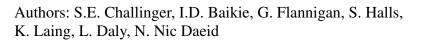
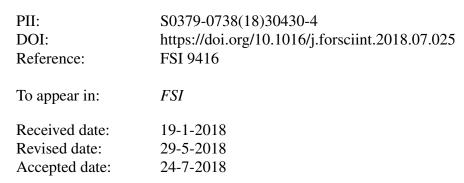
### Accepted Manuscript

Title: Comparison of Scanning Kelvin Probe with SEM/EPMA Techniques for Fingermark Recovery from Metallic Surfaces





Please cite this article as: S.E.Challinger, I.D.Baikie, G.Flannigan, S.Halls, K.Laing, L.Daly, N.Nic Daeid, Comparison of Scanning Kelvin Probe with SEM/EPMA Techniques for Fingermark Recovery from Metallic Surfaces, Forensic Science International https://doi.org/10.1016/j.forsciint.2018.07.025

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



### ACCEPTED MANUSCRIPT

# Comparison of Scanning Kelvin Probe with SEM/EPMA Techniques for Fingermark Recovery from Metallic Surfaces

S.E. Challinger<sup>1</sup>, I.D. Baikie<sup>1</sup>, G. Flannigan<sup>2</sup>, S. Halls<sup>3</sup>, K. Laing<sup>4</sup>, L. Daly<sup>5</sup>, N. Nic Daeid<sup>5,6</sup>

1. KP Technology, Burn Street, Wick, Caithness, KW1 5EH, Scotland, UK

2. Detective Chief Superintendent (retired), Police Scotland, Scotland, UK

3. Detective Sergeant, Major Investigation Team (East), Specialist Crime Division, Queen Charlotte Street, Edinburgh, EH6 7EY, Scotland, UK

4. Mark Enhancement Team Manager, Forensic Services, Scottish Police Authority, Scottish Crime Campus, Craignethan Drive, Gartcosh, G69 8AE, Scotland, UK

5. Centre for Anatomy and Human Identification, University of Dundee, Dow Street, Dundee, DD1 5EH, Scotland, UK

6. Leverhulme Research Centre for Forensic Science, University of Dundee, Smalls Lane, Dundee, Scotland, UK

#### Highlights

- The Scanning Kelvin probe provides a fermi energy map revealing latent fingermarks
- Scanning Kelvin probe could pre-identify fingermark areas for targeted DNA recovery
- SEM/EPMA data was compared to Scanning Kelvin Probe images of fingermarks
- An increase in sodium, chlorine and oxygen coincided with a change in CPD
- Scanning Kelvin probe worked best on non-enhanced surfaces without VMD

#### Abstract:

Most traditional techniques to recover latent fingermarks from metallic surfaces do not consider the metal surface properties and instead focus on the fingermark chemistry. The scanning Kelvin probe (SKP) technique is a non-contact, non-destructive method, used under ambient conditions, which can be utilised to recover latent prints from metallic surfaces and does not require any enhancement techniques or prevent subsequent forensic analysis. Where a fingermark ridge contacted the metal, the contact potential difference (CPD) contrast between the background surface and the fingermark contact area was 10 - 50 mV. Measurements were performed on the untreated Brass, Nickel-coated Brass and Copper metal surfaces and compared to traditional forensic enhancement techniques such as vacuum metal deposition (VMD) using Au-Zn and Au-Ag. Using VMD, the CPD change ranged from 0 - 150 mV between the dissimilar metal surfaces affected by the fingermark. In general, SKP worked best without additional enhancement techniques.

Scanning Electron Microscope (SEM) scans were used to identify the fingermark contact areas through a Sodium, Chlorine and Oxygen electron probe micro-analyzer (EPMA). The fingermark was observed in the backscattered electron image as the carbon deposits scattered the electrons less than the surrounding metal surface. The fingermark is shown clearly in a Cathodoluminescence scan on the Copper sample as it blocks the photon emission at band gap (2.17 eV) from the underlying Copper Oxide (Cu<sub>2</sub>O) surface. For the first time, SEM, EPMA and Cathodoluminescence techniques were compared to SKP data.

Visible and latent fingermarks were tested with latent, eccrinous fingermarks more easily imaged by SKP. Results obtained were very encouraging and suggest that the scanning Kelvin probe technique, which does not need vacuum, could have a place as a first stage analysis tool in serious crime investigation.

#### Keywords: Scanning Kelvin Probe, Fingermarks, Forensic Science, Metal Surfaces, Contact Potential Difference, SEM

Download English Version:

## https://daneshyari.com/en/article/8941379

Download Persian Version:

https://daneshyari.com/article/8941379

Daneshyari.com