The Identification of Metal Transfer From Bullets onto Laminated Glass

John Chester

Indiana State Police Laboratory, Microanalysis Unit, Indianapolis, Indiana 46202

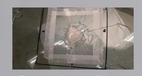
Experiment

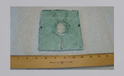
Introduction

Occasionally forensic scientists are asked to perform an examination to determine if a broken window is consistent with being impacted by a bullet or another object. Currently at the ISP lab, only visual examination and spot chemical tests have been used for this examination. This experiment was designed to give a more conclusive result with instrumental data that can support the conclusion. This experiment was based on a case that was submitted to the Indiana State Police Laboratory for examination. Information on the case has been included on the right.

Materials and Methods

8 windshields were donated by Safelite AutoGlass. A wooden frame was constructed to hold the windshields in place. The ISP firearms unit fired 3 shots from various firearms and ammunition through the windshields. One area of impact was selected and cut out of each windshield using a Dremel Tool equipped with a blade coated in Diamond dust.





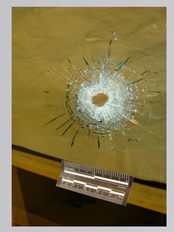
Analysis

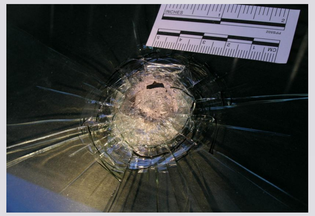
The windshield sections that were cut out were analyzed microscopically to identify any points of interest. These areas were photographed as a means of locating the microscopic areas of interest around the area of impact. The windshield sections were then placed in the EDAX micro-XRF spectrometer and analyzed in these specific areas of interest.

EDAX Micro-Eagle III Conditions: 40keV, and 55-200µm spot size, 17.0 – 35.0 AmpTm, and micro-amps were adjusted to achieve a dead time ~40%. Background spectra were taken of each windshield on the surface away from the area of impact.

Results

The XRF spectra identified the presence of lead and/or copper metal on the areas of interest in all 8 windshield sections. The amount of metal present is consistent with the type of ammunition used. Copper jacketed ammunition transferred copper and some lead. Unjacketed ammunition also transferred lead, but in a more significant quantity.





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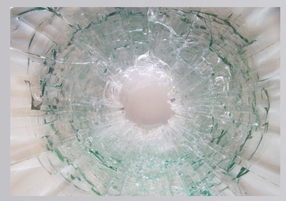
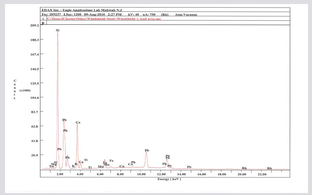
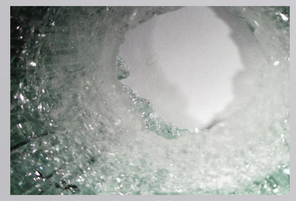


Windshield section with a lead metal transfer

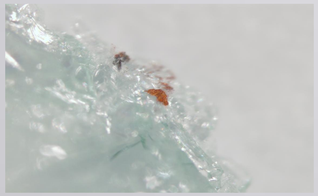
Microscopic lead metal transfer



XRF spectrum of the lead metal transfer



Windshield section with a copper metal transfer



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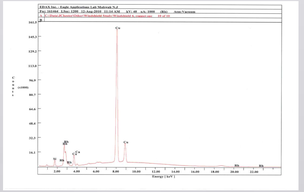


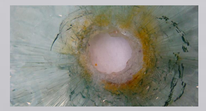
XRF spectrum of the copper metal transfer

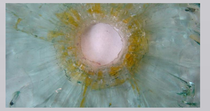
Retention Study

The windshield sections were placed outdoors for a period of 3 weeks to test if the metal transfers would be retained after exposure to the environmental elements. The lead metal transfers were shown to be retained for at least 3 weeks after exposure to outdoor environmental conditions. A large amount of microscopic debris collected on the bullet hole area of the windshield sections. The copper metal transfers, present in a much lesser quantity than the lead transfers, were not observed microscopically. However, the copper metal may still be present.

Chemical Test Follow Up

Sodium rhodizonate chemicals were directly sprayed onto the windshield sections. The chemical tests yield a positive reaction (purple color) for any substance containing lead in any form. From these images, are these positive reactions? Would a photograph of a microscopic metallic lead transfer in conjunction with an ID of lead via XRF be more conclusive?



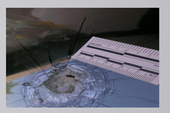


Case

Background

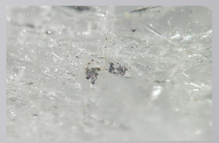
While driving home, three women saw a man walk out in front of their truck. The man was carrying a pistol and opened fire on the truck. One hole in the windshield was created (shown left). No exit hole was observed and no bullet was recovered. Initially the women reported to the police that the windshield had been shot; later on their story changed and they said that a rock had hit the windshield while they were driving on the highway. The truck was not impounded, and was driven around for 18 days before it was taken in as evidence.

"A small stone thrown at a comparatively high speed against a pane of glass will often produce a hole very similar to that produced by a bullet" (Saferstein). Is there a form of analysis that could differentiate between these two scenarios?



Analysis and Results

Elemental analysis of the cut out area of impact of the windshield revealed the presence of several areas containing lead metal. These areas of the windshield have come into contact with an object containing lead metal.



Testimony and Sentencing

On January 27st 2011, I testified to my findings in court, along with a retired FBI special agent. He testified that from looking at the photographs of the area of impact the hole in the windshield was caused by an impact from a bullet. The defendant was found guilty on one count of attempted murder and three counts of criminal recklessness. He was sentenced to 60 years in prison.

Literature cited

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Acknowledgments

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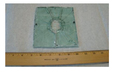

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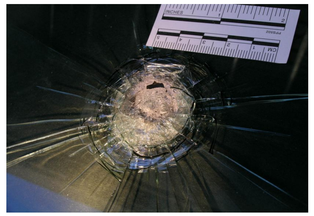

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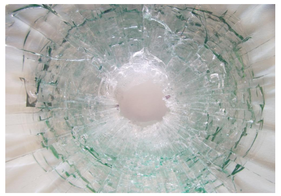

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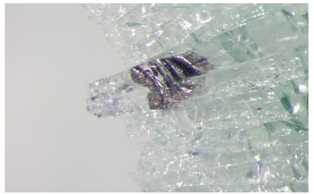

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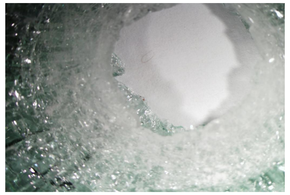

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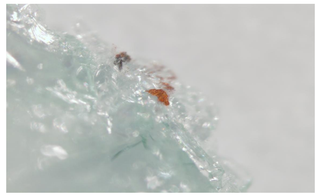

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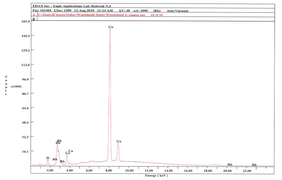

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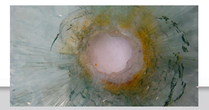

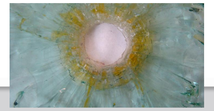

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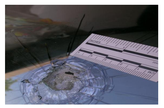

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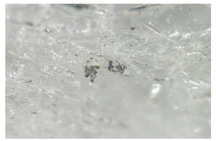

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