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In this issue-

THE POWDERS PROCESS, STUDY 2:

Evaluation of Fingerprint Powders on Smooth Surfaces

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EXECUTIVE SUMMARY

This newsletter is the second in a series of reports to provide guidance to scene examiners on the powders process. It concentrates on the performance of the most commonly used powders on the most commonly occurring smooth surfaces – both identified from a recent survey of scene examiners. The objective is:

- *To ascertain if there is a significant difference in the performance of fingerprint powders on smooth surfaces encountered at scenes of crime.*

Approximately 11,000 marks were developed with the fingerprint powders on glass, ceramics, painted metal and gloss painted wood. The developed marks were graded on the surface using a scheme based upon the amount of developed ridge detail.

It is our intention to report on best practice for powdering on textured surfaces or lifting/imaging of the developed mark in future newsletters in this series.

Results suggest that the effectiveness of the powder is very surface specific; however flake powders generally outperform granular ones on smooth surfaces. The study also highlighted the importance of good technique when applying the powder as the number of marks developed is very dependent upon the care and attention taken by the scene examiner.

Based upon the results in this trial the following recommendations are made:

- *Scene examiners must receive appropriate training and maintain good application technique when applying powders. This is likely to be as important as powder selection for some smooth surfaces.*
- *Glass should be powdered with aluminium powder unless contamination prohibits its use.*
- *Magnetic powders should be used on surfaces that are not perfectly smooth.*



Figure 1: Application of magnetite flake

INTRODUCTION

HOSDB has been tasked by the Fingerprint Development and Imaging User Group to provide scene examiners with guidance on the most effective powdering techniques for use at scenes of crime. Due to the vast quantity of products (brushes, applicators, lifting media etc) on the market, HOSDB is not able to evaluate each individual product. Instead, a series of newsletters is being issued that report on best practice for commonly used techniques.

In order to have an accurate picture of current powdering practice, in 2004 HOSDB conducted a survey of scene examiners and procurement departments within each police force in the UK. Responses, 208 in total, were received from scene examiners from 29 police forces and 23 procurement departments replied. Information was gained about which types of powder were used, how often they were used, how they were applied, to which surface it was applied, etc. The survey results were a valuable source of information and will be referred to throughout this newsletter.

STUDY 1: ALUMINIUM POWDER

In August 2004 the first of this series of newsletters was published (Publication No. 54/04 – Study 1: Evaluation of Fingerprint brushes for Use with Aluminium Powder)*. It concentrated solely on the use of aluminium powder, predominantly because it is the most widely used powder in the UK and believed to be one of the most sensitive on smooth surfaces. This study demonstrated that the number and quality of marks found was dependent upon the scene examiner’s choice of brush, with glass fibre brushes outperforming others.

The survey was conducted at about the same time that the results from Study 1 were published. Interestingly, 48% of aluminium powdering was performed with the top three brushes (glass fibre, Tetra washable and squirrel zephyr) recommended in that study (see Table 1).

The survey also indicated that 18% of aluminium powdering was performed with a

squirrel mop brush. This brush is traditionally used to apply granular powders. Of the brushes tested in Study 1, this was shown to be least effective when applying aluminium powder and should not be used.

Brush	Average % of aluminium powdering performed with brush
Glass Fibre	24%
Tetra Washable	9%
Squirrel Zephyr	15%
Other	34%
Squirrel Mop	18%

Table 1: Brush selection by scene examiners for applying aluminium powder (from Survey)

No adverse health effects were associated with the use of glass fibre brushes or aluminium powder.

STUDY 2 – POWDERS ON SMOOTH SURFACES

Objective

Aluminium powder is reported in the literature to be one of the most effective fingerprint powders on smooth surfaces. However it is unknown how much better it is, if at all, than other powders. Does powdering one smooth surface give the same results as powdering another smooth surface, and what do we actually mean by ‘smooth’? To our knowledge, there has never been a study that has looked at this basic problem, yet ~50% of fingerprint identifications come from powders at scenes of crime – the majority of which were developed on smooth surfaces. Therefore, the objective is:

- *To ascertain if there is a significant difference in the performance of fingerprint powders on smooth surfaces encountered at scenes of crime.*

HOSDB plans to follow this with two further studies. Study 3 is a continuation of Study 2 but moves away from the more commonly powdered surfaces and concentrates on surfaces that are generally considered difficult to

* Can be accessed at www.hosdb.homeoffice.gov.uk

powder e.g. textured laminates, melamine, u-PVC. Publication of this newsletter is planned for summer 2006.

The survey data indicated that there is a wide variation in the lifting and imaging of fingerprint powders at scenes of crime. 90% of aluminium powder users lift the mark. This drops to 74% for magneta flake and 64% for black granular powder. A variety of lifting tapes are used along with a variety of ways of imaging the lift. Each step has an effect on the overall quality of the final mark. The lifting and imaging issues will be studied as Study 4 of this project following input from practitioners.

POWDERS AND THEIR APPLICATION

There are hundreds of fingerprint powders available for purchase from forensic suppliers that can be used to develop marks at scenes of crime. The majority can be grouped into a small number of categories relating to their chemical composition, particle size or shape. Each category has its own characteristics regarding its method of application to a surface, how it interacts with the latent fingerprint/surface and its visibility.

