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Fingermark Visualisation on Polymer Currency (Bank of England)

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Currency - Bank of England (Polymeric)

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The base material of the new £5 and £10 polymer banknotes from the Bank of England (BoE) is polypropylene plastic, and they are non-uniformly coated in a varnish. The banknotes feature transparent windows, printed areas of varying detail, and foil patches.

The fingermark visualisation processes recommended for paper-based banknotes, for example ninhydrin, are ineffective on non-porous substrates. Therefore alternative recovery processes were studied on the new polymer £5 notes in 2016, and this has been expanded upon in 2017, with further laboratory-based investigations on uncirculated £10 polymer banknotes.

Studies on polymer banknotes issued by other countries have been carried out. However it is not always possible to use findings from overseas research because of differences in the banknotes themselves, not all the processes available within the UK were included in the overseas studies, and because of differing environmental conditions between countries. Therefore CAST has carried out investigations on new BoE banknotes using a comprehensive array of processes to ascertain which are the most effective to visualise fingermarks.

The advice presented here was generated from the results of these experiments. It should be used in conjunction with the Fingermark Visualisation Manual.

Results and validation data from the £10 note study will appear in a journal paper which is in preparation. The reference for the study on £5 banknotes is - Downham R P, Brewer E R, King R S P, Luscombe A M, Sears V G, Fingermark visualisation on uncirculated £5 (Bank of England) polymer notes: Initial process comparison studies; Forensic Sci Int; 2017; V275; p 30–43.

For more information regarding the new polymer banknotes, see the Bank of England web pages at: http://www.thenewfiver.co.uk, http://www.thenewten.co.uk

OPTIONS - POWDERS

- If limited to Visual Examination to detect developed fingermarks then black magnetic powder is one of the most effective processes.
- The use of IR Reflection visualises many additional fingermarks and is non-destructive.
- *fp*Natural® 2 powder when viewed using IR fluorescence offers similar capability to black magnetic powder in combination with IR Reflection.
- Fluorescence of *fp*Natural® 2 enhanced fingermarks is excited with red (600-650 nm) or IR (730-800 nm) wavelengths and viewed with an IR imaging system fitted with a 900nm sharp-cut long pass filter.

OPTIONS – POWDER SUSPENSION

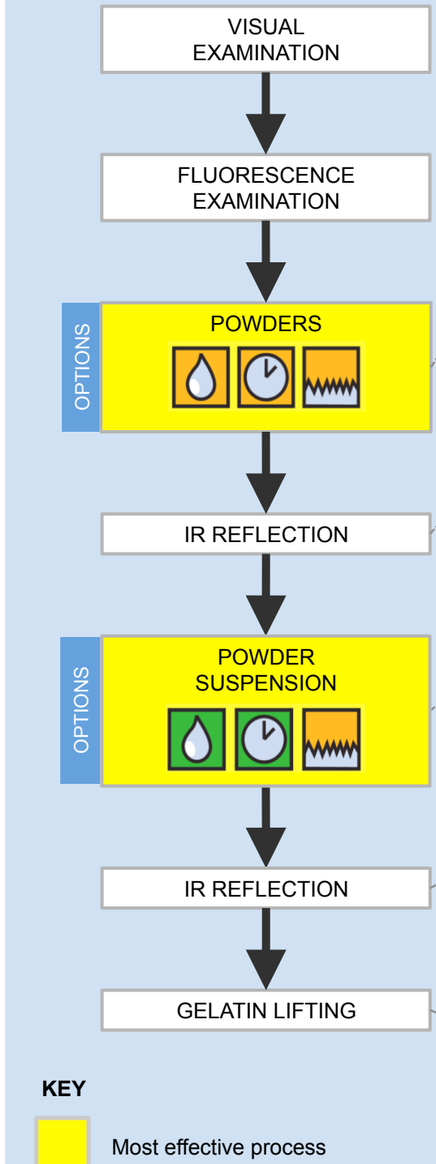
- If limited to Visual Examination to detect developed fingermarks then iron oxide-based and carbon-based powder suspensions are two of the most effective processes.
- The use of IR Reflection visualises many additional fingermarks and is non-destructive.
- Titanium dioxide-based powder suspension is also effective, but fingermarks are very difficult to see. Black gelatin lifters must be used after titanium dioxide-based powder suspension (and appropriately imaged) for detected fingermarks to be effectively visualised.

[*fp*Natural® 2 powder suspension visualises additional fingermarks when used after *fp*Natural® 2 powder. It is an immature process that has not been tested after any other processes and is not yet commercially available.]

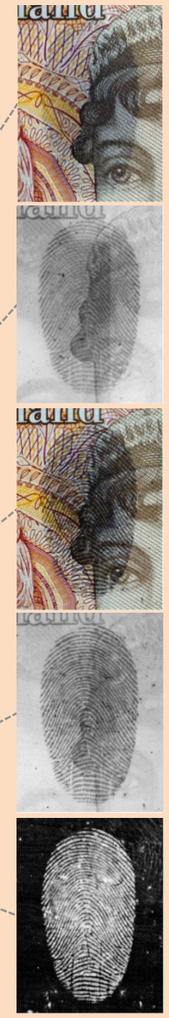
GELATIN LIFTING

- Gelatin lifting may find additional fingermarks after Powders and Powder Suspensions, offering similar effectiveness to IR Reflection, but may impact on subsequent processes.
- For this reason it has been omitted from the flow chart until the end, but should be considered if only Powders are to be used.
- IR Reflection and gelatin lifting find unique fingermarks but must be used in sequence to maximise recovery. See page 3 ‘Examples & Tips’.

