NOTE:

The fingerprint technician referenced in this paper, Ken Shaw, is currently battling hepatitis C (which he probably got on the job) and needs a new liver. Details can be found online here.

The Cyanoacrylate Fuming Method

Eric W. Brown

feneric@ccs.neu.edu

There is little need to mention the importance of obtaining fingerprints in criminal investigations. Fingerprints have long been considered one of the most valuable types of physical evidence that can be found at a crime scene.
The cyanoacrylate fuming method (often called the super glue method) of developing latent fingerprints has proven to be an effective tool for professional investigators, and the quality of its results has made it a popular one. Any agency that works with latent fingerprints and does not already use the cyanoacrylate fuming method should seriously consider adopting it.

The super glue method was first employed by the Criminal Identification Division of the Japanese National Police Agency in 1978. Shortly thereafter, it was brought to the United States by the United States Army Criminal Investigation and Bureau of Alcohol, Tobacco, and Firearms Laboratories. It is currently used in most state and metropolitan police forces across the country.

To understand how the super glue method works, one must first know some basic information about fingerprints themselves. There are three different types of fingerprints: visible, impression, and latent. Investigators normally need a portable, permanent copy of the fingerprints. A photograph can generally fulfill this need. Of the three types of fingerprints, visible fingerprints can be photographed directly, and impression fingerprints can usually be photographed under special lighting conditions. It is only the invisible latent fingerprints that are difficult to photograph. They must first be made visible.

There are three general groups of techniques for making latent fingerprints visible, and virtually every known method can be categorized into one of the three groups or a combination of the three. The three groups consist of the physical techniques, the chemical techniques, and the instrumental techniques. Cyanoacrylate fuming is a chemical technique.

Latent fingerprints are composed of several chemicals exuded through the pores in the fingertips and are left on virtually every object touched. The primary component of latent fingerprints is ordinary sweat. Sweat is mostly water, and will dry after a fairly short period of time. The other components of latent fingerprints are primarily solid, however, and can remain on a surface for a much longer period of time. These other components include organic compounds like amino acids, glucose, lactic acid, peptides, ammonia, riboflavin, and isoagglutinogens as well as inorganic chemicals like potassium, sodium, carbon trioxide, and chlorine.

The basic concept behind all of the chemical techniques is to apply something that will chemically react with one of the constituent chemicals of latent fingerprints to the area suspected of containing such a fingerprint. The resulting reaction will give all present latent fingerprints a new chemical composition. This new chemical composition will make the latent fingerprints easily rendered visible, and they can then be photographed.

The super glue method is no exception to this rule. Most liquid super glues are really either methylcyanoacrylate or ethylcyanoacrylate. Less common types of super glue include butylcyanoacrylate and isobutylcyanoacrylate. Fortunately, all these types of super glue are nearly identical physically and chemically. Super glue reacts with the traces of amino acids, fatty acids, and proteins in the latent fingerprint and the moisture in the air to produce a visible, sticky white material that forms along the ridges of the fingerprint. The final result is an image of the entire latent fingerprint. This image can be photographed directly, or after further enhancement.

To enable such a reaction to take place, the cyanoacrylate must be in its gaseous form. The basic procedure to develop latent fingerprints using super glue takes this fact into account, but is still not overly complicated. The surfaces that are to be checked for latent fingerprints are placed in an airtight tank along with a small heater. A few drops of liquid super glue are placed into a tiny, open container, and the container is placed on top of the heater inside the tank. The tank is then carefully sealed, and the heater activated. According to Lee and Gaensslen, the boiling point for most super glue varies between forty-nine and sixty-five degrees celcius (roughly one-hundred twenty to one-hundred fifty degrees fahrenheit) depending upon its exact chemical composition[1].

Once the super glue in the container reaches its boiling point, it will begin to boil away into the surrounding atmosphere, creating a concentration of gaseous cyanoacrylate. If any latent fingerprints exist anywhere inside the tank, they will eventually be exposed to the gaseous cyanoacrylate. This exposure and the natural humidity contained in the atmosphere are enough to trigger the reaction automatically. Thus, once everything has been set up, the investigator merely waits for the reaction to occur. The whole reaction can take over two hours, with the exact time determined by the size of the tank, the concentration of the gaseous cyanoacrylate in the air, the humidity of the air, and numerous other factors. Since it is in practice very difficult to calculate this amount of time in advance, the reaction must be monitored to insure that it is not allowed to continue for too long. If it runs unchecked, the latent

fingerprints can overdevelop; the chemical images of the ridges will slowly grow wider until they overlap, obscuring vital detail.

There are a few methods by which the process may be accelerated. These add to the complexity of the basic procedure, but offer vast improvements in the speed of the reaction. Most agencies that use the super glue technique for developing latent fingerprints employ at least one acceleration method; many agencies, like the Boston Metropolitan Police Crime Lab[2], use two. The three most common acceleration methods are the fume circulation method, the chemical acceleration method, and the water vapor method.

The fume circulation method is fairly straightforward in principle; if the cyanoacrylate fumes are actively circulated around the tank, the air inside will have a constant concentration of them and all latent fingerprints in the tank will be in constant contact with some cyanoacrylate. In practice, the fumes can be forced to circulate by the strategic use of a couple of electric fans inside the tank.

The chemical acceleration method is quite different from the other acceleration methods. Instead of being an addition to the basic procedure, the chemical acceleration method is a replacement for part of it. When the chemical acceleration method is used, the heater is discarded and a chemical like sodium hydroxide is placed in contact with the super glue. This chemical will cause the super glue to produce cyanoacrylate fumes, and the reaction will then proceed normally.

The water vapor method is extremly simple in theory and in practice. Since the reaction requires moisture from the air to occur, the air in the tank can be kept at a high level of humidity to ensure that there will always be enough moisture for the reaction to take place. The humidity in the tank can be kept high simply by placing an open container of water inside the tank.

Regardless of whether or not an acceleration method was used, the final image of the fingerprint is not always easy to photograph. Since the

chemical deposits left by the reaction are white, there may not be enough contrast for an effective photograph to be taken if the surface they are on is also white.

If this is the case, a simple method exists that solves the problem. This is the technique of dusting. Different colored dusts may be brushed onto the image of the fingerprint, and they will cling to the sticky white chemical from which it is formed, effectively changing its color. The super glue technique produces outstanding results on all non-porous surfaces like metal, glass, and plastic; it will sometimes work on porous surfaces too, but not as well.

Overall, the super glue technique is an excellent means of developing latent fingerprints. It stands as one of the best methods of obtaining one of the most important types of physical evidence. It can be highly recommended to any agency that has not already adopted it as a primary method of developing latent fingerprints.

References

1. Lee, Henry C., & Gaensslen, R. E. *Cyanoacrylate Fuming: Theory and Procedures*. West Haven, CT: Connecticut State Police Forensic Science Laboratory in conjunction with the Forensic Sciences Program at the University of New Haven, 1984.

2. Shaw, Ken (fingerprint technician for the Boston Police). Personal Interview. 21 April, 1990.

Published in NU-ENG 1990