Examples of flake powders include aluminium, brass and magneta flake. These smooth metallic flakes lie flat on the surface causing the developed marks to be highly reflective. The developed ridge detail tends to be continuous.

Black fingerprint powder consists of granular carbon particles. The ridge development can be heavier around the sweat pores giving the appearance of a dotty mark. There are many variations of this type of powder such as jet black and grey fingerprint powder. These are predominantly carbon-based powders with small percentages of other powders added to change the colour. It is unknown if these powder mixtures are more effective than the pure powder.

Magnetic powders are not applied with a brush; instead, a magnetic applicator picks up the powder to form a brush head which is swept across the surface. The powders come in two forms: the first is a one component powder where the magnetic particles act as the developing powder; the second is a two

component system where the magnetic particles act as a carrier for non-magnetic powder. As with granular powders, magnetic powders can vary in colour as a result of added components.

Table 2 shows the extent to which fingerprint powders are used at scenes according to the survey. The column highlighted in yellow is the product of the first two columns and represents the overall usage of the powder. It can be seen that aluminium, magneta flake and black granular powders account for the majority of powder used at scenes of crime. All other powders such as fluorescent, bichromatic, fluorescent magnetic etc, are used infrequently and in total account for only 10% of all powdering. According to the survey most of this powdering is conducted on problematic surfaces where texture or colour may cause difficulty in developing or seeing the mark. Small trials at HOSDB have shown that most of these powders offer no advantage over the commonly used powders on the majority of surfaces powdered (i.e. smooth surfaces) although it is acknowledged that they may be invaluable in specific situations. The only exception to this is black magnetic powder which proved to be an effective fingerprint powder in the trials.

	% of scene examiners using the powder	Average % of powdering done by scene examiners using the powder	Average % of powdering done using the powder
Aluminium	95	76	72
Magneta Flake	49	25	12
Black Granular	80	8	6
Others	-	-	10

Table 2: Popularity of commonly used fingerprint powders (from survey)

Therefore, powders used in this study were: aluminium, magneta flake, black granular and black magnetic. The survey also showed that the main application of white powder was on vehicle paintwork; therefore it was included in the trial on painted metal.

Aluminium Flake and Glass Fibre Brush

From Table 2, it can be seen that aluminium flake powder is used much more frequently than any other powder (72% vs. 12% for magneta flake). In fact it is used by 95% of scene examiners and purchased by all forces. It is predominantly used on smooth surfaces, the most common of these being glass, painted metal, ceramics and gloss painted wood. Table 3 shows the percentage of aluminium powdering on each surface. 98% of glass powdered at scenes is done so with aluminium. This drops to between 55-62% for the other three surfaces.

Surface	Glass	Painted Metal	Ceramic	Gloss Painted Wood
% of surfaces treated with aluminium powder	98%	62%	58%	55%

Table 3: Aluminium powder use on the four most commonly powdered surfaces (from Survey)

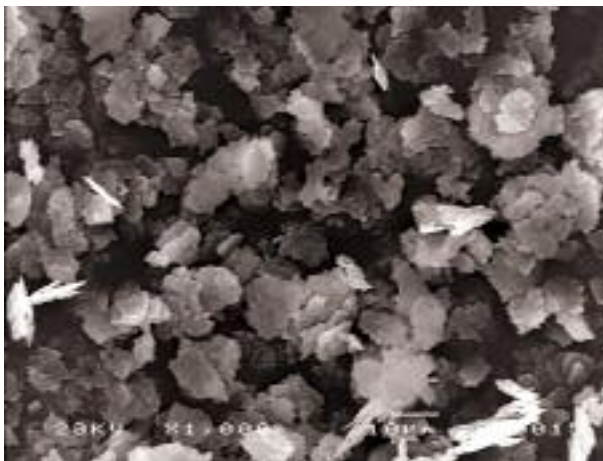


Figure 2: Scanning Electron Microscope (SEM) image of aluminium flake fingerprint powder (Super 8000)

Two grades of aluminium flake powder can be purchased from UK forensic suppliers under the generic name 'aluminium powder'. Both grades (Super 8000 and Offset 901) are manufactured by Wolstenholme International Ltd and differ slightly in particle size (4-6 μ m and 7-10 μ m respectively). They both have a 3-5% w/w stearic acid coating. A recent HOSDB trial indicated that there is no difference between them in terms of the quality of the developed marks. Super 8000 aluminium powder was used throughout this study (See Figure 2).

Aluminium powder was applied with a starched glass fibre brush (Figure 3a) as it was found to be the most effective method of application in Study 1. This is a Lightning Powder Co. product and can be purchased from most of the UK forensic suppliers. The powder was applied with a light brushing action and the mark was gradually built up as described in the MoFDT*. Spinning the brush offered no advantage. 48% of aluminium powder users reported that they sweep/clean out over-developed marks. The most popular brush for this is the squirrel mop brush (Figure 3b).



(a) Starched glass fibre brush



(b) Squirrel mop brush size 16



(c) Magnetic applicator

Figure 3: Powder applicators used in this study

Magneta Flake and Magnetic Applicator

The survey suggests that magneta flake is the second most widely used powder. It accounts for 12% of all powdering and is used by approximately half of the scene examiners surveyed (See Table 2). It is used on a wide range of surfaces including both textured and smooth.

