ISOMARK Spray: A Novel Method for the Replication of Marks

Authors: John S. Brennan D.Phil, Louise M. Davies M.Sc., Simon K. Bramble Ph.D.

Introduction

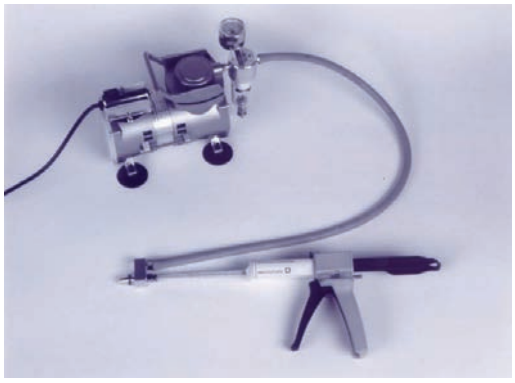
Fingermarks on irregular surfaces have traditionally been particularly difficult to photograph. As a solution to this problem a novel spray system has been developed that is capable of producing ultra-thin replicas of marks on difficult surfaces. Replicas produced through the use of this spray system can be laid flat thus removing the problem of photographing marks on irregular surfaces. It is worth noting the differences between the two procedures that are currently used to produce three-dimensional representations of crime scene marks. Firstly, lifting is the transfer of a mark onto a new substrate and secondly casting is the replication of a mark in a new material. The latter method may cause damage to the mark depending on the type of surface and the casting material used. At present there is a variety of casting materials in use for replicating fingermarks (1-12). However, the majority of these have not been specifically designed for forensic applications and therefore do not exhibit all the required properties of a forensic casting material. These key properties are reliability, accurate reproduction of detail (causing no damage to the mark), ease of use, reproducible cure rate, resolution of detail and dimensional stability. It is also necessary for the material to be cost effective.

Within the range of casting materials currently available none are able to produce ultra-thin replicas of marks from irregular surfaces. This is because none have a suitable viscosity and their methods of preparation and application are not amenable to producing ultra-thin replicas. The majority are manually mixed and applied to the desired surface using a spatula or similar instrument. There might be immediate potential if these materials were available in a hand-operated gun dispenser and a suitable viscosity for spraying. It must be noted, however, that a thorough experimental comparison of each casting material has not been carried out.

A synthetic rubber replicating compound, Isomark XF Black (supplied by Isomark Ltd., Nuneaton,U.K.) satisfies all the criteria mentioned previously for forensic casting applications. It can be applied via a hand-operated gun dispenser (see figure 1) or in a spray format (see figure 2)

Figure 1: The hand-operated gun dispenser with compound XF Black

Figure 2: The spray system with compound XF Black



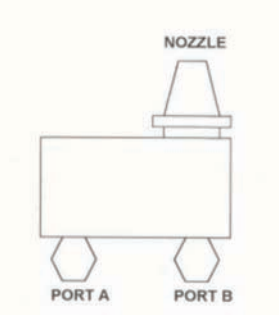
Compound XF Black is made up of two components (base and catalyst) which are contained within a cartridge. These two components are mixed during dispensing via a nozzle using a hand-operated gun dispenser. The resulting replicas have high resolution, are strong, flexible, dimensionally stable and highly opaque.

Experience has shown that to produce a thin enough cast to accurately replicate irregular surfaces the standard hand-operated gun dispenser was not suitable as the replicas were too thick to be laid flat for photography. This paper demonstrates how a hand-operated gun dispenser was modified to enable material to be sprayed onto a surface to produce ultra-thin replicas. This novel method reliably produces casts that are approximately 0.2mm or less. This type of application is excellent for reproducing detail on irregular, non-porous, non-textured surfaces.

Materials and Methods
The XF Black formulation with a nominal working life of 15 minutes and a curing time of 60 minutes at 25 deg. C, was employed for the tests. This compound produces replicas with a resolution of 0.1 microns. The hand-operated dispensing system includes a dispensing gun and a 50 ml cartridge divided into two compartments for base polymer and the catalyst. A static disposable mixing nozzle containing interrupted reversed pairs of Archimedes spirals is attached to the cartridge. The system allows the specially formulated Silicone polymer to be accurately metered, fully mixed and applied to surfaces with minimum air entrapment.

