



Designation: D5596-94

Standard Test Method for Designation: D 5596 – 03 (Reapproved 2009)

Standard Test Method For Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics¹

This standard is issued under the fixed designation D 5596; 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 test method covers equipment, specimen preparation techniques, and procedures for evaluating the dispersion of carbon black in polyolefin geosynthetics containing less than 5 % carbon black by weight.

~~1.2 This test method allows for a qualitative evaluation of carbon black agglomerates and other inclusions in polyolefin geosynthetics. This evaluation is based on visual comparisons between microscopic fields of view and micrographs on the carbon dispersion reference chart.~~

1.2 This test method allows for a qualitative evaluation of carbon black agglomerates and other inclusions in polyolefin geosynthetics. This evaluation is based on carbon black dispersion size calculated area within microscopic fields of view.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

~~1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.~~
This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

NOTE 1—This test method is for the evaluation of carbon black dispersion. This test method does not support or evaluate the distribution of carbon black.

2. Referenced Documents

2.1 *ASTM Standards*:² [www.astm.org/catalog/standards/sist/35b674c5-a5ef4011-9855-9c8fa7152fc1/astm-d5596-032009](#)

D 883 [Terminology Relating to Plastics](#)

D 3053 [Terminology Relating to Carbon Black](#)

D 4439 [Terminology for Geotextiles](#)—[Terminology for Geosynthetics](#)

E 7 [Terminology Relating to Metallography](#)

~~2.2 ASTM Adjuncts: ASTM~~

~~D 35—Carbon Dispersion Reference Chart~~⁶ [Terminology Relating to Metallography](#)

3. Terminology

3.1 Definitions:

3.1.1 *carbon black, n*—a material consisting essentially of elemental carbon black in the form of near spherical colloidal particles and coalesced particle aggregates of colloidal size, obtained by partial combustion or thermal decomposition of hydrocarbons. (D 3053)

3.1.2 *carbon black agglomerate, n*—a cluster of physically bound and entangled aggregates. (D 3053)

3.1.3 *geosynthetic, n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geo-technical

¹ This test method is under the jurisdiction of ASTM Committee ~~D-35~~ D35 on Geosynthetics and is the direct responsibility of Subcommittee [D35.02](#) on Endurance Properties.

Current edition approved August 15, 1994. Published January 1995.

Current edition approved June 1, 2009. Published July 2009. Originally approved in 1994. Last previous edition approved in 2003 as D 5596 – 03.

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.

engineering-related material as an integral part of a man-made project, structure, or system. (D 4439)

3.1.4 *micrograph, n*—a graphic reproduction of an object as seen through the microscope or equivalent optical instrument, at magnifications greater than ten diameters (micrograph). (E 7)

3.1.5 *microtome, n (that is, sliding microtome)*— an apparatus capable of cutting thin slices (less than 20 μm in thickness) of various geosynthetic samples.

3.1.6 *polyolefin, n*—a polymer prepared by the polymerization of an olefin(s) as the sole monomer(s). (D 883)

3.1.7 *dispersion, n*—a polyolefin product formulated with carbon black.

3.1.8 *distribution, n*—a property of a carbon black formulated polyolefin product that refers to the existence of streaks, light or dark, within a microsectioned sample.

4. Summary of Test Method

4.1 This test method consists of two parts: (1) microtome specimen preparation and (2) microscopic evaluation.

4.1 This test method consists of two parts: (1) microtome specimen preparation and (2) microscopic evaluation.

4.1.1 *Microtome Specimen Preparation*—A sample is clamped in the sample holder, which can be raised or lowered precisely in increments of approximately 1 μm. A rigid knife is slid manually across the sample so that the specimens range in thickness from 8 to 20 μm. These thin sections are then evaluated microscopically using a visual comparison between each random field of view (R_f) and the carbon dispersion reference chart. Each R_f is classified or rated according to the arrangement of categories on the reference chart.— A sample is clamped in the sample holder, which can be raised or lowered precisely in increments of approximately 1 μm. A rigid knife is slid manually across the sample so that the specimens range in thickness from 8 to 20 μm.

4.1.2 *Microtome specimen examination:* These thin sections are evaluated microscopically calculating the largest agglomerate or inclusion in each random field of view (R_f). The associated carbon dispersion chart can be used to assist to determining shape and area

5. Significance and Use

5.1 Carbon black is added to many polymers to provide long-term resistance to ultraviolet-induced degradation. To achieve this, carbon black should be dispersed and distributed uniformly throughout the as-manufactured geosynthetic material. This test method is used to evaluate the uniformity of carbon black dispersion.

5.2 This test method is suitable only for those geosynthetics that can be sampled using a rotary or sledge microtome. The geometry, stiffness (hardness), or elasticity of some geosynthetic products precludes their being sampled with a micro-tome. The cross-sectional area of the geosynthetic must be composed of a continuous solid polyolefin material to be sampled using a microtome.

5.3 Extruded and oriented geogrids will require that microtome specimens be cut from the non-oriented bars of uniaxial products and the non-oriented nodes of biaxial products.

6. Equipment

6.1 *Microtome*—A rotary or sledge-type microtome equipped with a sample clamp and knife holder is required. Steel knives are recommended; however, glass knives may be suitable (Fig. 1).

6.2 *Microtome Accessories*—Lubricant, dust cover, and tweezers are recommended.

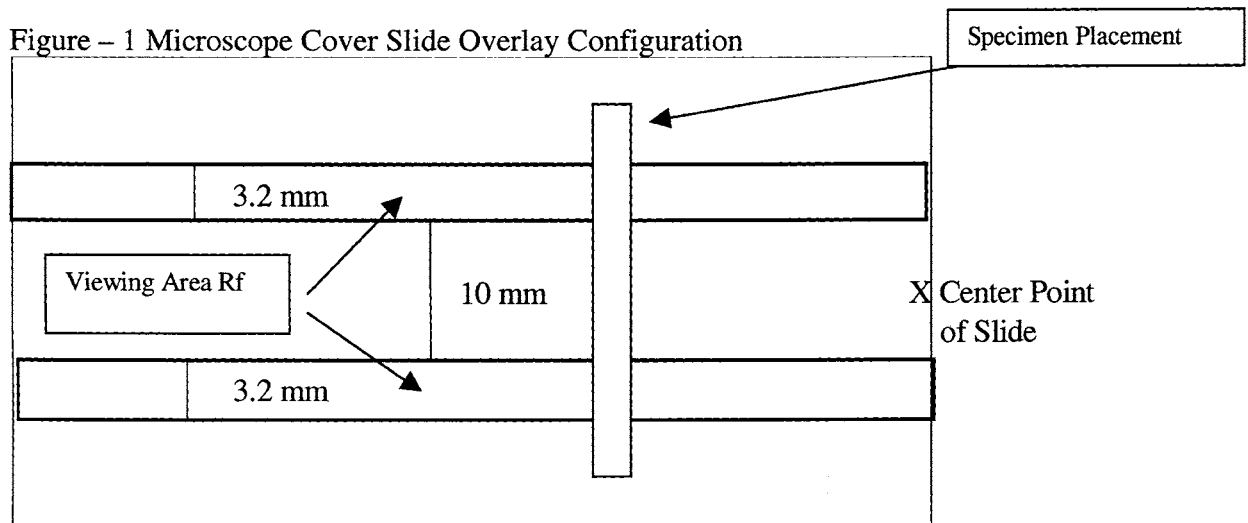


FIG. 1 Microscope Cover Slide Overlay Configuration