Overview of Latent Print Development Techniques

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Prior to use of any of the following latent print development processes, consult the appropriate Safety Data Sheets (SDS) for handling and personal safety information found on the Sirchie website at www.Sirchie.com/support. For proper use of each product, consult the appropriate Technical Information Bulletin.

Foreword

Sirchie recommends the use of a controlled test prior to using any powder or chemical development. When using powders, place a test print on the surface in an area not likely to have been touched by the suspect. For chemical development, place test prints on a control surface such as a reversible backing card and include this control in the development process.

NOTE: *Many of the following powders and chemicals will interfere with subsequent testing of physiological fluids such as blood, seminal fluid, saliva, and urine, and with analysis for handwriting and ink identification on questioned documents. Collection of these forms of physical evidence should be completed before latent print development is undertaken.*

Sirchie Latent Fingerprint Powders

The selection of the correct powder and applicator to use on a specific surface is a critical decision. Powders are available in different colors to provide maximum contrast with the background being examined, and are generally recommended for use on non-porous surfaces.

IMPORTANT NOTE: *To avoid cross-contamination of your powder supply, never apply powder directly to a brush or applicator from the powder jar. Instead, measure out a small quantity of powder onto a clean sheet of paper, then apply powder to the brush or applicator from this independent supply. Do not return any unused powder to the powder jar.*

Latent processed with No. 101L Silk Black

Oxides: Oxide formulations are used on painted or smooth surfaces including most plastics. These powders are extremely sensitive to moisture—in particular—the sebaceous or oily secretions that may contaminate the fingertips. Silk Black (No. 101L), Silk Gray (No. 102L), Indestructible White (No. 103L) and Brilliant Red (No. 104L) are oxide powders. After latents are developed, we recommend that excess powder be removed using a feather duster (No. 123LB or No. 123LW).

Latent processed with No. 106L Gold Metallic

Metallics: This form of powder is most effective on plated or polished surfaces such as silver or chrome. Examples of metallic powders are: Silver Metallic (No. 105L), Gold Metallic (No. 106L), and Copper Metallic (No. 107L). After latents are developed, we recommend that excess powder be removed using a feather duster (No. 123LW & No. 123LB).

Magnetics: Magnetic powders are specially formulated from finely ground iron particles. Sirchie manufactures both regular and fluorescent/magnetic powders. Due to the magnetic properties of these powders, their use must be limited to surfaces that do not contain iron or steel. A magnetic applicator wand is used to dispense the powder over the surface.
To process prints with magnetic powder, allow the magnetic wand to contact the surface of the powder. The powder particles will cling to the tip of the wand forming a "powder brush". Sweep this powder brush over the surface being examined. When dusting is complete, lift the metal plunger of the wand to release the powder (*do not return unused powder to the powder jar*). After latents are developed we recommend that excess powder be removed by passing the magnetic applicator, plunger down, over the surface, being certain not to touch the surface with the applicator.

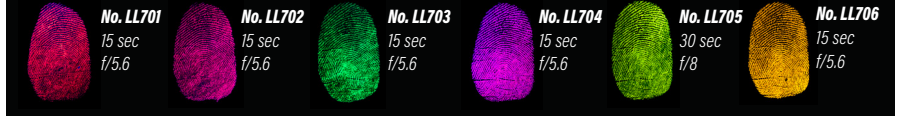
Latents processed with No. SB201L Silver/Black

Combinations (Dual-Purpose): This group of latent powders combines the properties of both oxide and metallic powders in that they may be used on virtually any surface. A further advantage is that they may be used on dark or light surfaces, and will provide sufficient contrast for photographic purposes. Silver/Black (No. SB201L) Silver/Gray (No. SG202L), and Silver/Red (No. SR301L) are combination powders. Any fiberglass or regular brush may be used to apply combination powders.

Photography: *We strongly recommend that all latent prints developed using the above methods be photographed prior to making any attempt to lift them. Always include a photo scale in each photo to ensure that a 1:1 ratio may be achieved when enlargements or copies are made.*

Fluorescents: Regular fluorescent powders are oxide in nature and are used only on the surfaces listed for oxide powders. Fluorescent powders are used to overcome the problems of multi-colored surfaces. We recommend using feather dusters to apply fluorescent powders. After processing, it will be necessary to darken the room and light latents with BLUEMAXX™ or longwave UV light (365nm) to examine and photograph.

