D74 Evaluation of Latent Fingerprint Development Techniques for Metallic Evidence

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After attending this presentation, attendees will understand the limitations currently associated with the development of latent fingerprints on metallic surfaces, and will learn about latent fingerprint residue components, how these are affected by exposure to different elements, and about nontraditional development techniques for latent fingerprint development on metallic evidence.

This presentation will impact the forensic science community by sharing important information that can lead to the successful development of more identifiable latent fingerprints on a variety of metallic surfaces.

Traditional latent fingerprint development techniques, such as cyanoacrylate fuming and powdering, have relatively low success rates on metallic surfaces on forensic evidence, mostly due to the nonporous nature of the metals, but also due to the fragile nature of the latent fingerprints. A latent fingerprint is composed mostly of bodily secretions (e.g., water, inorganic salts, amino acids, fatty acids, ammonia, and urea), which can degrade under extreme environmental conditions, such as high temperature and low humidity. The survivability of a latent fingerprint on any surface (metal surfaces included) depends on many factors including atmospheric conditions (e.g., temperature and humidity) and contaminants (e.g., dust, water, mud, and surface coatings). Traditional latent fingerprint development techniques rely on the physical and/or chemical interaction of the "developer" with the unaltered components (i.e., specific functional groups) of the latent fingerprint secretions. Therefore, traditional techniques are not very effective when the compounds in latent fingerprint secretions have been altered or degraded, as occurs when evidence is aged or has been exposed to extreme environmental conditions. Metals are nonporous in nature and, therefore, do not absorb fingerprint residues, rendering fingerprints exposed and, hence, easier to degrade and/or obliterate under extreme environmental conditions and/or when in contact with contaminants. Moreover, metals are excellent heat conductors; therefore, a metal surface will tend to heat faster and more uniformly than other surfaces, potentially exacerbating the degradation of the latent print residues.

Metallic evidence is critical in the forensic arena given that many weapons are constructed with metallic components. Many weapons are exposed to high temperatures, low ambient humidity, rough surroundings, and a variety of surface contaminants. Firearm cartridge casings, for example, undergo surface deformation and heat exposure when they are fired. Also, many weapons have anti-corrosive coatings or oily residues present on their surfaces, making traditional development techniques quite ineffective.

A variety of nontraditional latent fingerprint visualization techniques for metallic surfaces (e.g., modified small particle reagents, gun bluing, corrosion/oxidation etching, and nanoparticles) have been studied and modified accordingly. Natural and synthetic (sebaceous and amino acid) fingerprint residues have been placed on metallic coupons and have been subjected to controlled extreme environmental conditions (i.e., high temperatures and low relative humidity) using an environmental chamber in an attempt to degrade latent fingerprint residues. Degraded prints have been treated with traditional and nontraditional development methodologies for comparison, and developed prints have been assessed for quality and quantity of detail. The new methodologies are being evaluated to improve latent fingerprint recovery from metallic evidence, either as a replacement for or in combination with traditional nonporous processing protocols.

Latent Print, Development, Metal Evidence

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