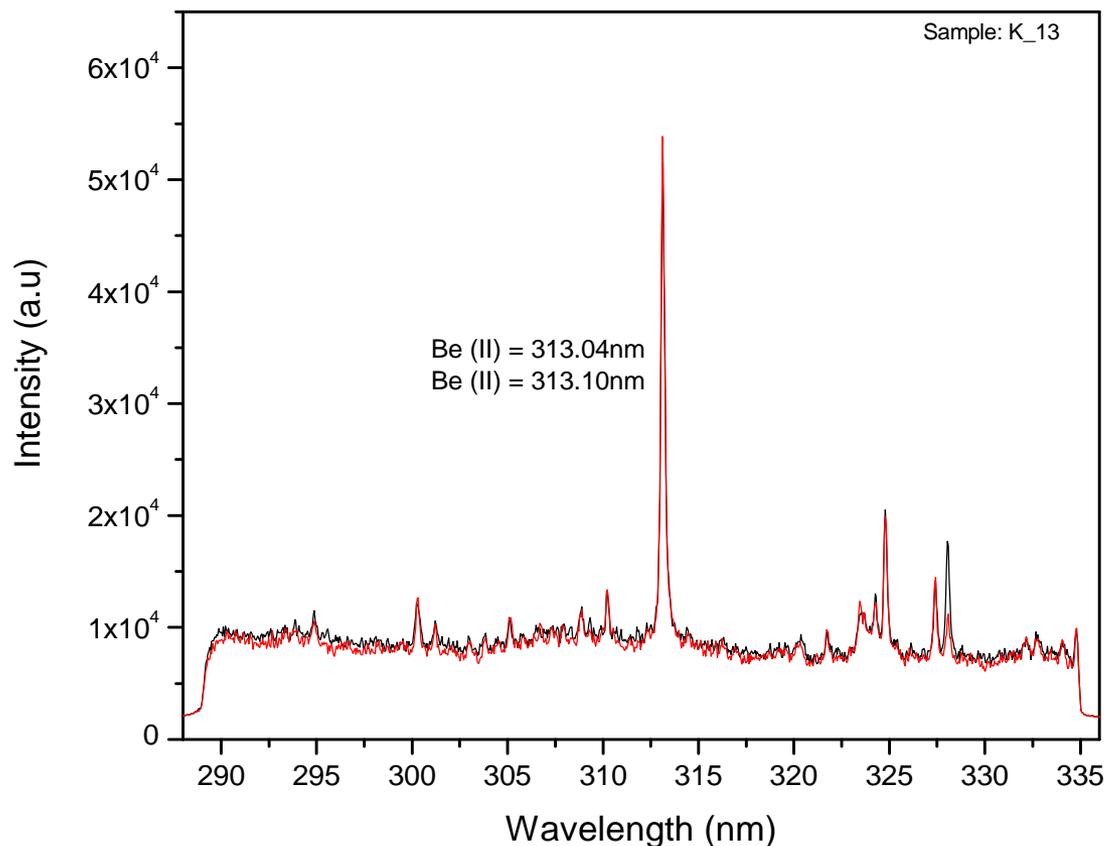
RESULTS



RUN THE SELECTED RECIPE

Test time calculated at 10 seconds per swipe

Can LIBS "See" Be?

