



Standard Guide for Microscopical Examination of Textile Fibers¹

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1. Scope

1.1 This section describes guidelines for microscopical examinations employed in forensic fiber characterization, identification, and comparison. Several types of light microscopes are used, including, stereobinocular, polarized light, comparison, fluorescence, and interference. In certain instances, the scanning electron microscope may yield additional information. Select which test(s) or techniques to use based upon the nature and extent of the fiber evidence.

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

2. Referenced Documents

2.1 ASTM Standards:²

[D123 Terminology Relating to Textiles](#)

[D276 Test Methods for Identification of Fibers in Textiles](#)

2.2 AATCC Standards:³

[AATCC Test Method 20:Qualitative Test Method 20–2007 Fiber Analysis: Qualitative](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology [D123](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *anisotropic*—a characteristic of an object, which has optical properties that differ according to the direction in which light travels through the object when viewed in polarized light.

3.2.2 *barrier filter*—a filter used in fluorescence microscopy that suppresses unnecessary excitation light that has not been

absorbed by the fiber and selectively transmits only light of greater wavelengths than the cut-off wavelength.

3.2.3 *Becke line*—the bright halo near the boundary of a fiber that moves with respect to that boundary as the fiber is moved through best focus when the fiber is mounted in a medium that differs from its refractive index.

3.2.4 *Becke line method*—a method for determining the refractive index of a fiber relative to its mountant by noting the direction in which the Becke line moves when the focus is changed.

3.2.4.1 *Discussion*—The Becke line will always move toward the higher refractive index medium (fiber or mountant) when the focal distance is increased and when the focal distance is decreased away from the objective and will move toward the lower refractive index medium when the sample is moved toward the objective.

3.2.5 *birefringence*—the numerical difference in refractive indices for a fiber, given by the equation: $n_{||} - n_{\perp}$. Birefringence can be calculated by determining the retardation (r) and thickness (T) at a particular point in a fiber and by using the equation:

$$B = r(\text{nm})/1000T(\mu\text{m})$$

3.2.6 *comparison microscope*—a system of two microscopes positioned side-by-side and connected via an optical bridge in which two specimens may be examined simultaneously in either transmitted or reflected light.

3.2.7 *compensator*—any variety of optical devices that can be placed in the light path of a polarizing microscope to introduce fixed or variable retardation comparable with that exhibited by the fiber; the retardation and sign of elongation of the fiber may then be determined.

3.2.7.1 *Discussion*—Compensators may employ a fixed mineral plate of constant or varying thickness or a mineral plate that may be rotated, or have its thickness varied by tilting to alter the thickness presented to the optical path (and retardation introduced) by a set amount.

3.2.8 *compensator, full wave (or red plate)*—a compensator usually a plate of gypsum, selenite or quartz, which introduces a fixed retardation between 530 to 550 nm (approximately the retardation of the first order red color on the Michel-Levy chart).

¹ This guide 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 Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709, <http://www.aatcc.org>.