A173 Assessing the Performance of Silver as a Post-Gold/Zinc Process for Vacuum Metal Deposition

Mary Nguyen-Quan, BS, Clayton State University, 2000 Clayton State Boulevard, Morrow, GA 30260; Henry Swofford, BS, and Mandi A. Hornickel, MFS, United States Army Criminal Investigation Laboratory, 4930 North 31st Street, Forest Park, GA 30297; and Michael J. Salyards, PhD, 45 High Street, Sharpsburg, GA 30277*

After attending this presentation, attendees will understand the performance of silver as an effective post-gold/zinc process for vacuum metal deposition.

This presentation will impact the forensic science community by demonstrating the ability of silver to develop more and higher quality latent prints when used as a post-gold/zinc vacuum metal deposition process than the traditional gold/zinc process alone.

Vacuum Metal Deposition (VMD) using gold/zinc is a process which may be used to develop latent prints on many types of non-porous and semi-porous substrates. VMD has been found to be successful when other traditional processing methods have failed, such as with older latent prints and those previously exposed to water and other environmental conditions. The effectiveness of the gold/zinc VMD process relies heavily on the composition and surface contamination of the substrate and latent print residue. Variations in the composition and surface contamination of substrates may prevent successful development of latent prints using the gold/zinc process producing no or poor quality latent prints. Further research has suggested silver may be used as a post-gold/zinc VMD process having the potential to improve poorly developed latent prints and develop additional latent prints which were not developed using the gold/zinc VMD process alone. However, the amount of research demonstrating the performance of silver as an effective post-gold/zinc VMD process is limited. This research, therefore, seeks to better understand the performance of gold/zinc VMD process alone compared to the performance of silver as a post-gold/zinc VMD process on various types of substrates.

Nine different types of non-porous and semi-porous substrates were used in this evaluation, which included: Duct tape, packaging tape, pressure sensitive tape, adhesive tape, masking tape, cardboard, photo-paper, plastic sandwich bag, and thick plastic wrap. The ability of the gold/zinc VMD process to develop latent prints on the non-adhesive side of many types of tapes has been demonstrated in the literature, but research is limited on the success of developing latent prints on the adhesive side. Because of this limited research, this evaluation focuses on the ability to successfully develop latent fingerprints on the adhesive side of tapes. Each substrate contained a depletion series of five fingerprints using a sebaceous standard fingerprint matrix and a depletion series of five fingerprints using natural sebaceous fingerprint matrix obtained from the study coordinator's forehead. All fingerprints were deposited under controlled conditions on each substrate surface. Four sets of each substrate were used to evaluate the gold/zinc and silver VMD processes with fresh, one week, two week, and three week old fingerprints yielding a total of 360 fingerprints processed by each VMD process. All substrates were stored in controlled laboratory conditions until being processed. Following the VMD processing, each fingerprint was photographed and digitally presented to a certified Latent Print Examiner for evaluation. The Latent Print Examiner rated the quality of development according to a numeric rating scale (zero to five) corresponding to the quality of friction ridges which developed. Data were evaluated according to the quality of fingerprints developed with the gold/zinc VMD process, the quality of additional fingerprints developed and those further enhanced with the silver VMD process, and whether the type of fingerprint matrix used, the age of the fingerprints, and depletion series impacted the ability of the gold/zinc and silver VMD processes to develop quality fingerprint impressions.

The gold/zinc VMD process consistently yielded poor quality results on the adhesive side of the tapes and plastic substrates; however, successful results were obtained on both the cardboard and photo-paper substrates. The silver VMD process yielded positive results on many substrates in which the gold/zinc VMD process failed or developed poor quality fingerprints. The quality of fingerprints developed using silver as a post-gold/zinc VMD process were greatly improved compared to the quality of fingerprints developed using the gold/zinc VMD process alone ($p<0.001$). Further analysis revealed no statistical differences in the quality of the fingerprints developed using the different fingerprint matrices and the fingerprint ages; however, those fingerprints having more matrix (deposition #1 in the depletion series of five fingerprints) yielded higher quality results when compared to the fingerprints having less matrix (deposition #5 in the depletion series of five fingerprints). These results suggest silver is an effective post-gold/zinc VMD process having the ability to develop additional fingerprints and further enhance those previously developed using the gold/zinc VMD process alone. Further research is warranted, however, to better understand the performance of the various VMD processes on other substrates, fingerprint matrices, and ages.

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

Forensic Science, Vacuum Metal Deposition, Silver

 ** Presenting Author*