

O4. A Surface Study of Fingerprints: From Model Surfaces to Fired Cartridge Cases

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As stated by Locard's principle, the interaction between two objects results in the transfer of material. This applies to the contact between a fingertip and a surface: the material transferred is sweat. This deposit mirrors the ridge pattern of the fingertip responsible for the initial contact. When the object is a semi-reactive metal, components of the sweat, such as salt and water, can react with the surface. This reaction is a corrosion process, resulting in a permanent mark of the contact, localised to areas of deposition. This "etched" mark resists attempts at removal including fire, vigorous washing and light abrasion.

When the fingerprint is still fairly fresh, conventional forensic techniques, like powder, can be used to successfully recover the print. Unfortunately, after several months there is often not enough sweat residue remaining for this to work. Cartridge cases in particular present a significant challenge since most of the residue has been removed by high temperatures and abrasion, however there is still enough material remaining for it to be possible to locate and image the fingerprint by surface sensitive imaging techniques, such as X-ray Photoelectron Spectroscopy (XPS) and Atomic Force Microscopy (AFM).

XPS can be used to study a sample via the use of X-rays, this enables the different elements present to be identified. Here we apply this in a spatially resolved manner allowing us to map the surface, enabling spatial differentiation between the metal surface and the sweat (via the salts) as well the interaction between the two. AFM is used to study the surface by moving an atomically sharp stylus across the sample, the information gathered is used to create an image representing the topographical features of the surface. This depicts the height and dimensional differences between the sweat and the substrate.

In addition to imaging, these techniques have also been used to reveal significant information about the interaction between the sweat and the brass surface. The application of these techniques was extended from model brass samples to fired brass cartridge cases. The long term goal of this work is the imaging of fingerprints on cartridge cases.

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