The powder is a single component magnetic powder where the powder serves as both the carrier and developing medium. It was developed in the 1991 by James *et al*** as part of a joint project between the Home Office and

* V.Bowman Ed., Manual of Fingerprint Development Techniques 2nd ed. 1998, Revised 2001 and 2004

** James J.D, Pounds C.A. and Wiltshire B., *Journal*

the University of Swansea. It is now produced exclusively by CSI Equipment Ltd, although it can be purchased from other suppliers. It is produced by milling spherical carbonyl iron with 3-5% stearic acid in an appropriate solvent to produce a smooth edged flake with a particle size varying from 10-60 μ m (see Figure 4). As with aluminium powder it is extremely reflective.

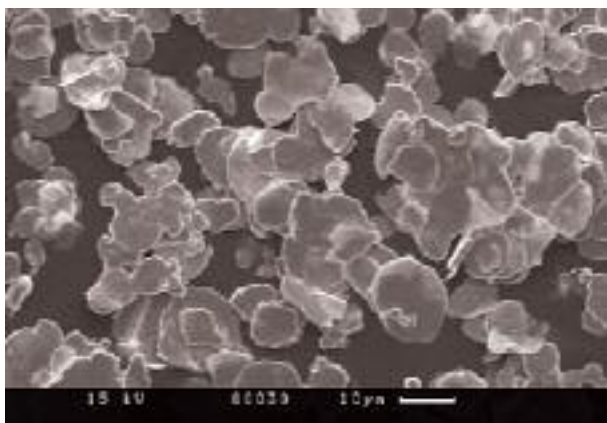


Figure 4: SEM image of magnetite flake fingerprint powder

There are many magnetic applicators sold by forensic suppliers and little work has been carried out to assess the performance of each. The most commonly used applicator identified in the survey was 'magnetic powder applicator' from WA Products and consequently was used in this study (see Figure 3c).

The powder is applied by sweeping a loaded applicator across the surface. One sweep should be enough for development however multiple sweeps are sometimes required. It is quite common for heavy marks to be over-developed and removal of the excess powder can be achieved by either passing a loaded or unloaded applicator over the area of interest or sweeping out the mark with a suitably soft brush. In this trial a size 16 squirrel mop brush was used as this was the most commonly used sweeping out brush identified in the survey. It should be noted that some marks can be destroyed by any amount of sweeping out.

Black Granular and Squirrel Mop Brush

According to the survey, black granular powder is used by the majority of scene examiners (80%), but only accounts for 6% of powdering at scenes (Table 2). It is commonly used on both textured and smooth surfaces.

Most black fingerprint powders are carbon-based. The main carbon manufacturer in the UK is Cabot Ltd. They currently supply most of the forensic suppliers with Elftex 415 carbon powder. This elemental carbon has a particle size of 5-10 μ m and can appear textured and irregular in shape (see Figure 5).

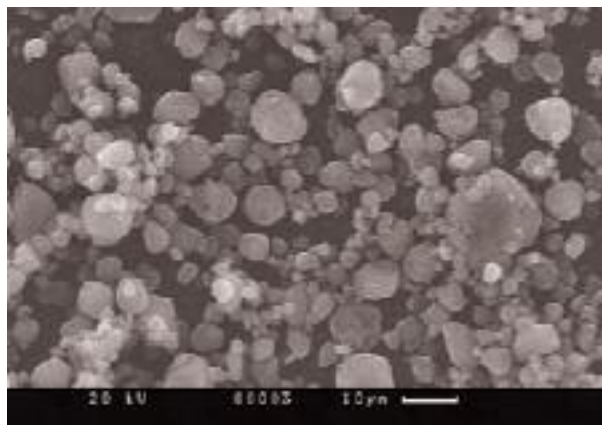


Figure 5: SEM image of black granular fingerprint powder

There are many modified versions of black fingerprint powder. They generally have a small percentage of dye or other chemical added to the carbon in order to change the colour slightly. It is not believed that these modifications to the carbon powder will alter its effectiveness. This study will only determine the effectiveness of Elftex 415 carbon powder.

As far as we are aware no studies have been conducted on the method of application of granular powders. Traditionally black granular powder is applied with a squirrel mop brush. Survey results suggest that 72% of scene examiners currently apply this powder with a squirrel mop brush, with size 16 being the most common. This brush was used in the study and the powder was applied as described in the MoFDT Section 7.3. Overdeveloped marks were brushed out with a clean size 16 squirrel mop brush.

Black Magnetic and Magnetic Applicator

Of the powders chosen to be studied in this trial, black magnetic powder is the least used according to the survey. It is predominately used on textured surfaces.

It is not similar (chemically or physically) to

the other powders used in the trial. It consists of large magnetic carrier particles of iron (20-200 μm) and smaller non-magnetic particles of iron oxide, Fe_3O_4 (3-12 μm) (see Figure 6). The larger particles act as a carrier medium for the smaller particles which adhere to the fingerprint residue thus developing the mark. Discussions with suppliers indicate that their supply of black magnetic powder was manufactured by BVDA, Holland.

