B167 The Discrimination and Identification of Fiber Samples Using Raman Microspectroscopy

Sergey Mamedov, PhD, HORIBA Scientific, Piscataway, NJ 08854*

Learning Overview: After attending this presentation, attendees will understand Raman microspectroscopy in applications to fiber analysis discrimination and identification, which are important elements in forensic identification of these materials.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by serving as a key aspect of fiber analysis and an example of a practical application of Raman microspectroscopy to fiber identification.

Raman spectroscopy and infrared spectroscopy are complementary techniques, often used for the identification of compounds. Raman spectroscopy offers several advantages over infrared spectroscopy. Raman spectroscopy is a light scattering technique whereby light from a laser interacts with a sample producing scattered light of different wavelengths. The scattered light, which is specific to a particular compound, is directed to a detector enabling chemical identification. Raman analysis has been recognized to have potential for solving a wide variety of problems associated with forensic science. Early motivation was to identify substances and contaminants that appeared in crime scene evidence and manufactured products. Nevertheless, it was quickly applied to all types of material analyses.

Raman microspectroscopy is very applicable in the field of forensics. It uses a technique that offers a non-destructive and non-contact method of analysis. Only a small amount of sample is required and little or no sample preparation is necessary. It allows for trace analysis, whereas sampling can be done directly through transparent evidence bags and packaging, such as glass and plastics. It covers a wide spectral range from 10 cm^{-1} to 4000 cm^{-1}, making the technique ideal for the identification of both organic and inorganic substances, which includes fibers, drugs, pharmaceuticals, explosives, inks, paint etc. Raman microspectroscopy also allows to identify the components of inhomogeneous samples and to obtain automated high definition Raman mapped images.

To aid law enforcement personnel and the public at large, investigations have been geared toward the ability of Raman microspectroscopy to identify a variety of polymers used in fibers. This is very important, as the presence of fibers at a crime scene has often been instrumental in the process of solving crime. The capability of Raman spectroscopy to differentiate between fibers of similar chemical structure will be demonstrated. “Fingerprints” of nylon 6, Kevlar, polystyrene, PET, poly-propylene, and some other fibers along with different types of nylon (nylon 6, nylon 6/6, nylon 12, and others) will be highlighted in this paper, as well as the ability to identify fiber mounted on substrate.

Spectral data of the fibers was collected using 532 nm, 633 nm, and 785 nm laser excitations. Comparison of the Raman spectra of the fibers taken with different excitation wavelength will be discussed. It will be shown that search can provide quick identification of materials whose spectra have been collected in a library or just matched to suspect material samples.

Raman, Fibers, Identification