



Standard Test Methods for Absorbance of Polyethylene Due to Methyl Groups¹ at 1378 cm⁻¹

This standard is issued under the fixed designation D2238; 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.

^{ε1} NOTE—Reapproved with editorial changes in December 2012.

1. Scope

1.1 These test methods cover measurement by infrared absorption spectrophotometry of the 1378.4-cm⁻¹ (7.255-μm) band in polyethylene due to methyl groups. (1, 2, 3-6)² Two test methods are covered:

1.1.1 *Test Method A* uses compensation with a standard sample film or wedge of known methyl content.

1.1.2 *Test Method B* uses compensation with a wedge of polymethylene or a polyethylene of known low methyl content.

1.2 These test methods are applicable to polyethylenes of Types I (density 910 to 925 kg/m³), II (density 926 to 940), and III (density 941 to 965).

NOTE 1—For determination of density, see Specifications [D1248](#).

NOTE 2—In cases of Type III polyethylene with densities greater than 0.950 g/cm³, different results are obtained with the two test methods.

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.* Specific hazards statements are given in Section 7.

NOTE 3—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 ASTM Standards:³

[D618 Practice for Conditioning Plastics for Testing](#)

¹ These test methods are under the jurisdiction of ASTM Committee [D20](#) on Plastics and are the direct responsibility of Subcommittee [D20.70](#) on Analytical Methods (Section D20.70.08).

Current edition approved Dec. 1, 2012. Published December 2012. Originally approved in 1964. Last previous edition approved in 2004 as D2238 - 92 (2004). DOI: 10.1520/D2238-92R12E01.

² The boldface numbers in parentheses refer to the list of references at the end of these test methods.

³ 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.

[D1248 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable](#)

[D1505 Test Method for Density of Plastics by the Density-Gradient Technique](#)

[D1898 Practice for Sampling of Plastics](#) (Withdrawn 1998)⁴

[E131 Terminology Relating to Molecular Spectroscopy](#)

[E168 Practices for General Techniques of Infrared Quantitative Analysis](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[IEEE/ASTM SI-10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *absorbance*—the logarithm to the base 10 of the reciprocal of the internal transmittance:

$$A = \text{LOG}_{10}(1/T) = -\text{LOG}_{10}T \quad (1)$$

3.2 Units, symbols, and abbreviations used in this test method appear in Terminology [E131](#) or Practice [IEEE/ASTM SI-10](#).

4. Significance and Use

4.1 When interpreted with the aid of appropriate calibration data, either test method can be used to compare the total methyl contents of polyethylenes made by similar processes. Such information can be interpreted in terms of specific alkyl groups with the aid of data on infrared absorption at certain other wavelengths (7).

NOTE 4—The bias of determination of the concentration of total alkyl groups depends on knowing the concentrations of methyl and ethyl branches present, since these branches have anomalously high absorptivities per group at 1378 cm⁻¹ (7.25 μm).

4.2 Knowledge of total methyl groups in polyethylene, when combined with data on molecular weight and on reactive end groups such as vinyl, can lead to assignment of end-group structures and can shed light upon polymerization mechanisms.

⁴ The last approved version of this historical standard is referenced on www.astm.org.