Introduction to Forensic Glass Examination

Working Group for Materials Analysis (SWGMAT)

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1. Scope

1.1. This document is the introduction to the guidelines for the forensic examination of glass. The guidelines are intended to assist examiners who conduct forensic glass analyses in their evaluation, selection, and application of tests that may be of value to their investigation.

1.2. The guidelines describe procedures and methods to develop discriminatory and other pertinent information using an efficient and reasonable protocol. The need for experience and training of the examiner is as important as the employment of validated methods and proper quality assurance procedures. The guidelines are not intended to describe methods in detail, or to be a rigid scheme for the analysis and comparison of glass samples, but as guides to the strengths and limitations of each analytical method.

2. Reference Documents

2.1. Scientific Working Group for Materials Analysis Documents

Quality assurance guidelines
Trace evidence recovery guidelines

3. Terminology

Class is a group of items that share properties or characteristics.

Class characteristics are traits that define a group of items collectively.

Density is mass per unit volume (g/cm^3).

Glass is an inorganic product of fusion that has cooled to a rigid condition without crystallizing.

Individual is a unique item, identified as itself to the exclusion of all other items.

Individual characteristics are traits that define and identify an item as unique, exclusive to all other items.

Known sample is a subset of a larger population or sample originating from an identifiable source, collected as being representative of that larger grouping (e.g., fragments removed from a broken window at the scene of a crime).

Questioned sample is material of unknown source collected from a known location either as, or from, items of evidence (e.g., fragments recovered from a suspect's clothing).

Refractive index for a particular transparent medium is the ratio of the speed of light in one media compared to another, mathematically expressed as $n_i = v_1 / v_2$, where refractive index = n_i

at a specific wavelength i, and the speed of light in each media are v_1 and v_2. For glass analysis, v_1 is the speed of light in a vacuum.

4. Summary of Guideline

The other Scientific Working Group for Materials Analysis documents in this issue address the principal methods of forensic glass comparisons in the order that they should be performed, if practicable. The various analytical methods available for glass analysis yield different kinds of information. It is highly desirable to select a combination of methods and apply them in an order that provides the most useful information, while most effectively using the laboratory's resources.

5. Significance and Use

5.1. The other Scientific Working Group for Materials Analysis documents in this issue are designed to assist the forensic glass examiner in selecting and organizing an analytical scheme for locating, collecting, identifying, and comparing glass. The size and condition of the samples, as well as the information requested will influence the selected analytical scheme.

5.2. Glass is a material commonly found in our environment. The breakage characteristics of glass under impact forces can produce features that can be used as physical evidence in many types of cases. The various examination techniques described in the other Scientific Working Group for Materials Analysis documents in this issue apply to most types of glass, including the following: flat glass used for windows, doors, display cases, and mirrors; container glass; tableware glass; optical glass; decorative glass; and specialty glass used for headlamps, cookware, and others.

5.3. Typically, forensic glass examinations involve a comparison of samples from known and questioned sources to determine if they originated from different sources (e.g., window from a suspect's car compared to glass recovered from the victim's clothing). This comparison involves the recognition and evaluation of class characteristics that associate materials to a group but never to a single source. Conversely, individual characteristics allow the association between two or more items with each other to the exclusion of all other items. For glass examiners, this can only occur when pieces of glass are physically matched.

5.4. Due to inherent heterogeneity of physical and chemical properties within a single source of glass, it is essential to emphasize the need to collect and analyze a sample(s) of the known source for comparison to any recovered fragments.

6. Sample Handling

Proper sample handling and preparation techniques are prerequisites for obtaining reliable results. See the *Scientific Working Group for Materials Analysis Collection, Handling, and Identification of Glass.*

7. Analysis

See the other Scientific Working Group for Materials Analysis documents in this issue for specific analysis information.

8. Considerations

See the other Scientific Working Group for Materials Analysis documents in this issue for general report considerations.

9. Bibliography

Caddy, B. *Forensic Examination of Glass and Paint,* Taylor and Francis Forensic Science Series, London, 2001.

Koons, R. D., Buscaglia, J., Bottrell, M., and Miller, E. T. Forensic glass comparisons. In: *Forensic Science Handbook.* 2nd ed. R. Saferstein, ed. Prentice-Hall, Upper Saddle River, New Jersey, 2002, Volume I, pp. 161-213.