



## Standard Test Method for MOLECULAR WEIGHT AVERAGES AND MOLECULAR WEIGHT DISTRIBUTION OF POLYSTYRENE BY LIQUID EXCLUSION CHROMATOGRAPHY (GEL PERMEATION CHROMATOGRAPHY—GPC)<sup>1</sup>

This standard is issued under the fixed designation D 3536; 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 reappraisal.

NOTE—Additional information was added editorially to Section 13.4 and the Appendix in September 1980.

### 1. Scope

1.1 This method covers the determination of molecular weight (MW) averages and the distribution of molecular weights in linear soluble polystyrene by liquid exclusion chromatography (gel permeation chromatography—GPC). The method uses commercially available polystyrene (PS) standards and equipment for this purpose and is applicable for samples containing molecular weight components from 5000 to  $3 \times 10^6$  g·mol<sup>-1</sup>. This is discussed in more detail in 12.1. The method is not absolute and requires calibration.

1.2 The values stated in SI units are to be regarded as the standard.

### 2. Applicable Documents

#### 2.1 ASTM Standards:

D 3016 Practice for Use of Liquid Exclusion Chromatography Terms and Relationships<sup>2</sup>

E 380 Metric Practice<sup>3</sup>

#### 2.2 Other Documents:

AMD 40 Bibliography on Liquid Exclusion Chromatography<sup>4</sup>

### 3. Summary of Method

3.1 In this technique a solution of a polymer sample is injected into a chromatographic column (series) packed with a solid, porous substrate which separates the diverse molecules according to their size in solution. The size-separated molecules are detected and recorded according to their concentration. Through calibration, sizes are converted to molecular

weights, and various molecular weight parameters for the sample are calculated from the molecular weight/concentration data.

### 4. Significance and Use

4.1 *General Utility*—The molecular weight (MW) and molecular weight distribution (MWD) are fundamental characteristics of a polymer sample. They may be used for a wide variety of correlations for fundamental studies or product applications. For example, the observed molecular weight distribution may be compared to a predicted one from assumed kinetics or mechanisms of reaction, or both. Differences between the values will allow alteration of theory or experimental design. Similarly, strength, melt flow, and other properties may be dependent on molecular weight and molecular weight distribution.

4.2 *Limitations*—Because of the need for specific calibration of the polymer type under study, and because of the specific nature of polymer/solvent/column-packing interactions, this method is valid only for polystyrene. However, many of the principles of the method may be used to generate methods for other polymer systems.

<sup>1</sup> This method is under the jurisdiction of ASTM Committee D-20 on Plastics, and is the direct responsibility of Subcommittee D20.70 on Analytical Methods.

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<sup>2</sup> Annual Book of ASTM Standards, Part 35.

<sup>3</sup> Annual Book of ASTM Standards, Part 41.

<sup>4</sup> Available from ASTM, 1916 Race St., Philadelphia, Pa. 19103.