The prints pictured below were developed with Sirchie's fluorescent powder and photographed using ISO *100. The typical aperture setting and exposure time for illumination are listed below. Prints were illuminated with a 365nm longwave UV light.*



Latent Fingerprint Brushes & Applicators

Most powders are applied with a latent powder brush such as the Fiberglass Brush (No. 122L), animal hair brushes (No. 118L, No. 117L, No. LHB02 & No. 120LS), Feather Dusters (No. 123LB & No. 123LW), and the Carbosmoove Carbon Filament Brush (No. CFB100).

No. 122L Standard Size Fiberglass Brush

No. 125L Magnetic Applicator

Magnetic powders require the use of a magnetic wand applicator. Sirchie offers several magnetic wands including: the Standard Magnetic Applicator (No. 125L), Megawand™ (No. 125MD), Magnetic Burnishing Applicator (No. 125MBA) and Gigamag™ (No. 125GM).

No. 123LW White Marabou Feather Duster

Lifting and Backing Developed Latent Fingerprints

There are several methods are for lifting and preserving developed latent prints.

Lifting Tape

Sirchie offers three types of lifting tapes: clear, frosted and polyethylene. Lifting tapes are to be used on non-porous surfaces. These tapes are provided in various widths to accommodate most situations.

To lift latents developed with any of the above powders, proceed as follows:

1. Pull off a suitable length of tape from the roll—enough to cover the prints to be lifted leaving at least an inch at each end.
2. Tack down the free end of the tape adjacent to the developed prints, and then begin pressing the tape to the surface using finger pressure. Prevent air bubbles from forming. Cut the tape from the roll and carefully, using the free end, remove the tape from the surface.
3. Immediately mount the lift on a sheet of contrasting backing material such as Sirchie's Latent Print Backing Cards (No. LB001, etc.).

Hinge Lifters

The Hinge Lifter is a lifting medium that includes an adhesive-surfaced sheet connected by a hinge to a sheet of backing material. Hinge Lifters are available with black, white and transparent backing material. Sizes available include 1.5" x 2", 2" x 4" and 4" x 4". Hinge Lifters are to be used on non-porous surfaces.

1. To use a Hinge Lifter, first remove the plastic cover protecting the adhesive and discard it.
2. Tack down the free end of the lifting medium to the surface holding a latent(s).
3. Firmly press the lifting medium to the surface with finger pressure, being careful to avoid air bubbles.
4. Carefully pull the lifting medium from the surface.
5. Seal the lift against the backing material, beginning at the hinged end, and being careful to avoid air bubbles.

Rubber Lifters and GELifters™

Rubber lifters and GELifters™ are used in an identical fashion on porous and non-porous surfaces.
A transparent cover protects each lifter. Do not discard the cover after removing it. Tack down one end of the lifter to the surface holding the latent(s). Press to the surface using firm finger pressure.

1. Carefully remove the lifter from the surface.
2. Replace the clear plastic cover over the lifter, being certain to avoid air bubbles.

   When viewing the lift through the clear plastic cover, the image will be *reversed*. Rubber lifters are available in opaque black and white. GELifters™ are available in black, transparent and white.

Methods for the Chemical Development of Latent Fingerprints

Chemical methods are best applied to porous surfaces such as paper, cardboard and raw wood. Many of the following procedures involve complex actions on the part of the technician, and it is therefore recommended that prior to using any of these products, that you consult the appropriate Technical Information.

The information given here is, in most cases, an overview of the procedures and not necessarily full step-by-step instructions. The following is the correct order of use when it is anticipated that a number of different processes may be used.

