Synchrotron radiation-based Fourier Transform Infra-Red micro-imaging in service of forensic science

A. Banas[1], K. Banas[1], M. B. H. Breese[1, 2], J. Loke[3], S.K. Lim[3] and H.O. Moser[4]

[1] *Singapore Synchrotron Light Source, National University of Singapore, 5 Research Link, Singapore 117603*

[2] *Physics Department, National University of Singapore, 2 Science Drive 3, Singapore 117542*

[3] *Forensic Management Branch, Criminal Investigation Department, Police Cantonment Complex 391 New Bridge Road #20-04, Tower Block C, Singapore 088762*

[4] *Network of Excellent Retired Scientists (NES) and Institute of Microstructure Technology (IMT), Karlsruhe Institute of Technology (KIT), Postfach 3640, D-76021 Karlsruhe, Germany*

Synchrotron radiation-based Fourier Transform Infra-Red (SR-FTIR) micro-imaging has been developed as a rapid, direct and non-destructive technique. This method, taking advantage of synchrotron light brightness and a small effective source size, is capable of exploring the molecular chemistry within the microstructures of microscopic particles without the destruction of inherent structures at ultraspatial resolutions. This is in contrast to traditional "wet" chemical methods, which, during processing for analysis, often caused destruction of original samples.

In the present study, we demonstrate the potential of SR-FTIR micro-imaging as an effective way to identify accurately microscopic particles deposited within latent fingerprints. These particles are present from residual amounts of materials left on a person's fingers after handling such materials. Fingerprints contaminated with various types of powders, creams, medications and high explosive materials (3-nitrooxy-2,2-bis(nitrooxymethyl)propyl nitrate (PETN), 1,3,5-trinitro-1,3,5-triazinane (RDX), 2-methyl-1,3,5-trinitrobenzene (TNT)) deposited on various - daily used - substrates have been analysed herein without any further sample preparation. Non-destructive method for the transfer of contaminated fingerprint from hard to reach areas of the substrates to the place of analysis was also presented.

This method potentially could have a significant impact on forensic science and could dramatically enhance the amount of information that can be obtained from the study of fingerprints.