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Leaving a mark on forensic science: Using synchrotron microscopy and spectroscopy to explore fingermark chemistry

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Fingermarks are an important tool in forensic investigations however, a large number are not successfully recovered and are never used as evidence.(1) A significant challenge in their detection is the chemical variability of fingermark deposits. This research aims to answer important questions in fingermark chemistry using synchrotron sourced analysis including x-ray fluorescence microscopy (XFM), infrared microspectroscopy (IRM) and THz-Far infrared (Far-IR) spectroscopy to deepen the understanding of fingermark residue and improve recovery methods.

First, what is the chemical composition of a fingermark? We explored the distribution of inorganic material using XFM to discriminate between the endogenous and exogenous metals present in a natural fingermark, with multimodal studies using IRM connecting this distribution to the organic material.(2,3) Further investigation of the transfer and persistence of exogenous metals demonstrated how handling different metal objects can affect fingermark chemistry, suggesting daily activities can influence the material present in a fingermark.

Second, what happens to this material as the fingermarks age? The material deposited in a fingermark is not static and changes over time, with the rate of change being influenced by the environment and surface. We have directly imaged the rate of change post deposition using IRM, demonstrating the dehydration of hydrophilic material in a fingermark droplet over time. To volumetrically measure this rate of change we have measured the water evaporating off a fingermark in the gas phase using Far-IR, providing important insight into the water content in fingermark residue.

1. S. Chadwick et al. Forensic Science International, 2018, 289, 381-389.
2. B. N. Dorakumbura et al. Analyst, 2018, 143, 4027-4039.
3. R. E. Boseley et al. Analytical Chemistry, 2019, 91, 10622-10630.

Presenter Gender

Woman

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

Students Only - Are you interested in AINSE student funding

Yes

Level of Expertise

Student

Pronouns

She/Her

Which facility did you use for your research

Australian Synchrotron

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