This powder was applied with the magnetic powder applicator from WA Products in a similar way to magnetite flake in the study.

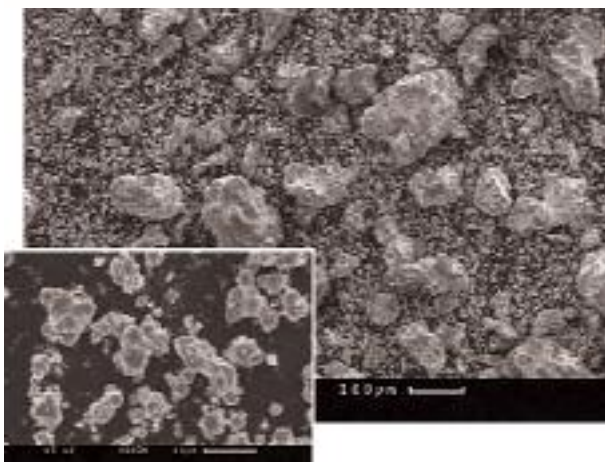


Figure 6: SEM image of black magnetic fingerprint powder

White Granular and Squirrel Mop Brush

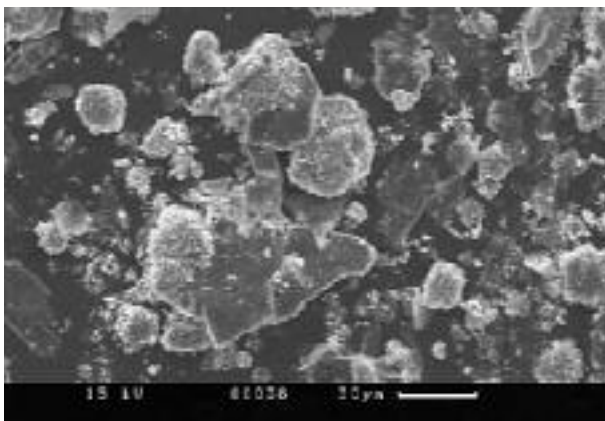


Figure 7: SEM image of CSI Ltd 'instant white' fingerprint powder

Data from the survey suggests that white powder is used on wood most frequently followed by vehicle paintwork (although its use is still considerably less than aluminium on this surface). It is used infrequently on glass, ceramics and painted doors and so will only be

evaluated on painted metal in this study. Powder effectiveness on wooden surfaces will be reported in the next newsletter.

EXPERIMENTAL

Laboratory Control Methods

All of the powdering was carried out in a Bassaire SPL 4 RFM powdering cabinet with a flow rate across the sash in excess of 0.3 ms^{-1} .

Test Surfaces

The survey suggested that the most commonly powdered surfaces at scenes of crime were glass, painted metal (vehicles), ceramic and gloss painted wood and so were used in this study.

A4 size toughened glass was purchased from a glazier. A variety of kitchen/bathroom ceramic tiles were purchased from DIY stores. Second hand white/cream gloss-painted doors were obtained. These doors were removed from a property prior to new doors being fitted and so have unknown history. They were then cut into A4 size. A4 size sheets of steel were sprayed with car paints including all undercoats. The two colours chosen were red ('Vauxhall Flame Red') and metallic blue ('Vauxhall Breeze Blue'). The metallic blue, as with all metallic cars, was coated with an isocyanate lacquer layer. The surfaces were cleaned with laboratory detergent followed by thorough rinsing. The surfaces were subsequently wiped with ethanol.

Fingerprint Donors

Fingerprint donors were selected from a pool of staff members at HOSDB. For each trial at least twelve donors were selected. It was important to obtain planted marks from a wide range of donors so that the chemical composition and quantity of the mark residue varied considerably.

Fingerprint Donation

For all laboratory trials a HOSDB standard protocol was followed for the collection of fingerprints from donors. Donors used had not washed their hands for at least thirty minutes prior to donating prints. This allowed adequate fingerprint residue to collect naturally on the fingers. In line with all HOSDB experiments, donors were asked not to rub their fingers

across the face, hair etc just prior to donating, as this increases dramatically the amount of latent material (predominantly sebaceous) on the fingers and is considered unrealistic.

Donors were asked to rub their hands together in order to get an even coating of natural secretions and/or contaminants across the fingers before depositing marks in a depletion series.

The following three experimental methods are used at HOSDB to compare processes: (1) comparison of split marks; (2) comparison of alternate marks within a depletion series; and (3) comparison of different depletion series. These methods are explained in detail in the Appendix. The majority of the experiments were conducted using the third option, with the exception of gloss painted wood for which the second option was used.

Development

After ageing for either 1 day or 1 week, the appropriate depletion series were powdered with aluminium flake, magneta flake, black granular, black magnetic or white powder (only for painted metal). Different staff members from the fingerprint group, who had developed expertise in powdering at HOSDB repeated the trials as the effectiveness of the powdering process can be very user dependent. It should be noted that it was not always possible to repeat the trials as planned, due to staff member availability.

Grading the Fingerprints

The aim of this study was to determine the effectiveness of the powder in terms of the quality of the mark that it developed on the surface. As a consequence, none of the marks developed in this study were lifted or imaged. Instead they were viewed using appropriate lighting and optical devices and graded from the surface.