*fp*Natural® products are available from Foster + Freeman Ltd, www.fosterfreeman.com



Example of black magnetic powder and iron oxide-based powder suspension



CAST would to thank the Bank of England, http://www.bankofengland.co.uk Foster + Freeman Ltd, www.fosterfreeman.com and West Technology Systems Ltd, http://www.west-technology.co.uk for their help in carrying out this study.

Currency - Bank of England (Polymeric) - Examples & Tips

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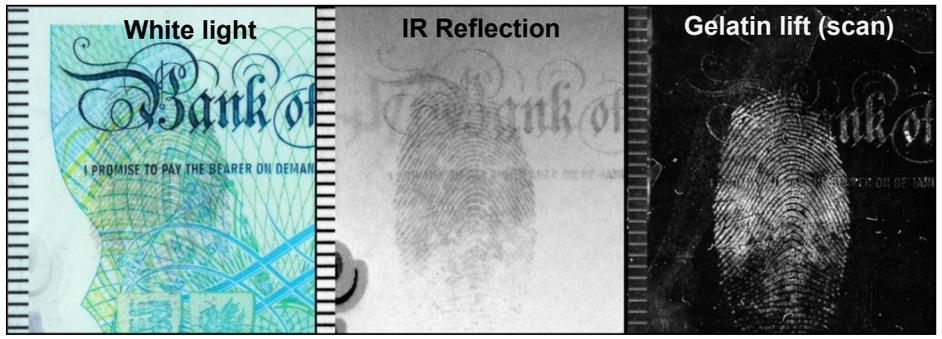

Figure 1: A fingermark visualised with iron oxide-based powder suspension on a £5 banknote, imaged under different conditions.

IR Reflection and gelatin lifting can provide similar background pattern elimination results when black powder-based processes have been used. However, one technique can sometimes add benefit over the other. IR Reflection may be slightly less effective than gelatin lifters overall, but it is non-destructive, whereas the application of a gelatin lift may impact on the effectiveness of subsequent processes.

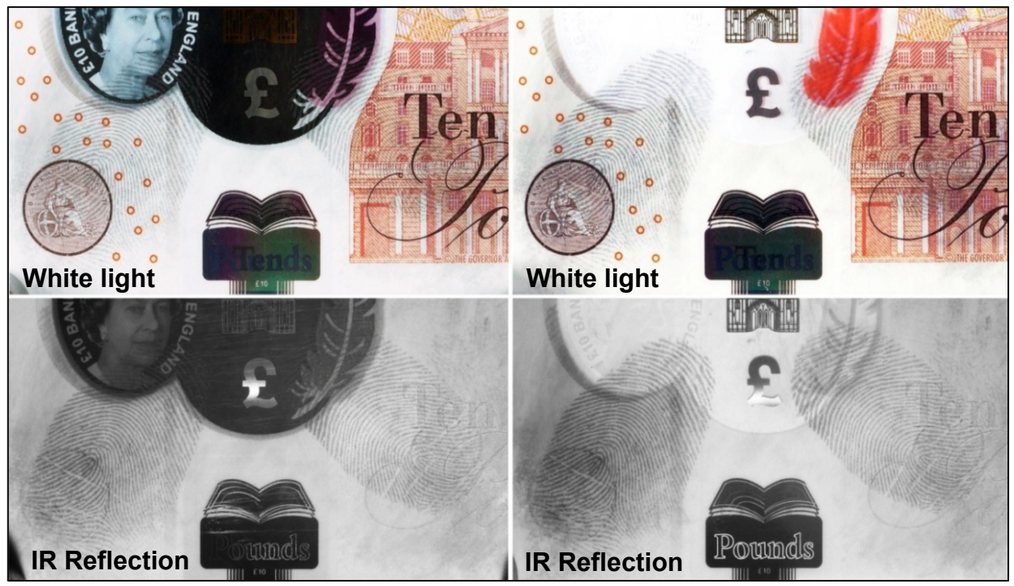

Figure 2: Two fingermarks visualised with black magnetic powder on a £10 banknote.

When viewing or imaging fingermarks over transparent windows, it may be necessary to experiment with different backgrounds in order to achieve the optimum results. In the above example, the images on the left have been photographed on an absorbing background below the banknote and the images on the right have been photographed on a reflective background. The best results are achieved using IR Reflection with an IR reflective background (lower right image).

Figure 3: A fingermark visualised with *fp*Natural® 2 powder on a £10 banknote.

*fp*Natural® 2 powder fluoresces more strongly when using red (600-650 nm) illumination than when using IR (730-800 nm) illumination (as shown above), however the former causes some inks in the banknotes to fluoresce, which can interfere with fingermark ridge detail.

Figure 4: The top half of a £5 banknote treated with titanium dioxide-based powder suspension, when viewed with white light (top) and when imaged from a black gelatin lift (bottom).

Some processes produce light coloured fingermark ridges that can be very difficult to observe with Visual Examination and IR Reflection on the polymer banknotes, including titanium dioxide-based powder suspension and *fp*Natural® 2 powder. These may be more easily visualised using black gelatin lifters.

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