B45 **The Analysis of Commercial Blasting Agents by Laser Induced Breakdown Spectroscopy (LIBS), With Emphasis on Methods for Heterogeneous Samples**

Katie L. Vomvoris, BS*, Candice Bridge, BS, Zachary M. Parker, Jean Mac Innis, PhD, and Michael Sigman, PhD, National Center for Forensic Science, PO Box 162367, Orlando, FL 32816-2367

The goal of this presentation is to demonstrate the importance of sam- pling techniques that should be considered when analyzing heterogeneous samples using Laser Induced Breakdown Spectroscopy (LIBS), and for the purpose of sample discrimination.

This presentation will impact the forensic community and/or humanity by emphasizing the importance of multiple shot averages that are necessary for heterogeneous samples, such as the blasting agents used in this study, to insure LIBS spectra acquired are representative of the sample composition.

LIBS is a technique that analyzes samples by elemental emissions (both atomic and ionic emissions), which has been utilized the scientific community since the 1980's. Only in recent years has this technique attracted the attention of the forensic science community due to advantages such as the ability for fast data analysis, little sample preparation, and high signal to noise ratio. The twenty-two (22) heterogeneous blasting agents used in this study are comprised of slurries, water gels, and emulsions. All data was collected using an Ocean Optics LIBS 2000+ system. Experimental parameters included a 1064 nm laser excitation using a Big Sky model CPR200 Nd-YAG at approximately 81mJ/pulse and a detection delay of 5µs, which was determined to be an optimal delay for the majority of the twenty-two samples.

When LIBS spectral averaging is utilized for heterogeneous sample analysis, several factors must be considered in order to achieve a represen- tative average spectrum. These factors include the number of spectra averaged, the heterogeneity of the sample, and other experimental para- meters such as laser power, detection delay time, and sample atmosphere. In order to reduce the complexity of the experimental system, a "homoge- neous" sample consisting of a glass microscope slide, was first analyzed. The influence of sample atmosphere (air versus argon), and number of spectra averaged on the reproducibility of average spectra was investigated. Results suggested that air can provide a better sampling atmosphere for these samples.

The influence of sample heterogeneity was investigated though the analysis of 22 commercial blasting agents. These materials often contain glass micro balloons, metal particles (*i.e.*, Aluminum), potassium nitrate prills, and other more homogeneously distributed organic and inorganic components. Samples were prepared as thin layers spread on copper sup- ports. Spectra were collected and averaged at a number of locations on the sample and the number of spectra was varied. Spectra were compared by a variety of techniques including full spectral correlation, selected line cor- relations and spectral line ratioing. Results will be presented describing the utility of each data analysis method for sample discrimination and the potential efficacy of LIBS for heterogeneous sample analysis.

LIBS, Heterogeneous Sample, Blasting Agents