In order to assess the performance of each powder a suitable grading scheme had to be devised. A grade was given to the mark depending upon the quantity of clear ridge detail, taking into account the continuous ridge flow and Galton features. The grading system is described in Table 4.

Grade	Comments
0	no development
1	signs of contact but < 1/3 of mark continuous ridges
2	1/3-2/3 of mark continuous ridges
3	>2/3 or mark continuous ridges, but not quite a perfect mark
4	full development – whole mark clear continuous ridges

Table 4: Grading system used for determining the quality of ridge detail for developed marks

Trial Size

As discussed in Study 1, there are many factors that affect the performance of the powdering process. One way to reduce the chances of spurious results (especially for variables out of our control such as age of latent marks, donor-donor variation, and donor-time variation) is to carry out large studies to give meaningful conclusions. As there are so many variables it is clear that a trial can very quickly become extremely large – in this work 11,568 fingerprints were studied (see Table 5).

	Number of graded marks
Glass	1,296
Painted Metal	4,800
Ceramic	2,880
Gloss Painted Wood	2,592
Total	11,568

Table 5: Total number of fingerprints developed in this trial

RESULTS AND DISCUSSION

The results for each surface are presented and discussed individually. Each data set is presented as bar graphs showing the percentage of marks with greater than a third ridge detail (i.e. marks graded two, three or four) for each powder and age. This was selected as a mark graded either 0 or 1 was considered unlikely to have sufficient detail for identification. The data in the graphs is averaged across all donors and evaluators. There are many practical factors, such as ease of use, visibility etc that influence the scene examiner's choice of powder. These are difficult to quantify but are crucial to the successful use of a powder. The results show only small differences in performance of some of the powders and so these other factors become increasingly important and are discussed throughout this section. Table 6 summarises the advantages and disadvantages of each powder.

Glass

There are few in-depth comparisons of fingerprint powders in the literature. Those that do exist quite often use glass as the test substrate as it is most frequently encountered at points of entry or on vehicles. It is also considered to be an ideal smooth surface on which to test powders as it normally gives little background development and is very smooth.

This was the smallest trial in the study with 432 marks being developed and graded by three different staff members – totalling 1296 marks. The three staff members conducting the trial all produced similar results for the relative performance of the powders. These results are combined and presented in Figure 8, which shows that aluminium powder is the most effective powder, developing 96-99% of the planted marks. Magneta flake did not perform as well as aluminium but was more effective than the two non-flake powders which developed approximately 20% fewer marks than aluminium.

Powder	Advantages	Disadvantages
Aluminium	<ul style="list-style-type: none"> easy to apply very sensitive reflective good continuous ridge detail generally does not give much background development 	<ul style="list-style-type: none"> can be difficult to see therefore mark can be missed (especially on a reflective surface) a good torch must be used to see the marks – especially the faint ones
Magneta Flake	<ul style="list-style-type: none"> very reflective easy to see – good contrast Once developed they are easier to see than aluminium 	<ul style="list-style-type: none"> application is not straightforward – had to do several passes in areas due to the powder brush not making contact in all areas more infill between ridges than aluminium although the contrast is still very good brushing out often necessary for heavy marks light marks can be removed when brushed out
Black Granular	<ul style="list-style-type: none"> easy to see It is very effective on marks from heavy donors, where flake powders may overdevelop Good contrast 	<ul style="list-style-type: none"> less sensitive than flake powders on glass marks can be dotty making it more difficult to see clear continuous ridge detail very messy
Black Magnetic	<ul style="list-style-type: none"> good quality continuous ridge detail Generally it does not require sweeping out 	<ul style="list-style-type: none"> Poor contrast for weak marks Some background development

Table 6: Advantages and disadvantages of fingerprint powders

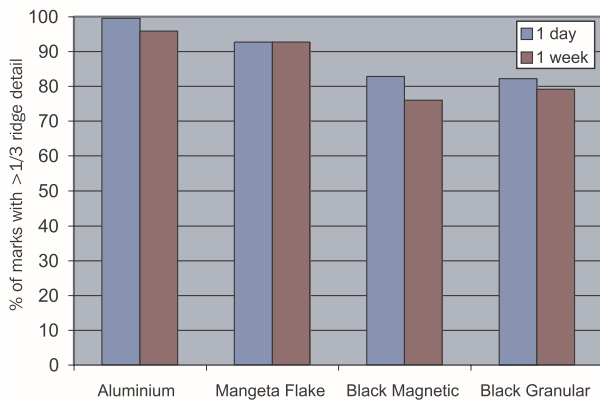


Figure 8: Effectiveness of fingerprint powders on glass

The results suggest that on glass the flake powders are slightly more sensitive than the non-flake ones. Aluminium was marginally more effective than magneta flake.

Applying aluminium powder was relatively straightforward compared to magneta flake. The brush was loaded sparingly with powder and applied to the surface with a sweeping motion allowing the mark to build up gradually until optimum development was achieved. Magneta flake, on the other hand, required considerably more skill. The first pass of the loaded magnetic applicator frequently overdeveloped the heavier marks. The developed lighter marks also had interference from background development. The excess of deposited powder was removed as described on page 4. This was very successful for heavy marks leaving clear ridge detail; however lighter marks were quite often destroyed. For this reason, all of the marks developed with magneta flake were graded before and after cleaning out and the best score was included in the results.

