J16 Examination of Fraud Documents by Microscopy Raman Spectroscopy Method

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After attending this presentation, attendees will learn a new method for the determination of the sequence of printed text and signatures in questionable documents with no intersecting areas of pen ink and toner lines.

This presentation will impact the forensic science community by improving its capabilities in fraudulent document investigations.

In recent years, due to the widespread availability of laser printers and photocopiers, offenses in connection to document alterations have become more frequent. Crimes and illegal acts related to document manipulation include fraud, counterfeiting, blackmail, anonymous letters, and acts of terrorism among others. Following the trend of the increasing number of document fraud cases, efficient investigation techniques of printed materials have come into the focus of forensic research.

In cases with suspicions that the content of a signed legal document has been subsequently altered, the determination of the order of crossing lines is an appropriate investigation approach. If the printed text overlaps or intersects with the signature on the document, the alteration may be investigated by examining the areas of intersections. In these cases a number of techniques are available to determine the order of crossing lines. They include standard optical microscopic techniques and some special types of microscopy for example SEM and AFM. Recently a new analytical method was published, the microscopy FTIR- ATR method, which is a suitable technique to determine the sequence of the crossed lines. This can be done by measuring the surface layer at the areas of intersection. In the visual mode of the ATR objective, the exact definition of line crossing points is provided, so the chemical composition of the surface layer can be examined at this point based on the spectrum. Analyzing the upper layer, the sequence of crossed lines of printer toner and pen ink can be determined. However, if there was no intersecting area the sequence order of the toner and pen ink layers could not be determined with the application of the above standard methods.

In this paper a new method is presented that is applicable for the determination of the order of different ink layers even if there is no visible intersection of printed lines. The microscopy-based Raman technique is an eligible method for the determination of the chemical structure of printer toners and pen inks directly on the document. This new method is based on the features of the printing process used by the copiers and laser printers. During this electro-photographic process, dry toner particles of size 6-8 mm diameters are melted and flattened by pressure onto the surface of the document. The polymer resin, the main component of dry printer toners creates a few mm thin surface layer that forms the characters and further thousands of discrete toner particles contaminate the full surface of the paper. These microscopic toner spatters are evenly distributed over the whole document, approximately 100 spatters/ cm^2. Such particles can almost surely be found in the critical area of the signature or other lines of high importance. As the chemical structure of these particles is the same as the toner material, these micro-sized toner particles are suitable for the sequencing examination.

This new method helps to investigate the chronological sequence of two writing media in both possibilities: document with and without intersecting lines. This is a simple, fast, non-destructive method, which doesn't require sample preparation and provides an objective result leaving the documents intact.

Document, Fraud, Raman

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