Real-life CSI: What can investigators really tell from gunshot residue?

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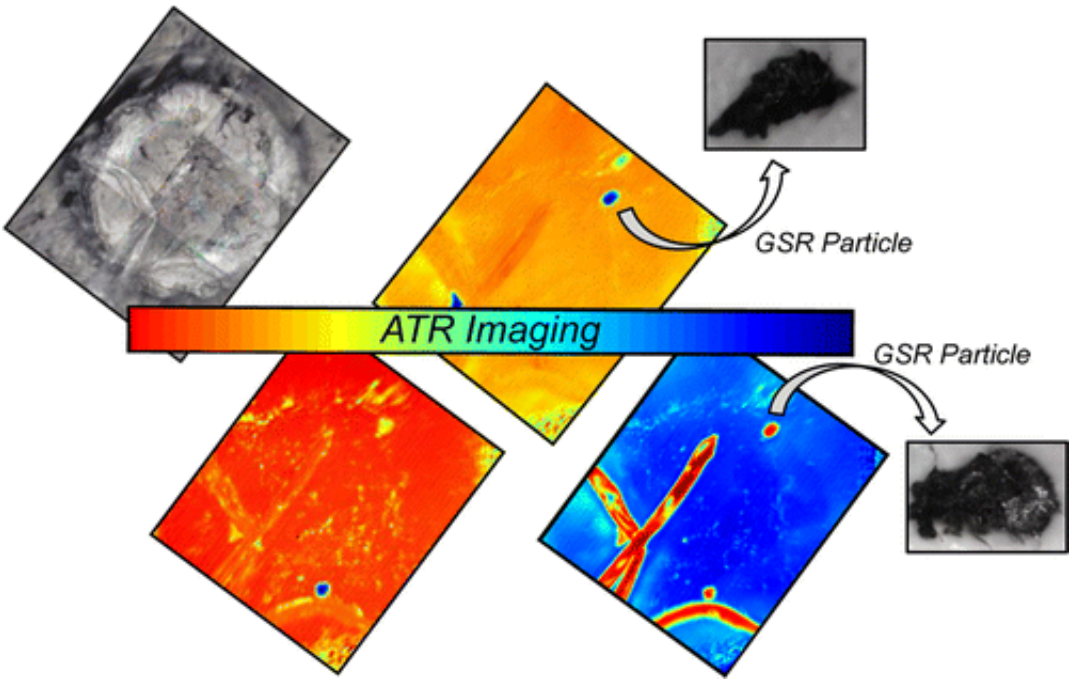

The popular TV series "CSI" is fiction, but every day, real-life investigators and forensic scientists collect and analyze evidence to determine what happened at crime scenes. In a study published in the ACS journal *Analytical Chemistry*, scientists say they have developed a more rapid and accurate method that could allow crime scene investigators to tell what kind of ammunition was shot from a gun based on the residue it left behind.

Igor K. Lednev and Justin Bueno point out that when someone fires a gun, burnt particles from the bullet spray out of the weapon onto a shooter's hand, clothes, furniture and other surfaces nearby. The presence or absence of that residue says whether a gun was discharged and—based on its location on clothing and other surfaces—who and what was near the weapon when it was fired. But current analysis methods can only re-create a crime scene story in hazy detail. The most widely used technique today specializes in detecting the heavy metals that some ammunition contains. Newer bullets, however, aren't necessarily made with heavy metals, making analyses much more difficult. Also, existing methods require expensive equipment and a lot of time, luxuries law enforcement can't afford. To bring real-life CSI closer to what's hyped on TV, Lednev's team set out to find a new way to trace the ammunition used in a crime.

They developed a novel approach to improve gunshot residue "fingerprinting" that can rapidly detect a wider range of particles than existing methods. "Therefore the ability to detect these chemicals may indicate that a specific ammunition brand was discharged (or was not) during a shooting incident," the researchers state, adding that their work could also have applications in the fields of homeland security and counter-terrorism.

More information: "Attenuated Total Reflectance-FT-IR Imaging for Rapid and Automated Detection of Gunshot Residue" *Anal. Chem.*, Article ASAP. DOI: 10.1021/ac4036718

Abstract
An alternative approach for the nondestructive, rapid and selective detection of gunshot residue (GSR) was investigated. A cloth substrate containing GSR particles expelled during a firearm discharge was used as an analog for the clothing of a shooting victim or a suspect discharging a firearm. An established and efficient procedure for GSR

collection (tape lifting) was utilized to recover GSR particles from the cloth substrate. Microscopic-attenuated total reflectance (ATR) Fourier transform (FT) infrared (IR) spectroscopic imaging rapidly and automatically scanned large areas of the tape collection substrate and detected varying morphologies (microscopic and macroscopic) and chemical compositions (organic and inorganic) of GSR. The "spectroscopic fingerprint" of each GSR type provided unique virbrational modes, which were not characteristic of the tape collection substrate or the cloth debris which was also recovered. ATR images (maps) targeted the detection of these unique chemical markers over the mapped area. The hues of the ATR images were determined by the intensity of the signal for the chemical marker of each analyte. The spatial resolution of the technique was determined to be 4.7 μm. Therefore, all GSR particles sized 4.7 μm or larger will be resolved and detected on the tape substrate using micro-ATR imaging.

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