Working and best practices for glass appear to be in line as the survey indicates that 98% of glass is already powdered with aluminium.

Painted Metal

This was the largest trial in this study with 2400 marks being developed and graded by two staff members – totalling 4800 marks. As for glass, only small differences were observed between the two staff members and their overall conclusions were the same. The effectiveness of all of the powders on the non-metallic painted

metal was greater than on the metallic painted surface; however the relative performances of the powders were similar.

The results for the painted metal trial are presented in Figure 9. It shows that white powder is considerably less effective than the other four powders developing considerably fewer identifiable marks. This is due to the lower sensitivity of the powder rather than background interference, ridge infill or application difficulty. This was identified by a quick drop off in development down the depletion series resulting in light marks being missed. This concurs with earlier HOSDB studies and reinforces why it was not chosen to be trialled on the other surfaces.

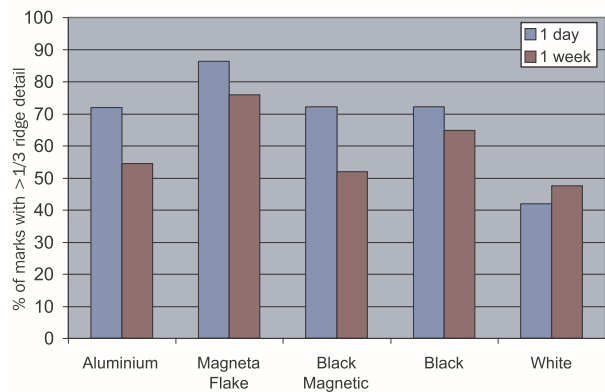


Figure 9: Effectiveness of fingerprint powders on painted metal

The other powders follow the same trend as for glass with the exception of aluminium powder. Surprisingly, the amount of identifiable marks developed with aluminium falls to levels similar to those from the granular powders. However, magneta flake continues to outperform granular powders.

A limitation of aluminium powder is visibility, especially if applied to reflective surfaces such as vehicles. In normal circumstances these marks would be lifted and imaged without the background reflectivity interfering with the quality of the mark. In this trial all marks were graded on the surface and as expected this proved to be more time consuming than grading other powders due to the low contrast. However with appropriate angled lighting and magnification all developed ridge detail could be viewed.

Magneta flake, although developing a higher percentage of marks than all of the other powders trialled was difficult to apply. As with glass, heavy marks tended to fill in requiring cleaning out with either the magnet or a brush in order to develop the best mark. Light marks could easily be removed if this cleaning out process were performed.

Ceramic

For the ceramic tile study 1440 marks were developed and graded by two staff members – totalling 2880 marks. Although there were minor difference between the staff members and type of tile, overall there was very little difference between the four powders as can be seen in Figure 10.

On the ceramics tested, neither of the flake powders appeared to be any more sensitive than the granular powder. The powders applied with a brush tended to give less background development than those applied with a magnetic applicator, however this did not affect the number of identifiable marks developed.

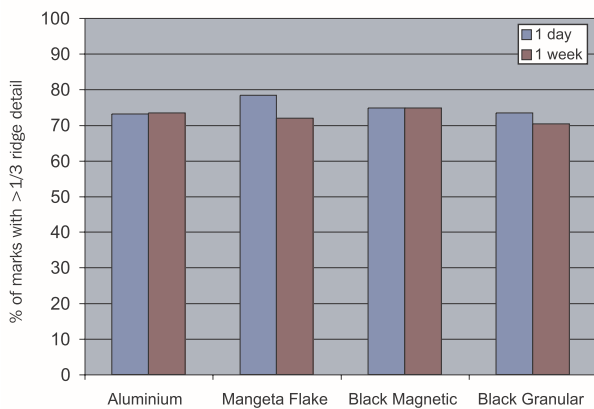


Figure 10: Effectiveness of fingerprint powders on ceramic

Gloss Painted Wood

Gloss painted doors are one of the most commonly powdered surfaces at scenes and are treated by many scene examiners with aluminium powder (see Table 3). The surface can quite often show brush marks where the paint has been applied. For this trial, one of the doors had clear brush marks whilst the other had a texture as though the paint had been applied with a roller.

2592 marks were developed and graded by one staff member. As stated in the ‘fingerprint donation’ section of this newsletter, a new method (method 2) was trialled to assess the powders and is described in more detail in the Appendix. This method offers one main advantage over the other method used throughout this report – it is comparing the effectiveness of processes on marks taken from the same depletion series. These marks will be closer in chemical composition than those taken from different depletion series giving a greater level of confidence hence the need for fewer trial repeats. The main disadvantage of this method is that it only allows for the comparison of two processes. In this trial four powders were being tested therefore the trial was divided into halves. The first half compared the two flake powders, whilst the second half compared the two granular powders.

