



Standard Terminology Relating to Gunshot Residue Analysis (GSR)¹

This standard is issued under the fixed designation E3391; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This terminology standard is a compilation of terms and corresponding definitions that are used in gunshot residue analysis. Some legal or scientific terms that are generally understood or defined adequately in other readily available sources are included.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E1588 Practice for Gunshot Residue Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry

E3309 Guide for Reporting of Forensic Primer Gunshot Residue (pGSR) Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry (SEM/EDS)

3. Significance and Use

3.1 These terms have particular application to gunshot residue analysis. In addition, several sources of definitions were used in the development of this terminology (1-7).³

4. Terminology

4.1 Definitions:

¹ This terminology is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility of Subcommittee E30.01 on Criminalistics.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The boldface numbers in parentheses refer to a list of references at the end of this standard.

accelerating voltage, *n*—voltage/electrical potential applied to the filament that accelerates the electrons emitted by the electron gun/filament. **Flegler (1)**

beam current, *n*—current that impinges on the specimen. **Flegler (1)**

NOTE 1—Also referred to as probe current.

Berdan primer, *n*—primer/case system, designed by Col. Hiram Berdan, having two or more flash holes consisting of a cup, explosive mixture, and covering foil or paper; the anvil is an integral part of the cartridge case head in the bottom of the primer pocket. **AFTE Glossary, 6th Ed. (2)**

boxer primer, *n*—ignition component consisting of a cup, explosive mixture, anvil, and covering foil or paper disk that together form the completed primer ready for assembly into the primer pocket of a cartridge case. **AFTE Glossary, 6th Ed. (2)**

candidate particles, *n*—particles classified by the instrument software based on detection of appropriate (as specified in Practice **E1588**) constituent elements as potential pGSR. **E3309**

centerfire cartridge, *n*—any cartridge that has its primer central to the axis in the head of the case. **AFTE Glossary, 6th Ed. (2)**

condenser lens aperture, *n*—metal strip mounted on a holder that is inserted into the column under the condenser lenses: the strip can have three selectable holes or one fixed hole that the electron beam passes through the center and stray electrons are then captured by the surrounding plate. **Goldstein (3)**

condenser lens current, *n*—current in the condenser lens changes the spot size or diameter of the electron beam. **Goldstein (3)**

frictionator, *n*—provides sharp corners against which the particles of sensitizer and initiator are forced by the movement of the primer cup or case rim under the firing pin blow. **Frost (4)**

gunpowder, *n*—a generic term used for propellant powders used in firearms. **SWGSR (5)**

gunshot residue, GSR, *n*—residues formed during the discharge of a firearm. **SWGSR (5)**

initiator, *n*—primary explosive that will explode or detonate when heated or subjected to shock. **Meyer (6)**

DISCUSSION—Examples include lead styphnate, mercury fulminate, lead azide, and silver fulminate.

inorganic GSR, *n*—that portion of GSR coming from metals as vaporous material from the bullet, cartridge case, and primer. **SWGSR (5)**

kilo electron volts, keV, *n*—unit used to measure the energy of X-rays emitted from atoms when excited by the electron beam of an SEM. **Goldstein (3)**

DISCUSSION—By definition, one electron volt is the amount of energy gained (or lost) by the charge of a single electron moving across an electric potential difference of 1 V. One kilo electron volt is 1000 eV.

lead-free ammunition, *n*—ammunition incorporating a primer that does not contain lead. **Gunaratnam (7)**

organic GSR, *n*—residues from the propellant and the priming mixture that are organic compounds. **SWGSR (5)**

oxidizer, *n*—compounds generally containing oxygen that react vigorously with fuel compounds (reductants) thereby increasing the energy of the deflagration of the primer. **Meyer (6)**

primer, *n*—ignition component of a cartridge. **AFTE Glossary, 6th Ed. (2)**

DISCUSSION—Commonly, a mixture of initiator, sensitizer, oxidant, fuel, and frictionator.

primer GSR, *n*—that portion of GSR resulting from the explosion of the primer compounds. **SWGSR (5)**

rimfire cartridge, *n*—flange-headed cartridge containing the priming mixture inside the rim cavity. **AFTE Glossary, 6th Ed. (2)**

sensitizer, *n*—explosive compound that increases the sensitivity of the shock-sensitive component of a primer. **Meyer (6)**

sinoxid, *n*—name for the most commonly used primer. **Meyer (6)**

DISCUSSION—It is composed primarily of lead styphnate, barium nitrate, and antimony sulfide.

working distance, *n*—distance between the final aperture and the specimen. **Flegler (1)**

5. Keywords

5.1 analysis; gunshot residue; terminology

REFERENCES

- (1) Flegler, S. L., Heckman, J. W., Klomparens, K. L., *Scanning and Transmission Electron Microscopy: an Introduction*, Oxford University Press, NY, 1993.
- (2) Association of Firearm & Tool Mark Examiners, *Glossary*, 6th Edition, Version 6.110619, 2013.
- (3) Goldstein, J. I., Newbury, D. E., Echlin, P., Joy, D. C., Lyman, C. E., Lifshin, E., Sawyer, L., Michael, J. R., *Scanning Electron Microscopy and X-Ray Microanalysis*, 3rd Edition, Kluwer Academic/Plenum Publishers, NY, 2003.
- (4) Frost, G. E., *Ammunition Making: An Insider's Story*, National Rifle Association of America, Washington, D.C., 1990.
- (5) SWGSR, "Guide for Primer Gunshot Residue Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectroscopy," available from <http://www.swggsr.org>.
- (6) Meyer, R., Kohler, J., Homburg, A., *Explosives*, Sixth Edition, Wiley-VCH Publishers, Germany, 2007.
- (7) Gunaratnam, L., Himberg, K., "The Identification of Gunshot Residue Particles from Lead-Free Sintox Ammunition," *Journal of Forensic Sciences*, Vol 39, No. 2, 1994, pp. 532-536.

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