



Standard Test Method for Copolymerized Ethyl Acrylate In Ethylene-Ethyl Acrylate Copolymers¹

This standard is issued under the fixed designation D 3594; 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 ethylene-ethyl acrylate copolymers containing from 1 to 25 % ethyl acrylate comonomer.

1.2 The values stated in SI units are to be regarded as the standard. (See Practice E 380.)

1.3 *This standard does not purport to address all of the safety problems, 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—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

B 883 Terminology Relating to Plastics²

D 1898 Practice for Sampling of Plastics³

E 131 Terminology Relating to Molecular Spectroscopy⁴

E 168 Practices for General Techniques of Infrared Quantitative Analysis⁴

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁵

E 275 Practice for Describing and Measuring Performance of Ultraviolet, Visible, and Near Infrared Spectrophotometers⁴

E 380 Practice for Use of the International System of Units (SI)⁵

3. Terminology

3.1 See Terminology D 883.

4. Summary of Test Method

4.1 The infrared absorption band at 11.60 μm responds to increases in comonomer content. There is no absorption at this wavelength when there is no comonomer present. It apparently is unique and characteristic of the copolymer. There is no

interference from the monomer at this wavelength.

4.2 The infrared absorption band at 11.60 μm is of medium intensity; consequently, fairly thick films are employed. This is an advantage in that errors in measurements of the thicknesses of films have minimal influence on the analytical result. Film thickness is selected so that not more than 80 % of the infrared energy is absorbed at the analytical wavelength. The approximate thicknesses found to be satisfactory for different concentrations of comonomer are as follows: (1) less than 5 weight % ethyl acrylate = 0.5 mm, (2) 5 to 15 weight % ethyl acrylate = 0.25 mm, and (3) 15 to 25 weight % ethyl acrylate = 0.18 mm. It is necessary first to press a film approximately 0.25 mm in thickness and scan it to observe the absorption intensity unless the approximate ethyl acrylate content is known.

4.3 For the highest precision, the test method requires that the thickness of the sample film be determined accurately.

4.4 The general procedure is to scan the absorption band from 10.50 to 12.50 μm, although a single-point measurement may also be used. This test method describes the use of a scan and employs the base-line method as outlined in 7.2 and the figure illustrating the Base-Line Method for Measuring Absorbance of Practices E 168. A calibration curve is prepared by plotting absorbance per millimetre values versus weight percent ethyl acrylate for several copolymers which have had ethyl acrylate contents established by a fast neutron activation analysis of oxygen content. The ethyl acrylate content of an unknown sample is then obtained by referring the absorbance per millimetre value to the calibration curve.

5. Significance and Use

5.1 Ethyl acrylate is copolymerized with ethylene to produce film, molding, and wire coating resins with improved physical properties. Ethyl acrylate comonomer increases flexibility, stress cracking resistance, toughness, and clarity. A rapid quantitative technique is needed for the evaluation of the amount of ethyl acrylate in a resin for specification purposes because physical properties change rapidly with increasing comonomer content.

5.2 Infrared spectrophotometric analysis, when suitably calibrated, can be used for the measurement of the concentration of comonomer present. Calibration is performed with samples that have been analyzed for oxygen content by fast neutron activation analysis. Oxygen content is converted to

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.70 on Analytical Methods (Section D20.70.08).

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² Annual Book of ASTM Standards, Vol 08.01.

³ Annual Book of ASTM Standards, Vol 08.02.

⁴ Annual Book of ASTM Standards, Vol 14.01.

⁵ Annual Book of ASTM Standards, Vol 14.02.