Iodine Fuming

The fumes from iodine react with the oily, fatty components of latent prints. This method is best used when prints are known to be fresh, since the oily residue will eventually be absorbed into the porous surface. Sirchie provides iodine crystals in raw form (No. A211C) and in Iodettes (No. AMP2066). Disposable Iodine Fuming Guns (No. DF2016) and IO-FUME™ Instant Vaporizers (No. LPF1006) are also available. The raw crystals and IO-FUME™ Vaporizers should only be used inside a fuming chamber (*No. 214CA features a fiberglass construction, making it ideal for fuming with iodine*). Iodettes are best used in a resealable zip-top plastic bag. When exposed to heat, iodine crystals undergo a process known as sublimation. Sublimation is the process of a solid changing directly to a gas. ***CAUTION: Do Not use iodine to fume metal surfaces as it is highly corrosive to metal—even stainless steel.***

Iodine Crystals (No. A211C)

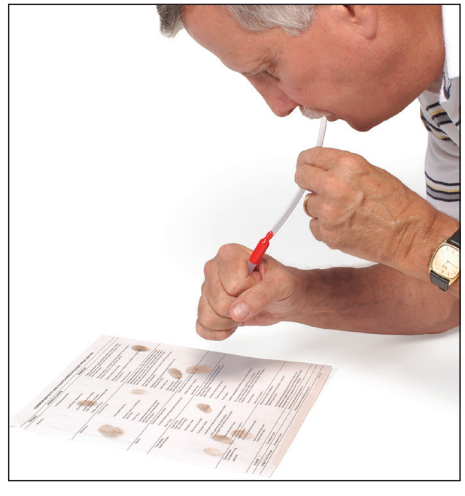
1. To avoid chemical interaction with surface metals, place iodine crystals on a ceramic or glass dish. Break the glass ampoule containing the crystals as shown to the right and pour the contents onto the dish. Place the dish on a small heating device such as a coffee warmer, which has been placed under a fuming hood or similar device.
2. Place the evidence to be examined in the fuming chamber and turn on the heating device. Keep a close eye on the evidence. As soon as latent prints begin to appear, turn off the power to the heater.
3. Allow the fuming process to continue for a few minutes.
4. Activate the fuming chamber's exhaust or re-circulating feature to get rid of the fumes.
5. Remove the evidence from the fuming chamber. Since iodine prints will fade rapidly, and before taking another step, photograph any latents visible. Be sure to include a scale in the photos.
6. After photos are taken, use Sirchie's Iodine Print Enhancers (No. DCA16). This will apply a dark color to the developed prints and also serves as a fixative. To apply the enhancer, hold the plastic tube so that your thumb and forefinger are over the center of the glass ampoule inside the tube. Crush the glass ampoule between the thumb and forefinger, remove the protective cap from the tube, and apply the reagent with the cotton tip of the applicator.

Iodettes (No. AMP2066)

Iodettes are supplied in ampoule form. Iodine crystals are mixed with an inert ingredient (silica), which helps to retain heat.

1. Place the item of evidence to be examined into a plastic zip-top bag.
2. Break the ampoule and pour the contents into the bag and discard the empty ampoule. Reseal the bag.
3. Shake the Iodettes into one corner of the bag and clamp one hand over that corner. This will generate heat to begin the fuming process.
4. When developed prints are visible, remove the evidence from the bag and photograph any prints present with the inclusion of a scale.
5. You may now apply Iodine Print Enhancer (No. DCA16) to enhance and fix your resulting prints.

Iodine Fuming Guns (No. DF2016)



Sirchie's Fumette Disposable Iodine Fuming Guns permit rapid iodine fuming in open areas or under a fuming hood. Avoid breathing iodine fumes. Use only with adequate ventilation.

1. Crush the glass ampoule contained inside the body of the fuming gun using thumb and forefinger pressure. Break the ampoule in the center, not on either end.
2. With the breath tube attached and the end cap open, blow through the breath tube while directing the fumes toward the surface to be examined. Heat from your hand and breath will start sublimation. The tip of the gun should be placed within an inch of the surface being examined. ***Do not inhale!***
3. When fuming is complete, photograph any visible prints (include a scale).
4. You may now apply Iodine Print Enhancer (No. DCA16) to enhance and fix your resulting prints.

IO-FUME™ Instant Vaporizer (No. LPF1006)

This device for iodine fuming involves a liquid chemical, dry crystals and a small vial of iodine crystals. This combination creates heat for the sublimation process, and it produces the same results as the methods discussed above.