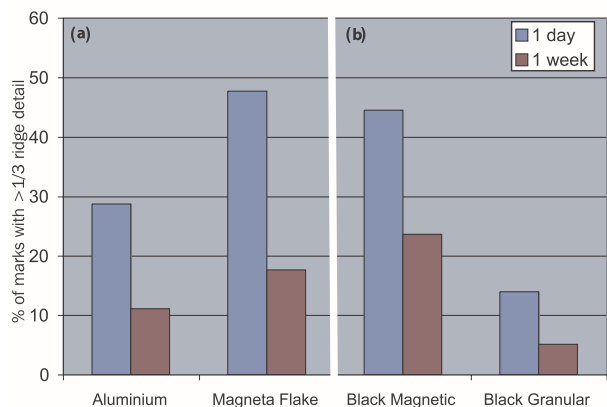


Figure 11: Effectiveness of fingerprint powders on gloss painted wood showing (a) aluminium vs. magneta flake, and (b) black magnetic vs. black granular

From Figure 11 it can be seen that magneta flake and black magnetic considerably outperformed aluminium powder and black granular respectively. In both cases, the powder applied with a magnetic applicator developed more marks than those applied with a brush irrespective of the particle size, shape and surface type. This was predominantly due to the brushes preferentially developing surface texture rather than ridge detail. Additionally, the granular powders (black and black magnetic) both gave uniformly high backgrounds. These two factors were key to determining the effectiveness of the powders on this surface.

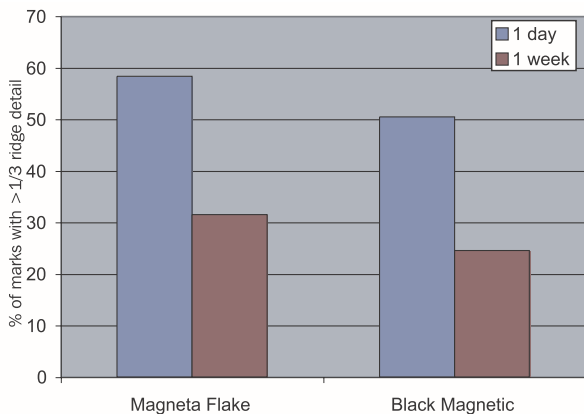


Figure 12: Effectiveness of fingerprint powders on gloss painted wood showing magneta flake vs. black magnetic

The two magnetic powders were then trialled against each other the results of which are shown in Figure 12. Magneta flake slightly outperformed the black magnetic powder across both ages of mark.

CONCLUSIONS

This study has highlighted the importance of appropriate training and subsequent good technique when applying fingerprint powders. All of the powders tested in this trial are applied differently and maximising the number and quality of marks developed is very dependent upon the care and attention taken by the scene examiner. Magneta Flake, for example, performed very well across all surfaces, but if applied hastily and not cleaned out appropriately a large percentage of marks will be missed or destroyed.

This study also demonstrates the importance of selecting the right powder for the surface presented to the scene examiner. There is not one powder that is clearly the most effective across all of the surfaces examined in this study. For glass, aluminium powder is still considered to be the most effective powder and is easy to apply. The results were less clear-cut for ceramics and painted metal. The gloss painted doors used in this study, although considered smooth, were actually slightly textured due to the paint application. This slight texture was developed with powders applied with a brush making it difficult to see the mark.

RECOMMENDATIONS

Based upon the results in this trial the following recommendations are made:

- *Scene examiners must receive appropriate training and maintain good application technique when applying powders. This is likely to be as important as powder selection for some smooth surfaces.*
- *Glass should be powdered with aluminium powder unless contamination prohibits its use.*
- *Magnetic powders should be used on surfaces that are not perfectly smooth.*

FEEDBACK

Feedback from Study 1 was positive, with many scene examiners adopting the advice given.

We would be very interested to hear from scene examiners who have made a change in working practice or will do so in the future based upon the newsletter results.

ACKNOWLEDGEMENTS

Thank you to all of the scene examiners and procurement staff who took the time to fill in the survey. Thank you to the scene of crime equipment suppliers and powder manufacturers for their time and assistance.

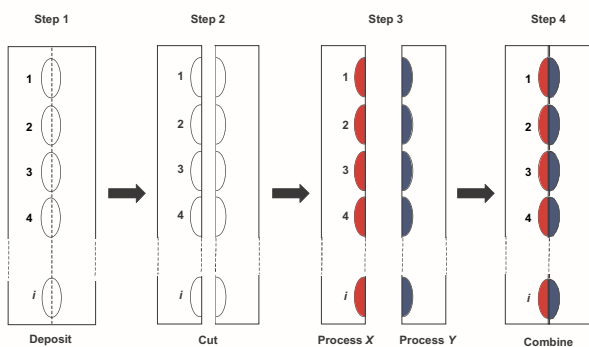
APPENDIX

The following methodology is used for most experimental trials of fingerprint development processes at HOSDB:

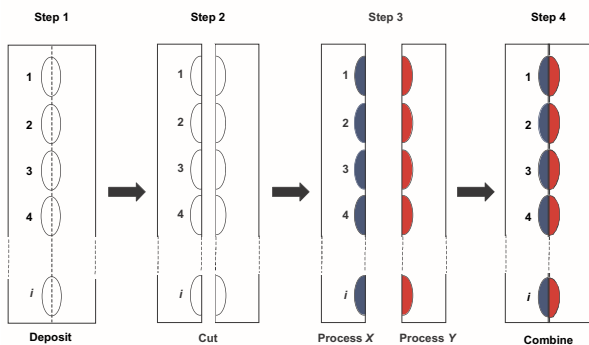
Option 1: Split Marks Depletion

Figure 1A outlines the necessary steps for comparing processes using split marks. Once a depletion has been deposited it is cut in half and each side is processed with a different technique before being reassembled for comparison. This is then repeated, but the side of the mark developed with the processes reversed. This will reduce the effect of any pressure differences that may have occurred when depositing the marks.

