

AUTOMATED GUNSHOT ANALYSIS BY SEM/EDS

Max M. Houck, Trace Analyst,
Tarrant County Medical Examiners Crime Laboratory

Firearms are involved in roughly 60% of all murders, 33% of all robberies and almost 25% of aggravated assaults. Given these statistics, it is easy to see why a determination of whether an individual has recently been in the immediate vicinity of a discharged firearm is important to law enforcement.

Ammunition is either rim-fire or center-fire, depending on where the hammer mechanism must hit to activate the primer. When a firearm is discharged, the hammer strikes the primer cap in the bullet causing it to explode and, thus, ignites the powder whose expanding gases propel the bullet out of the barrel of the gun. As this happens, molten primer material is expelled from the firearm in a 1 meter plus radius, showering that area with microscopic (submicron to 10+ microns) spherical bits of GSR. The hand holding the weapon during discharge usually has more GSR than the non-firing hand. But, after some two hours of normal activity, both hands usually have roughly equal amounts of GSR. And if the person has washed his hands, then almost no GSR remains. While the hands are usually the main focus of GSR col-

lection, some agencies collect from the face, clothing and even the ears and nostrils to obtain good sampling. GSR is collected by physically removing the particles by dabbing double-sided adhesive tape attached to an SEM stub on the area of interest.

Primers contain amounts of lead azide, lead styphnate, barium nitrate and/or antimony sulfate. While such individual microscopic particles may be found on a person, GSR produces a unique elemental signature.

Modern GSR analysis includes particle detection, spectral acquisition and classification based on elemental intensity. The SEM/EDS system is fitted with a backscattered electron (BSE) detector to visualize the GSR particles, since they have a high mean atomic number due to Pb, Sb and Ba. Other particles may be detected, such as Fe/Ce as produced by using cigarette lighters, etc. but these can be sorted out based on elemental content. The surface of the stub is searched at each stage position in a grid or random pattern at a magnification of around X1000. The particles that register on the BSE detector are located and a spectrum is acquired. Each particle can then be classified as being unique to, indicative of or not associated with GSR. Precision stage automation and specialized EDS software allows overnight analysis and is essential to the process.

GSR determination by SEM/EDS is clearly the most definitive method of determining if a person has been in immediate vicinity of a discharged firearm.

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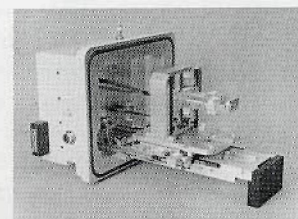
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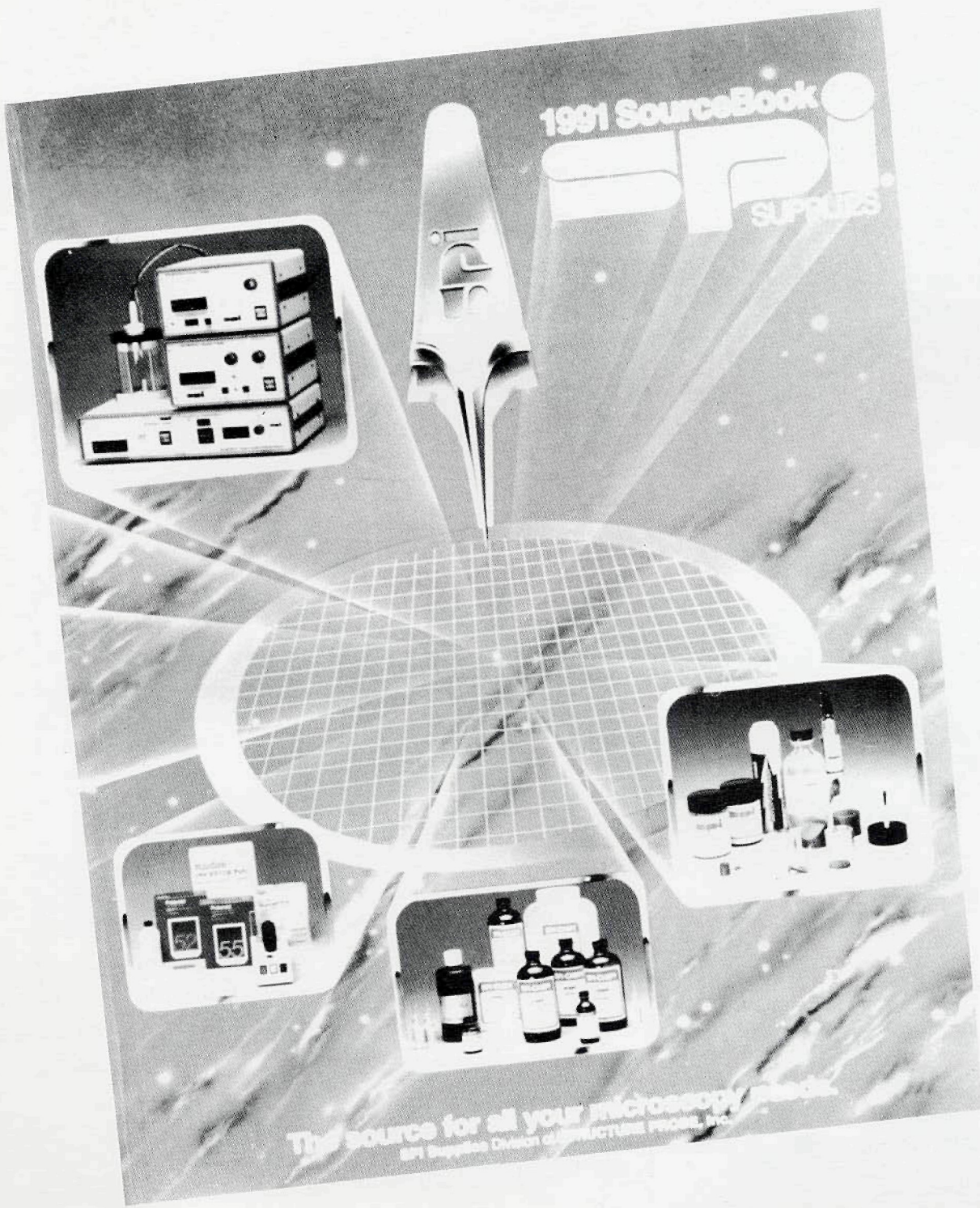


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