A64 Novel Nanoparticle Polymer Applications in Lifting or Preserving Imaged Latent Fingerprints

Charles R. Cornett, PhD,and Lindsey Sprangers, BS, University of Wisconsin-Platteville, Department of Chemistry, Platteville, WI 53818; Thea Somers, BS, and James Hamilton, PhD, University of Wisconsin-Platteville, Department of Chemistry, Platteville, WI 53818*

After attending this presentation, attendees will be introduced to a novel application of a polymer embedded with nanoparticles in the lifting and preservation of imaged latent fingerprints.

This presentation will impact the forensic science community by being aware of the research that has developed a clear polymer capable of lifting positive imaged latent prints from a wide variety of irregular surfaces as well as a nanoparticle-doped polymer capable of preserving imaged latents on a wide scope of paper documents. These constitute significant advances in the latent print discipline.

The 2005 on-going application investigation for a novel polymer began to focus on the lifting of imaged latent fingerprints from irregular and highly irregular surfaces such as plastic beverage containers, automobile dash boards, bank countertops, and mottled appliance surfaces including handles. Additional research demonstrated that the polymer provided a mechanism for preserving imaged latent prints on virtually any paper surface. Furthermore, accelerated aging tests involving heat and humidity sufficient to simulate ten years of aging were conducted. Experiments then focused on refinement of aerosol delivery of the polymer and solvent system.

Fingerprint samples were collected from these surfaces and the ridge detail assessed by five students who completed a three-credit course in fingerprint identification. Results demonstrated that the polymer spray provided an outstanding means of preserving imaged latent prints as well as lifting positive images of dusted latent prints from the aforementioned irregular surfaces with minimal stretching, distortion, or loss of ridge detail. Additional experimentation utilized latent prints collected from six volunteers on index cards at the same time of day, each day, for one week. The collected latents were dusted using magnetic black powder. One-half of the prints were sprayed with the polymer while the remaining prints are treated with a silicone-based product producing a negative image. Statistical results comparing the two lifts are presented. A semi-quantitative rubric was developed to compare ridge detail of the positive print images generated by this clear polymer and the negative print images generated by commercial available, silicone-based products for the index card experiment. Together, these studies demonstrate the viability of this polymer in the lifting of positive images of latent prints from nearly all surfaces.

In the preservation studies, simulated aging tests with heat and humidity demonstrated that the paper substrate yellowed prior to polymer degradation during tests designed to mimic ten years of aging. This led to the incorporation of zinc oxide (ZnO) nanoparticles into the polymer solution. The addition of the ZnO nanoparticles resulted in a clear solution given the nanochemistry of ZnO and filtration. The presence of the ZnO nanoparticles was confirmed by UV spectrometry scans ranging from 200nm to 400nm. Experiments demonstrated an increased resistance in simulated aging including UV light tests. In these experiments, newsprint, various cotton bonds, and copier paper were printed, dusted with magnetic black, and treated with the ZnO embedded polymer. The latent print was over-sprayed by a radius of approximately three centimeters. This enabled a comparison of the paper and the polymer coated paper outside of the latent print to assess the general effects of the polymer system on preventing paper oxidation. With regards to the effects of the embedding of the ZnO nanoparticles on the small potential of stretching distortion of ridge detail with the polymer-only application, the results indicate further reductions of distortion may be possible by this incorporation of the ZnO nanoparticles.

Nanoparticle, Latent, Fingerprint

 ** Presenting Author*