COLUMNAR-THIN-FILM ASSISTED VISUALIZATION OF ENVIRONMENTALLY INSULATED FINGERPRINTS, AND DNA DEGRADATION ANALYSIS

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Fingerprint-development techniques commonly employed in crime laboratories frequently involve chemical means, which can be inadequate and even destructive for environmentally insulted fingerprints. These techniques also do not promote preservation of the latent residue. Fingerprints that have been exposed to environmental factors (e.g., ultraviolet radiation, extreme temperatures, humidity, and/or aged) could generate low amounts of DNA, thereby yielding incomplete DNA profiles. The ability of a development technique to protect DNA can be ascertained through quantitative Polymerase Chain Reaction (qPCR) of the DNA obtained from latent and developed fingerprints.

The columnar-thin-film (CTF) technique involves the low-pressure resistive heating of a material, which evaporates and condenses conformally on a latent fingerprint as a tight stack of upright nanoscale columns. Unlike the other commonly used techniques, the CTF technique entombs the residue and keeps the topology intact. Comparison of this method is made against other environmentally challenged samples using cyanoacrylate fuming and dusting with black powder. The CTF film serves as a barrier between the fingerprint residue and its environment, potentially preserving the molecular integrity of any genetic material.

Latent fingerprints on brass, which had been exposed to various temperatures and humidity for different durations, are being developed using chalcogenide-glass CTFs. The biological material from latent and CTF-developed samples is collected using wet swabs. The extraction procedure involves methods for low-template DNA analysis previously used in this laboratory. A recently developed quantitation method, which enables the researchers to determine sample quality prior to PCR, is used to study degradation. The quantity of DNA in multiple latent fingerprints is sufficient to assess the amount of degradation during development. DNA has also been successfully extracted from beneath the surface of the CTF, pointing to the potential for its use in bio-criminalistics.