B122 Forensic Analysis of Architectural Paints Utilizing Raman Spectroscopy

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After attending this presentation, attendees will have been introduced to Raman Spectroscopy as an analytical technique that can aid in the forensic analysis and comparison of architectural paints.

The use and advantages of Raman spectroscopy in the forensic analysis of architectural paints and pigments will be presented. In this study, samples of architectural paint pigments and pigmented architectural paints were analyzed by Raman spectroscopy. The data presented will show that Raman spectroscopy can aid the forensic scientist in the discrimination of architectural paints. This research documents a new approach to the analysis and characterization of architectural paints. Although paint evidence is common trace evidence, the forensic analysis of architectural paints has not received significant attention in recent years.

The forensic scientist must not be concerned only with positive associations of physical evidence. As an unbiased finder of truth, the forensic scientist must be cognizant of analytical methods that provide the best discrimination among similar samples. Forensic scientists must consider all tests and analytical procedures that may result in the discrimination between paint samples. The greater the number of analytical techniques and methods the forensic scientist has available and utilizes to analyze physical evidence, the greater the probability of discriminating between items of evidence. The ability to provide greater discrimination among similar paints will result in a reduction of false inclusions. An analysis employing a battery of discriminating techniques that shows consistency between samples will result in a stronger association.

Forensic paint evidence is received at the forensic laboratory in the course of many types of criminal investigations. Such investigations include but are not limited to: forced entries, burglaries, robberies, assaults, vehicular hit and runs, abductions, rapes, and homicides. The transfer of paint occurs from miscellaneous contacts of painted objects with each other or contacts of painted surfaces with non-painted surfaces. Mutual transfers may not always be equal in quantity or quality. In some cases, very light or minimal transfers can occur, these types of transfers often present a challenge to the forensic scientist. Minimal transfers can make the characterization, identification, and association of items of evidentiary value very difficult. Raman spectroscopy can be applied to the analysis of very small samples; and therefore is ideal for the analysis of this type forensic sample.

Over the last five years, the technology for collection of Raman spectra has advanced, transforming Raman spectroscopy from a research curiosity into a practical analytical methodology. Raman spectroscopy holds great potential for analyzing all types of forensic evidence. Advances in Raman instrumentation and technologies, have resulted in instruments that are far different from their predecessors. The cost of these new commercial instruments has decreased sufficiently that forensic laboratories can now afford them.

Prior to application, architectural paint is a liquid medium containing a mixture of a solvent(s), dispersant(s), binder(s), pigment(s), and additive(s). When paint is applied to a surface it dries to form a thin film or coating that contains all but the solvent portion of the mixture. Architectural coatings are applied to both the interior and exterior surfaces of building structures. Over 600 million gallons of architectural paint are applied to the interior and exterior surfaces of building structures each year.

Paint can contain both organic and inorganic materials. The fact that paint binders are poor Raman scatterers is advantageous. A large number of pigments used in architectural paints are strong Raman scatterers. This phenomenon allows for the identification of pigments in architectural paints. In addition, with the requirement of little or no sample preparation coupled with the speed at which Raman spectral data can be acquired, the discrimination of architectural paints can be accomplished in a matter of minutes.

Multiple applications of paint result in the production of a series of layers. Samples consisting of single layer coatings of paint as well as intact, multiple-layered paint chips were analyzed using Raman spectroscopy. A semi-quantitative analysis of the Raman spectral data obtained resulted in the discrimination of similar white paint samples. The analytical data presented will support the utility and value of Raman spectroscopy in the analysis architectural paints.

Raman, Paint, Pigments

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