1. Fuming must be done in an enclosed fuming chamber (*the No. 214CA Laboratory Fuming Cabinet & Heat Chamber's fiberglass construction makes it ideal for iodine fuming*). Place the evidence to be fumed in the chamber.
2. Place the jar containing the activator solution into the fuming chamber with items to be fumed. ***NOTE:*** *Add a control to the chamber by placing test prints on a white backing card (No. LB0021).*
3. Break the iodine crystal ampoule as described previously and empty its contents onto the metal top of activator crystals canister.
4. Place the activator canister (hole side down) into the jar containing activator solution and close chamber. Fumes should take place within one minute.
5. When developed prints are visible, remove the evidence from the chamber and photograph any prints present with the inclusion of a scale.
6. You may now apply Iodine Print Enhancer (No. DCA16) to enhance and fix your resulting prints.

NOTE: *Iodine fuming* ***will not*** *interfere with subsequent chemical tests.*

DFO (1,8-Diazafluoren-9-One)

DFO is a Ninhydrin analog that reportedly will develop 2.5 times the number of prints as Ninhydrin alone. Sirchie provides DFO in a liquid spray (No. DFS300) as well as in crystal form (No. LV500) for those wishing to mix their own formulations. DFO exhibits many of the same characteristics as Ninhydrin, including the fact that it reacts to amino acids. DFO should be used only in an area with adequate ventilation or under a ducted or recirculating fuming hood as shown to the left. Wear rubber gloves to avoid staining of your fingers, and to prevent absorption of any of the chemical solvents present.

1. Saturate both sides of the document or evidence to be examined. Allow the evidence to air dry.
2. Place evidence in a heat chamber (No. DFC100) preheated to 200° F.
3. Remove the evidence after having been exposed to heat for 5-10 minutes.

4. Examine the item for any visible prints. Generally, DFO prints will not be immediately visible. If any prints are visible, they will be pale pink in color.
5. Examine the evidence in a darkened room using long-wave ultraviolet light or an alternate light source such as the BLUEMAXX™ (No. BM300 & No. BM500LED).
6. Photograph any visible latents while exposed to UV or alternate light source. Be sure to include a scale in each photo.

NOTE: *DFO treatment* ***will not*** *interfere with subsequent chemical tests.*

Ninhydrin

Ninhydrin is a biological stain that reacts with the amino acid content of latent prints. Amino acids form a permanent chemical bond with the cellulose-content of the items being examined, and laboratory tests indicate that excellent results may be obtained even when prints are known to be several years old. Ninhydrin may be purchased in several forms. Sirchie offers Ninhydrin in crystal form (No. NRP01A) for laboratories using their own chemical formulations. Other forms include two aerosol formulations and a pump spray formula. ***NOTE:*** *Certain Ninhydrin formulas will cause inks to run (Fig. 1). Read the instructions supplied with the product to ascertain whether the particular formula in use will cause this to happen.*

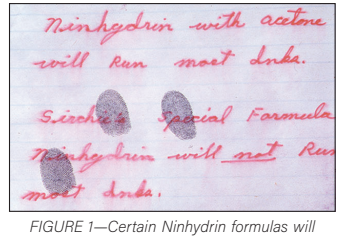


FIGURE 1—Certain Ninhydrin formulas will cause inks to run.

- **No. 201ACE** with acetone—***will*** cause some inks to run.
- **No. 201C** with xylene—***will not*** cause most inks to run.
- **No. NSI609** with NOVEC-HFE7100—***will not*** cause inks to run *(Fig. 2).*

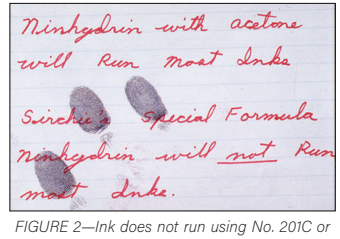


FIGURE 2—Ink does not run using No. 201C or No. NSI609.

Ninhydrin should be used only in an area with adequate ventilation or under a ducted or ductless fuming hood. Wear rubber gloves to avoid staining of your fingers, and to prevent absorption of any of the chemical solvents present.