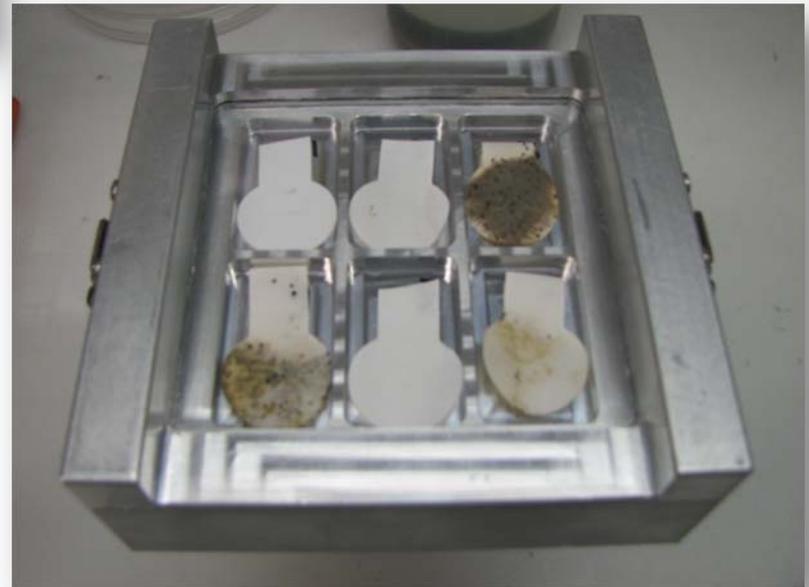


- Cotton swipe doped with Be solution

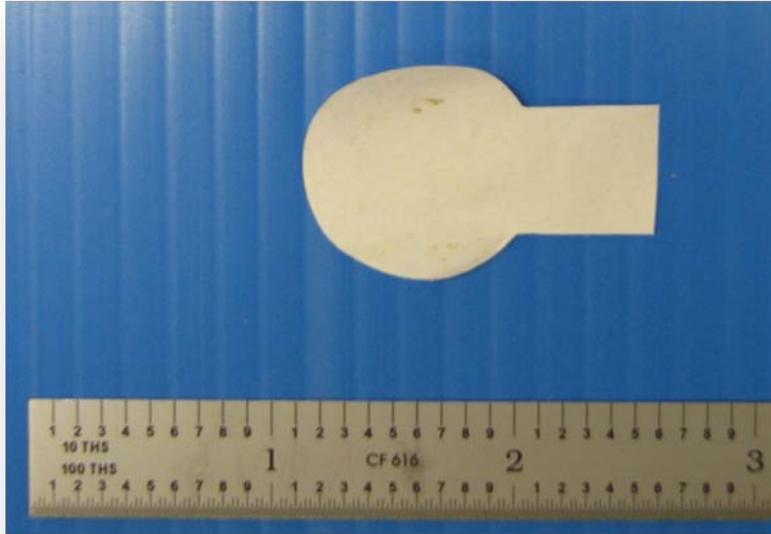
Be Multiple Swipe Holder



- 6 swipe sample holder
- Gasket sealed
- Easy loading of swipe samples and sample holder
- Can be customized for other sample types and materials (elements)

