A157 Discrimination of Glass Samples by Infrared Microprobe Analysis With Diamond Attenuated Total Reflection

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After attending this presentation, attendees will learn how infrared microprobe analysis can be a useful tool for forensic glass analysis.

This presentation will impact the forensic community by demonstrating a new method for discriminating between various types of glass samples, and illustrating the significance of using infrared microspectroscopy.

Glass is a component in numerous everyday objects, from bottles and containers, to windows and laboratory glassware. It is an excellent source of physical evidence because of its stability as well as ability to be transferred easily, making it commonly encountered as fragments due to its susceptibility to breakage. Because of these characteristics, the importance of reliable comparative analysis therefore cannot be understated, especially as glass can be found in both civil and criminal investigations. Over the last few years, glass examination has gradually moved towards elemental analysis and the identification of elemental composition, using ICP-MS and LA-ICP-MS. However, there is still a need for more discriminatory methods for forensic analysis, and current research with infrared microspectroscopy of glass shows great potential.

This research focuses on the analysis of several glass samples from the National Institute of Standards and Technology (NIST), for which compositional data is available, using infrared microspectroscopy with diamond attenuated total reflection (ATR). Infrared microprobe analysis (IMA) combines microscopy with IR spectroscopy, allowing for both visual examination and midinfrared spectral analysis of a material. IMA of glass is advantageous because it has the potential to provide chemical functional group information from the spectrum of the glass. This information from the spectral data in combination with the compositional data for the glasses allows for better comparisons.

The infrared microprobe is quick and simple to use, requires little to no sample prep, and is generally non-destructive. The Attenuated Total Reflection objective (ATR), which focuses the IR beam on to the diamond-glass interface, allows for ATR spectral measurements. The generated ATR spectrum can then be analyzed using various software programs and searched through various ATR spectral data libraries for comparison. Several spectra were obtained for each sample and used to create an ATR library. Each spectrum was then run in the library first against spectra from the same sample in order to test reproducibility, and then against all other spectra in order to test the discriminating power of this method.

The results show that despite fact that the elemental chemistry of the NIST samples used is very similar, it was still possible to observe the differences between the samples and distinguish between them. Overall, the success rate for identifying the correct number 1 hit in the library searches was an overwhelming 96.49%, with the correct answer always being within the first two hits, proving the usefulness of this method. In addition, this research emphasizes the need for the development of specialized spectral databases, such as ATR spectra, which can be invaluable for forensic research.

Glass, Infrared Microspectroscopy, Trace Evidence

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