A31 Classification and Discrimination of Container and Vehicle Glass by Laser Induced Breakdown Spectroscopy (LIBS)

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After attending this presentation, attendees will understand the significance of forensic glass examinations using Laser Induced Breakdown Spectroscopy (LIBS) including how the data from the analysis is interpreted.

This presentation will impact the forensic community by providing a better understanding of the capabilities, advantages, and limitations of LIBS in forensic analysis of glass.

The classification and discrimination of glass evidence can be of importance in forensic investigation of several types of cases. Glass fragments collected from a crime scene such as vehicle glass from a hit and run accident or fragments from container glass resulting from a struggle are sometimes the only evidence providing information of association between a suspect and the event. In this study, LIBS is used to classify glass fragments into an end use category and discriminate between similar container and similar vehicle glass fragments.

A 266nm pulsed Nd:YAG laser was used as the excitation source to create a very small (~2 mm diameter) plasma. A fiber optic positioned to collect the light emitted from the plasma is connected to a Mechelle spectrometer (Andor Technologies) with a wavelength range between 200nm and 900nm and a ICCD camera (Andor Technologies) thus producing a high resolution (R= 5000) spectra and a large amount of spectral information in a very short time (~1sec). The emission lines collected are characteristic of the elemental composition of the sampled glass fragments removing ng quantities of the glass, making this essentially a non-destructive technique. The samples included in this work include 40 different container and 25 different vehicle glass samples. The element menu used to classify and discriminate these two types of glass is different and one of the advantages of LIBS is that all the elemental information is available for interpretation. The laser energy was kept constant at ~25mJ throughout all the experiments. The lens to sample distance (LTSD) was optimized for the best coupling resulting in the best precision of the analysis (focusing the laser ~1.7mm into the sample).

Laser ablation inductively coupled plasma mass spectrometry (LA- ICP-MS) was also used to analyze the same set of samples and the data was compared to that obtained by LIBS. LA-ICP-MS is widely used in crime labs worldwide, but the cost of the equipment, maintenance and complicated data analysis makes LIBS a more cost-effective alternative that is very fast and easy to use and interpret.

The container and vehicle glass samples are easily classified by the elemental composition as determined by LIBS. Pairwise comparisons using the LA-ICP-MS and LIBS data/results were used for the discrimination study. All the container glass samples originating from different sources were differentiated by both LA-ICP-MS and LIBS and all vehicle glass samples known to have originated from different manufacturing sources were also distinguished by both LA-ICP-MS and LIBS. The use of LIBS has proven to be a reliable, useful technique requiring almost no sample preparation and also providing a viable alternative to the more established, but more resource intensive, LA-ICP- MS and uXRF techniques for elemental analysis of glass. **LIBS, Glass Discrimination, Glass Classification**

 ** Presenting Author*