To enable compound XF Black to be sprayed on to a surface a hand-operated gun dispenser was modified. This was accomplished by fitting a spray head with a hole of diameter 0.3mm (manufactured and supplied by Isomark Ltd, Nuneaton, U.K.) to the end of the mixing nozzle (see figure 3). Compressed air (approximately 20psi)from an oil free mini air compressor (sparmax AC100, Simair Graphics Equipment Ltd., North Yorkshire, U.K.) was fitted to port A using rubber tubing. This novel system allows material to be sprayed on to a surface immediately after the mixing process is complete but before curing occurs (patent application number 9911820.0)

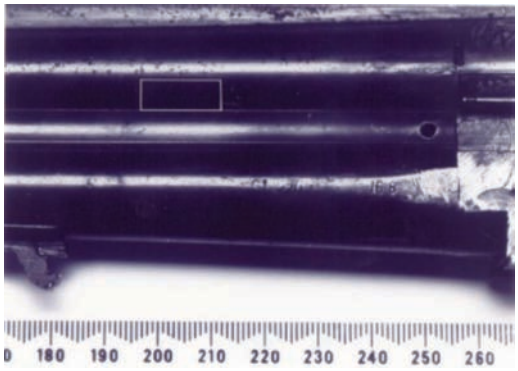
Figure 3: Diagram of the spray head



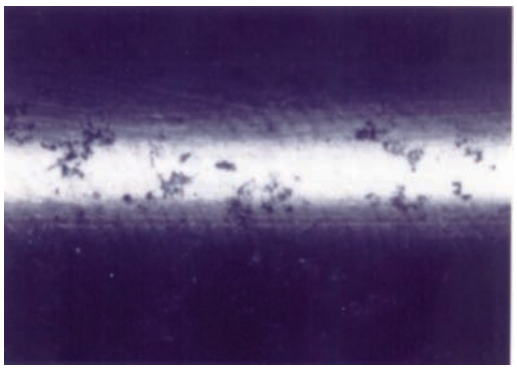
Example of operational use
Latent fingerprints were developed on the barrel of a shotgun with superglue (13, 14), see figure 4. Following superglue development it is usually necessary to stain the prints with a fluorescent dye. Experience has shown that dye staining would not have been an advantage for image purposes in this case.

Initially, three attempts were made to replicate the prints with the XF Black compound using the standard hand-operated dispenser. The material produced good replicas but these could not be photographed satisfactorily as the material was approximately 1mm thick and could not be laid perfectly flat.

Figure 4: (a) Position of a superglue treated fingermark on the barrel of a shotgun; (b) Enlargement of the fingermark

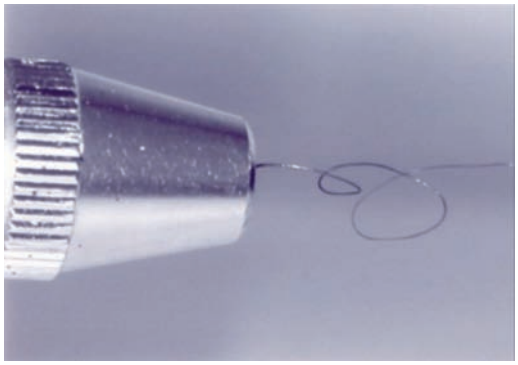


(a)


(b)

It was decided to use the spray system to produce ultra-thin replicas, still using the XF Black compound. This was done in a ventilated fume cupboard at ambient temperature. The material was sprayed over the whole area of superglue treated marks with the spray head kept at a distance of approximately 10 cm from the surface. Figure 5 shows an image of the continuous fine stream of material being projected from the spray head.

Figure 5: The projection of a continuous stream of compound XF Black from the spray head.


The shotgun barrel was held vertically to facilitate the flow and coalescence of the polymer over the surface and the production of a continuous film. The spraying process was completed in 1 minute or so and the compound had cured to produce a replica less than 0.2 mm thick, within 30 minutes.

The replica was laid flat and it was possible to photograph the developed fingerprints without difficulty, Figure 6. After 6 months the replica was reassessed for fingerprint ridge detail and it was found that no deterioration of the detail had occurred.

Figure 6: Replica of the superglue treated fingermarks from the barrel of a shotgun

Conclusions

The spray system demonstrates how fingerprint ridge detail can be reliably replicated from smooth, irregular surfaces using Isomark XF Black compound. The system is easy to use producing high resolution replicas that are strong, flexible and dimensionally stable over time.

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