LA-UR-05-0080

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Title: DETECTION OF FINGERPRINTS BASED ON ELEMENTAL COMPOSITION USING MICRO-X-RAY FLUORESCENCE

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Submitted to: LANL

DETECTION OF FINGERPRINTS BASED ON ELEMENTAL COMPOSITION USING MICRO-X-RAY FLUORESCENCE

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1) A method was developed to detect fingerprints using a technique known as micro-X-ray fluorescence. The traditional method of detecting fingerprints involves treating the sample with certain powders, liquids, or vapors to add color to the fingerprint so that it can be easily seen and photographed for forensic purposes. This is known as contrast enhancement, and a multitude of chemical processing methods have been developed in the past century to render fingerprints visible. However, fingerprints present on certain substances such as fibrous papers and textiles, wood, leather, plastic, adhesives, and human skin can sometimes be difficult to detect by contrast enhancement. Children's fingerprints are also difficult to detect due to the absence of sebum on their skin, and detection of prints left on certain colored backgrounds can sometimes be problematic.

   Micro-X-ray fluorescence (MXRF) was studied here as a method to detect fingerprints based on chemical elements present in fingerprint residue. For example, salts such as sodium chloride and potassium chloride excreted in sweat are sometimes present in detectable quantities in fingerprints. We demonstrated that MXRF can be used to detect this sodium, potassium, and chlorine from such salts. Furthermore, using MXRF, each of these elements (and many other elements if present) can be detected as a function of location on a surface, so we were able to "see" a fingerprint because these salts are deposited mainly along the patterns present in a fingerprint (traditionally called friction ridges in forensic science).

   MXRF is not a panacea for detecting all fingerprints; some prints will not contain enough detectable material to be "seen"; however, determining an effective means of coloring a fingerprint with traditional contrast enhancement methods can sometimes be an arduous process with limited success. Thus, MXRF offers a possible alternative for detecting fingerprints, and it does not require any additional chemical treatment steps which can be time consuming and permanently alter the sample. Additionally, MXRF is noninvasive, so a fingerprint analyzed by this method is left pristine for examination by other methods (eg. DNA extraction).

2) To the best of the author's knowledge, no studies have been published to date concerning the detection of fingerprints by micro-X-ray fluorescence. Some studies have been published in which other spectroscopic methods were employed to examine the chemical composition of fingerprints (eg. IR, SEM/EDX, and Auger), but very few papers discuss the actual detection and imaging of a complete fingerprint by any spectroscopic method. Thus, this work is unique.