1. Saturate both sides of the document or item of evidence with the Ninhydrin solution.
2. Allow the item to air dry.

3. Ninhydrin prints are usually not visible immediately after the reagent is applied. Unassisted development may take 24 to 48 hours at room temperature.
4. To accelerate development, expose the item to moist heat, such as that from a steam iron operating at medium heat, or one of Sirchie's heated development chambers (No. 214CA or No. DFC100A).
5. Ninhydrin prints have been known to fade over a period of time. Be certain to photograph any visible prints immediately, and always use a scale when photographing evidence.
6. If developed prints offer weak photographic contrast, consider the use of Ninhydrin Fixative (No. NFS200). The fixative may change the color of the developed print and add contrast. Use the fixative sparingly and according to the label instructions as adding the fixative may cause the prints to run. Use of the fixative will interfere with subsequent testing.

NOTE: *Ninhydrin development (without the application of fixative)* ***will not*** *interfere with subsequent chemical tests.*

No. 214CA Laboratory Fuming Cabinet & Heat Chamber

No. DFC100A DFO/ Ninhydrin Development Control Chamber

Silver Nitrate

Silver nitrate solutions such as Sirchie's Silver Nitrate Spray (No. 205C) are light sensitive and when they combine with the salt deposits of latent print residue, they will develop dark brown latents. Silver nitrate will stain most materials, and the stain is extremely difficult to remove. Prints developed with this method will not fade. On the contrary, they will continue to develop when exposed to light.

1. Saturate the evidence on both sides with the silver nitrate spray. Air dry. Apply Silver Nitrate in an area with adequate ventilation or under a ducted or re-circulating fuming hood.
2. Latent prints will develop over a few hours when exposed to room light. To accelerate development, expose the evidence to short-wave ultraviolet light or direct sunlight.
3. Photograph any visible latent prints. Be sure to include a scale in all photos.
4. When storing latents, place the evidence in a light-tight container.

NOTE: Silver Nitrate development ***will*** interfere with subsequent chemical tests.

Physical Developer

Physical Developer (No. LPD100 & No. LPD101) may be used in place of silver nitrate development and is best used after DFO and/or Ninhydrin development. It is a silver-based aqueous reagent that reacts to sebaceous components of latent print residue to form a silver-gray deposit. Physical Developer is superior in sensitivity to the silver nitrate products currently in use, and it may develop prints not found with DFO or Ninhydrin. It is supplied in a two-part formulation. Mix the two chemicals supplied according to directions, mixing only what is needed for the examination about to be undertaken. Mixing should be done using a vented or recirculating fuming hood.

1. Place the mixed chemicals in a clean glass or plastic developing tray. Do not use metal trays.
2. Immerse the evidence in the solution. Prints should appear in about 5 minutes. Allow development to continue for up to 15 minutes or until the background begins to darken.
3. Rinse the evidence under running water for up to 20 minutes. Air dry after rinsing.
4. Photograph any visible prints, and always use a scale when photographing evidence.

Adhesive Side Powder & Developer

Normal latent development techniques are not effective on certain surfaces. Latent prints may be recovered from the *sticky-side* of adhesive tape when standard powders and some chemicals will not produce usable results. Adhesive Side Powder & Developer are both sold in light and dark formulations.

1. Choose either light or dark version for best photographic contrast.
2. If using the pre-mixed Adhesive Side Developer (No. ASD7D & No. ASD7L) simply shake well before use, apply developer with included dauber applicator, wait 10-20 seconds, and rinse with cool water.
3. Adhesive Side Powder (No. ASP50D & No. ASP50L) must be mixed into a solution before use. Use a clean glass or plastic mixing bowl.
4. In a clean mixing bowl, add one teaspoon of the powder giving the best contrast against the background color of the tape. ***NOTE:*** *Dark Adhesive Side Powder (No. ASP50D) works best on gray duct tape.*

5. Add one teaspoon of EZFLO Solution (No. ASP51) into the bowl.
6. Mix the solution and the powder together using a clean brush such as the Regular Latent Print Brush (No. 118L). Stir until the mixture has a frothy appearance.
7. Brush the mixture onto the sticky side of the tape. Allow 10 seconds for setup, and then rinse under cool, running water. Any prints present should become visible.
8. After the tape is completely dry, photograph the prints with a scale, and then seal over the latent prints with a clear medium such as Sirchie Latent Print Lifting Tape.

