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Development of Latent Fingermarks from Difficult Surfaces by Laser Light Sources



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History



Crime Scene - Suzhou PD (2007)



Lasearcher Laser

Purple Laser 400 nm
Blue Laser 447 nm
Green Laser 532 nm
Red Laser 635 nm





Standard cutoff viewing filters

Photography

The first criminal fingerprint detected by laser





Detected, photographed and identified by Brian Dalrymple.

Photography





Photography

- Laser should not be held too close to articles since the article itself or the fingermark may be destroyed.
- Once a fingerprint is seen by its fluorescence, it should not be further illuminated until one is ready to photography it.
- Requiring careful scrutiny during the detection stage.

Experimental Design

Sample Collection Fingerprints were collected on a range of surfaces: Rocks, Stones, Wood, Fibers, Leather, Train Tickets

Chemistry

Modified Indanedione Stock



Experimental Design

"The stone which the builders rejected is become the chief corner-stone"

Crime Scene - Bricks



Bricks



Untreated Fingerprints on Brick



Green Laser 532 nm

Untreated Fingerprints on Brick



Blue Laser 447 nm

Untreated Fingerprints on Brick



Purple Laser 400 nm

IND



Laser + IND



Green Laser 532 nm

Laser + IND



Crime Scene



Samples



Untreated Fingerprints



Green Laser 532 nm

IND



Laser + IND



Green Laser 532 nm

Laser + IND



Fingerprint on stone



Laser + IND



Green Laser 532 nm

Fingerprint on wood



Laser + IND











Green Laser 532 nm

Surface











Fingerprint on leather



Laser + IND



Green Laser 532 nm

Surface



Train Tickets





Train Tickets





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Train Tickets



NaYF4:Yb Nanoparticles

Paper

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NIR-induced highly sensitive detection of latent fingermarks by NaYF₄:Yb,Er upconversion nanoparticles in a dry powder state

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ABSTRACT

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KEYWORDS

upconversion, nanoparticles, fingermark, development The most commonly found fingermarks at crime scenes are latent and, thus, an efficient method for detecting latent fingermarks is very important. However, traditional developing techniques have drawbacks such as low detection sensitivity, high background interference, complicated operation, and high toxicity. To tackle this challenge, we employed fluorescent NaYF&Yb,Er upconversion nanoparticles (UCNPs), which can fluoresce visible light when excited by 980 nm human-safe near-infrared light, to stain the latent fingermarks on various substrate surfaces. The UCNPs were successfully used as a novel fluorescent label for the detection of latent fingermarks with high sensitivity, low background, high efficiency, and low toxicity on various substrates including non-infiltrating materials (glass, marble, aluminum alloy sheets, stainless steel sheets, aluminum foils, and plastic cards), semi-infiltrating materials (floor leathers, ceramic tiles, wood floor, and painted wood), and infiltrating materials such as various types of papers. This work shows that UCNPs are a versatile fluorescent label for the facile detection of fingermarks on virtually any material, enabling their practical applications in forensic sciences.

1 Introduction

A fingermark is one of the most powerful traces that can be exploited as evidence for the identity of individuals since it represents the unique ridge skin pattern of an individual's finger. The most commonly found fingemarks at crime scenes are typically latent. Namely, they are normally invisible or less visible to

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Fingerprint on cotton



Laser + IND



Green Laser 532 nm

Quality



Quality



Web-based Software (PiAnoS)

Case # 1 – Homicide (06/01/2015)

- Cardboard found near the crime scene
- ◆ Laser examination negative
- > IND
- Two fingerprints located
- Identified as suspect

Case # 1 – Homicide (06/01/2015)



Case #2 – Homicide (2009)

• Varnished drawer surface

- ◆ Examined by LED negative
- Examined by Laser fingerprint found
- Examined by powder- negative
- ♦ Not identified as suspect

Case #2 – Homicide (2009)



Case #3 Serial Burglary Case (2013)

- Impressions located
- Examined by Laser
- Ridge detail detected
- ◆ Identified as accused



Case #3 Serial Burglary Case (2013)



Case #4 Homicide (2015)



Health and Safety Issues

- ◆ Always wear goggles when operating the laser.
- Never exposure of the skin to the laser beam.
- ◆ Always follow laser manuals.

Semiconductor Laser



Very portable



- No speckle
- More cheaper
- More powerful

Always worth a try !	7
Au	

Thank you for listening



Contact Information





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