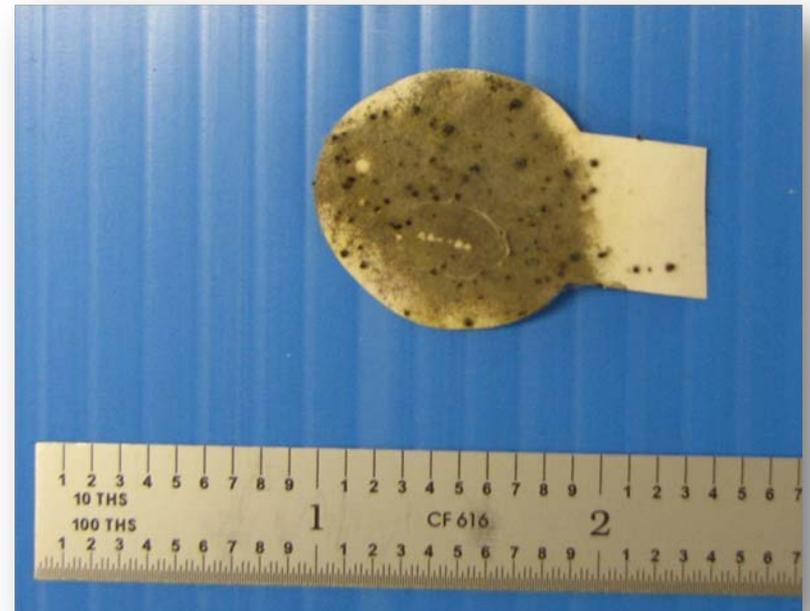


Swipe Samples from LLNL

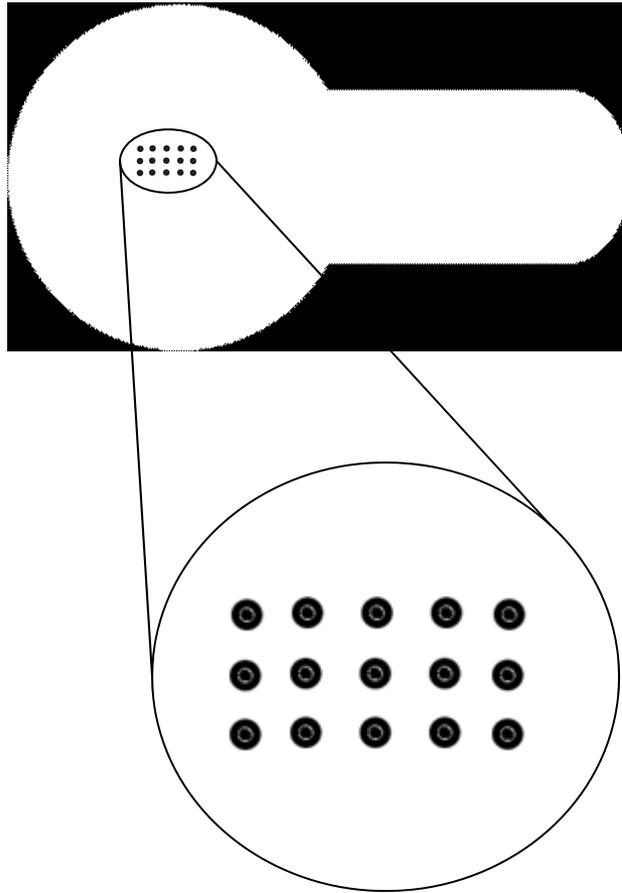


- Standard LLNL swipe
- # 6144078
- LIBS and ICP-OES confirm negative for Be

- Sample # 6144070
- LIBS and ICP-OES confirm positive of Be



Swipe Samples Under Test



Sample Results

Sample Group	LLNL Part #	ASI Part #	Locations Sampled	Locations Positive	LIBS Results	ICP-OES Results
1	6144053	6144070	9	9	Yes	0.0026
2	6144054	6144071	10	10	Yes	0.00085
3	6144055	6144072	10	10	Yes	0.0026
4	6144056	6144073	9	6	Yes	<0.0002 (0.000038ug/cm2)
5	6144057	6144074	10	7	Yes	<0.0002 (0.000085ug/cm2)
6	6144058	6144075	3	3	Yes	0.0069
7	6144059	6144076	7	7	Yes	0.14
8	6144060	6144077	3	3	Yes	0.0028
9	6144061	6144078	3	3	Yes	0.018
10	6144062	6144079	18	9	Yes	<0.0002 (0.00016ug/cm2)
11	6144063	6144080	15	0	No	<0.0002
12	6144064	6144081	9	9	Yes	0.052
13	6144065	6144082	10	10	Yes	0.24
14	6144066	6144083	10	0	No	<0.0002 (0.000074ug/cm2)
15	6144067	6144084	5	3	Yes	0.0021
16	6144068	6144085	10	10	Yes	0.0071
17	6144069	6144086	15	0	No	<0.0002

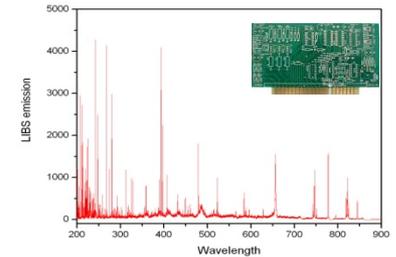
LIBS detection limit is approximately 1ppm per laser shot.

ASI and LLNL blind test shows 100% correlation.

Why LIBS?

- **Excellent sensitivity for Be**
 - Approximately 1ppm
- **Rapid Analysis**
 - Real time results
 - Only seconds per swipe
 - No sample preparation
- **Low cost of ownership**
 - No consumables (acids and gases)
 - No waste
 - Reduced exposure of hazardous materials to personnel
- **System Flexibility**
 - Easy to operate (integrated sampling and data analysis)
 - Auto sampling, single and multiple swipes
 - Accommodate other sample media and elements

Solder on PC board



Explosive residue