NOTE: *If the tape is wadded up and stuck together, several methods are available to loosen the adhesive. No. TRA20 Adhesive Tape Release Agent may be used without destroying latent prints that may be present or the tape may be sprayed with liquid nitrogen. Some report that leaving the tape in a deep freezer overnight will also serve to kill the adhesive for a brief time.*

Small Particle Reagent (SPR)

SPR works best on non-porous, vertical surfaces, but may also be used in tray development. This reagent is composed of finely ground particles suspended in a detergent solution. These particles adhere to the fatty constituents of latent fingerprints to form a visible deposit. Works well on oily windows, oxidized metals, galvanized surfaces and salt-sprayed surfaces.
Use No. SPR100 Dark SPR for light-colored surfaces, No. SPR200 White SPR for dark-colored surfaces and No. SPR400UV for multicolored surfaces. Latent prints developed using this method may be lifted using standard lifting mediums.

1. Select the proper reagent based upon background contrast.
2. Shake the spray bottle well to get the particles into solution. On vertical surfaces, spray above the area suspected of containing latent prints and allow it to drain down over the area.
3. For tray-development, shake the reagent well and pour into a suitable developing tray. Place the evidence in the tray. Rock the tray back and forth to permit adequate contact between the evidence and the solution.
4. Immediately after prints appear, rinse the surface with water to remove excess reagent. Do not allow the water to flow directly onto the developed prints. On vertical surfaces, apply water directly above the prints and allow it to flow across them. For tray development, remove the evidence from the developing tray and place it in a clean tray. Add running water but do not allow it to fall directly onto the developed prints
5. Photograph any developed prints as soon as possible. Be sure to include a scale.

Cyanoacrylate (Super Glue) Fuming

Cyanoacrylate fumes are known to react to the moisture content of latent print residue. The fumes polymerize when coming into contact with this moisture to form a hard, white compound that conforms to the ridge detail present.

A variety of methods and devices are available from Sirchie for fuming with cyanoacrylate:

- **Omega-Print™ Cyanoacrylate Liquid Compound** (No. CNA102 & No. CNA103). This has been the preferred method for fuming with cyanoacrylate for decades.
- **The Cyanowand™** (No. CW100) A self-contained, hand-held, heat generating wand utilizing disposable cyanoacrylate cartridges.
- **The Finder™** (No. CNA2000) A unique, easy-to-use, peel-apart foil packet system.
- **Cyano-Shot™** (No. CNA3006) A self-contained, heat generating cyanoacrylate fuming system.
- **CyanoPowder** (No. CYP15 & No. CYP30) This crystal form of cyanoacrylate features an unlimited shelf life, but requires higher temperatures (400° F) to activate.
- **Lumicyano** (No. LC120) Cyanoacrylate and fluorescent dye in one convenient product.

While the fumes are non-toxic, they can be quite annoying. Fuming operations should be conducted in a fuming chamber or with adequate ventilation. **WARNING*: Do not wear contact lenses when fuming with cyanoacrylate.***

1. Place the evidence to be fumed inside a fuming chamber (Sirchie offers a wide array of cyanoacrylate fuming chambers from disposable to laboratory models).
2. If the evidence to be fumed does not include reasonably fresh prints, it is advisable to reconstitute moisture content. To do this, place a cup of warm water inside the chamber and seal the chamber for 10-15 minutes. Humidity can also be introduced by attaching the Sirchie No. PUM100B Portable Humidifier to the fuming chamber.

