O6. Fundamentals of electrochromic enhancement of latent fingerprints on metal surfaces

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Over 200,000 items of fingerprint evidence are processed each year in the UK, of which 20,000 are metallic items. Surprisingly, despite the range of methods available, less than 10% of these produce useable fingerprints. Given the prevalence of metallic objects - weapons, tools, handles – in criminal investigations this is an important challenge.

Current techniques for developing fingerprints rely on physical or chemical interaction between a reagent and the deposit left from handling an item or surface, resulting in a positive image of the fingerprint. A complementary technique has been explored that involves interaction of a reagent with a surface rather than the fingerprint deposit itself. This technique is illustrated via the electrochemical polymerisation of thin films. Following polymerisation the fingerprinted object is transferred to electrolyte solution, where variation of applied potential allows reversible changes to polymer colour thereby optimising visual contrast.

Visualisation of latent fingerprints present on metallic surfaces has been demonstrated by means of spatially selective deposition of the polymers; polyaniline (PAni) and poly(3,4-ethylenedioxythiophene) (PEDOT). The novel technique utilises the inhibition of the electrochemical processes on areas of the surface that have been masked by the fingerprint. This results in polymer deposition between the ridges, generating a negative image of the fingerprint. By variation of the applied potential, the polymer's colour can be continuously and reversibly adjusted, as different redox states have distinct optical properties, i.e. the polymers are electrochromic. This can be used to optimise visual contrast of the fingerprint.

This concept will be demonstrated for latent fingerprints on a number of different metal surfaces of evidential value. These include precious metals (such as platinum) and base metals (such as lead and stainless steel), that present a range of chemistries.

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