B101 An Adhesive Analysis of Various Tapes Using Laser-Induced Breakdown Spectroscopy (LIBS)

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Learning Overview: After attending this presentation, attendees will better understand LIBS and how it can be applied to adhesive analysis to aid in forensic investigations.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by describing how LIBS can be a useful tool for adhesive analyses.

Adhesive tapes are commonly found in crime scenes. Any tape has adhesive on one or both sides. This adhesive can be left as residue when the tape comes into contact with other surfaces. Although it is not always considered the highest priority, this can often be interesting evidence in forensic cases as it still often has value in completing a full profile of the crime. The adhesive can be instrumental in differentiating between the different varieties of tape. This can include both different types of tape, such as duct tape or electrical tape, but also between different brands of the same type of tape. The most common type of tape used in crimes is duct tape, with the second being electrical tape. Other minor types of tapes found in crime scenes include packaging tape, filament tape, and masking tape. Once tape or tape residue is found at a crime scene, it is the forensic scientist's job to determine the type of tape and to further determine with certainty that it is the same tape that was found at other places (i.e., usually, with the person under investigation).[1]

LIBS is a spectroscopic technique in which a high-powered laser is focused onto a surface. The focused laser pulse heats, ablates, atomizes, and ionizes the surface material and results in the formation of a plasma. The plasma light is collected, spectrally resolved, and detected. Elemental emission is observed in the form of a spectrum. The LIBS spectrum can provide both qualitative and quantitative information. LIBS has many applications including space, environmental, explosives, forensics, etc.[2-5]

For this study, LIBS was used to analyze the adhesive side of various tapes to determine its feasibility for unique adhesive detection. The tapes analyzed included various brands of duct tape, electrical tape, masking tape, packaging tapes, filament tapes, and medical tapes. LIBS data was taken on the adhesive side of all of the tape analyses. Spectra were collected from 220 to 950nm. The spectral data was analyzed to determine unique spectral lines for the various tapes analyzed. The data shows that there are differences in the adhesives of the various brands of duct tape. Furthermore, duct tape and electrical tape were able to be distinguished from each other. Useful spectra were not obtained on many of the clear tapes analyzed due to coupling issues with the focused pulse and the clear surface of the tape face. However, spectra were obtained for many tapes with an opaque or colored tape face.

Reference(s):

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4. Rosemarie C. Chinni. A Simple LIBS (Laser-Induced Breakdown Spectroscopy) Laboratory Experiment to Introduce Undergraduates to Calibration Functions and Atomic Spectroscopy. *J. Chem. Ed.* 89, no. 5 (2012): 678.
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Adhesive Analysis, LIBS, Atomic Spectrscopy

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