No. CNA103 Omega-Print™ Cyanoacrylate Compound

No. CW100 Cyanowand™

No. CNA2000 The Finder™ Packet

No. CNA3006 Cyano-Shot™

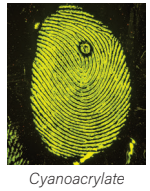
No. CYP15 CyanoPowder

No. LC120 Lumicyano

3. Select the cyanoacrylate formula to be used and place it in a chamber. Due to the fact that Sirchie offers a number of cyanoacrylate fuming methods, consult the appropriate Technical Information.
4. Place control prints in the chamber and seal.
5. Using cyanoacrylate liquid without any form of acceleration will produce prints only after several hours of exposure to the fumes. To accelerate development, place cyanoacrylate liquid on a Cotton Dispersal Pad (No. CNA104) or apply heat with a Fuming Hot Plate (No. FHP100). Fuming Trays (No. CNA106) should be used to contain the liquid cyanoacrylate. The use of Sirchie's Dual Temperature Cyanoacrylate Fuming Chamber (No. FR200DT) will allow for the regulation of temperatures up to 500° F.
6. Check the control prints from time to time. When prints are visible, remove and examine the evidence. Developed prints will be white in color. Contrast may be added with the application of latent print powder or a dye stain such as Basic Yellow (No. LVS500), Rhodamine 6G (No. LV505), Ardrox (No. LVS600), Basic Red 14 (No. LV620L), or Red 28 (No. LV511).

No. FR100 Cyanoacrylate Fuming Chamber with No. PUM100B Portable Humidifier attached.

No. FR100P Field and Lab Cyanoacrylate Fuming Chamber



Cyanoacrylate fumed latent dyed with Basic Yellow (No. LVS500)

No. FR175FG Shake-N-Fume Tent & No. CNA900 Portable Fuming Chamber Kit

Fuming with cyanoacrylate in a vacuum has been found to collect cyanoacrylate deposits on fingerprint ridge structures in a far more even manner. Sirchie's Cyanovac Vacuum Chambers (No. VAC150 & No. VAC350) offer cyanoacrylate fuming of evidence in an air-tight vacuum chamber.

No. VAC150 Cyanovac Laboratory Fuming Chamber Outfit

No. FR200DT Dual Temperature Cyanoacrylate Fuming Chamber

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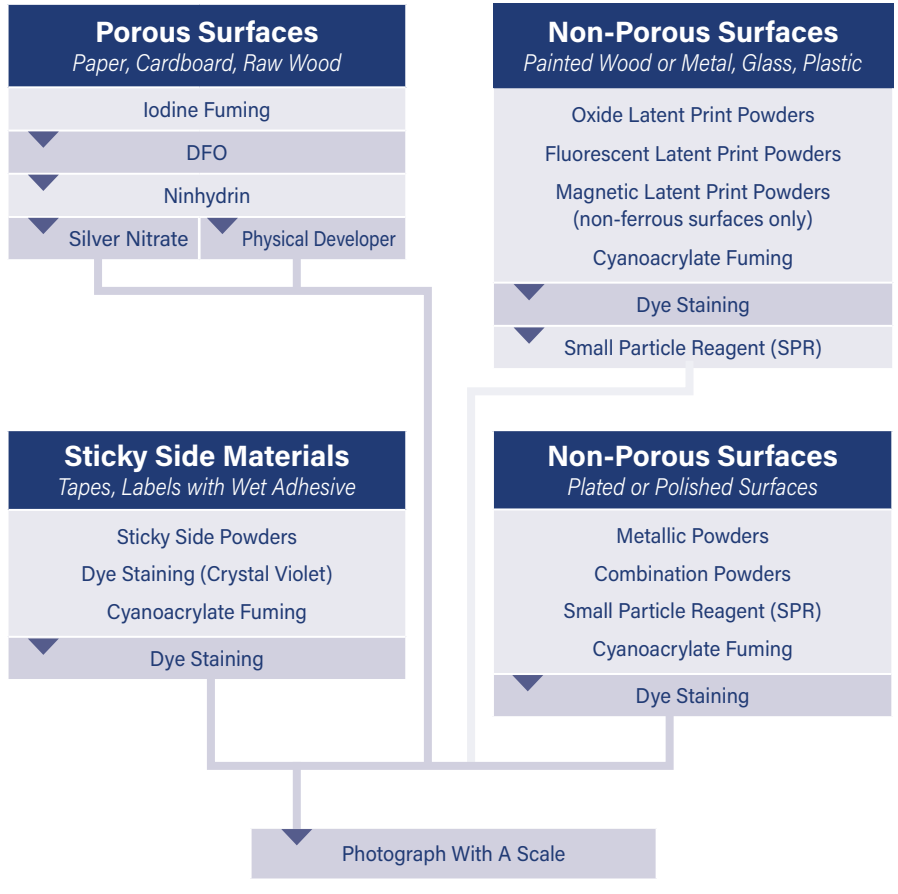
Quick Tour of Latent Fingerprint Development Techniques



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