Stage 1: Follow steps 1-4*



Stage 2: Repeat, but development reversed*



* Note: steps 1 and 2 can be reversed

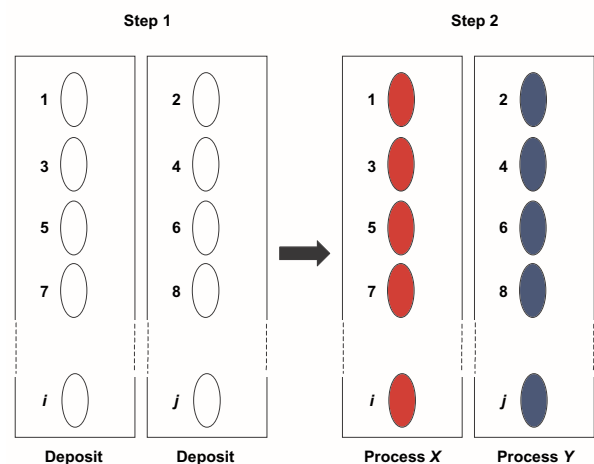
Figure 1A: Option 1 Methodology

If possible, this should be the method of choice as it directly compares half marks with the same chemical composition, quantity and pressure. However, it is only suitable on surfaces that can be cut cleanly into strips (e.g. adhesive tapes, plastic bags, paper etc). It is not suitable for processes that may have 'edge effects' such as powders and thus was not used in this study.

Option 2: Alternate Marks Depletion

Figure 2A outlines the necessary steps required for comparing processes using marks from the same depletion series. Donors are asked to deposit marks in positions 1,2,3 etc until the required length of depletion is reached. One surface will then contain the odd numbered marks in a depletion and the other the even marks. These are then processed and compared. It is important to repeat the steps but reversing the development process used on the odd and even numbered marks. This will remove any favouring of techniques based upon which marks are developed.

Stage 1: Follow steps 1-2



Stage 2: Repeat, but development reversed

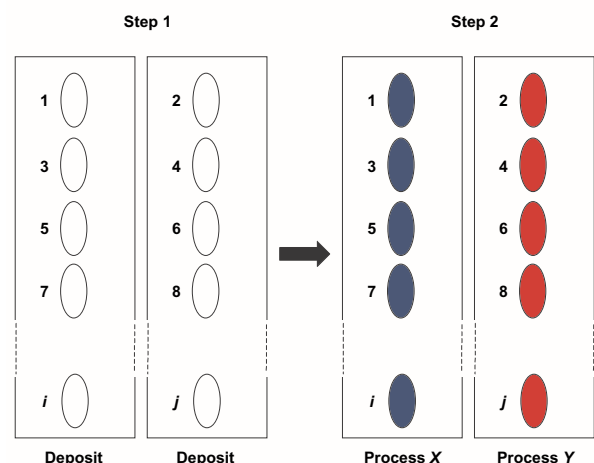


Figure 2A: Option 2 Methodology

This method can be used if comparing two processes. Although not directly comparing the same mark, Option 2 allows for a comparison of marks from the same depletion series. The marks will have similar chemical composition, quantity and pressure although this is not as

tightly controlled as in Option 1. This method is suitable for all surfaces. However it is not suitable if comparing more than three processes due to the length of depletion series required.

Option 3: Different Depletions

This is the simplest of the methods used to compare marks. In this case different depletions are processed entirely with different processes as shown in Figure 3A.

Stage 1: Follow steps 1-2 (repeat)

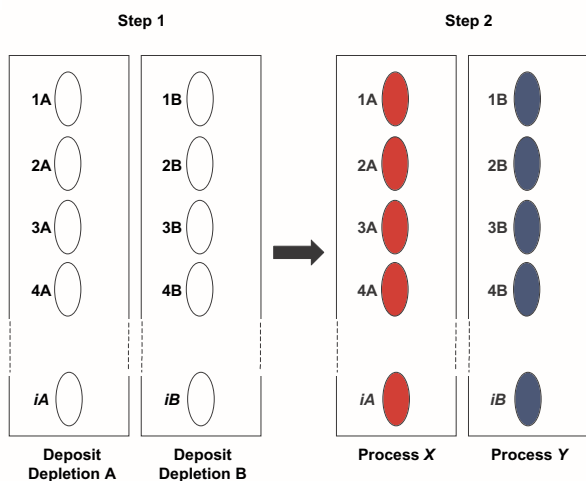


Figure 3A: Option 2 Methodology

This should be the method of choice if Options 1 or 2 cannot be used. In this case marks within the same depletion are not compared. Instead, depletions from the same donor are compared. The marks will have greater variability than those in options 1 or 2 although this is still an excellent method for comparing processes. It is suitable for all surfaces and processes, however, more data will be required due to the greater variability introduced by using different depletion series.

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