



Designation: D4875 – 18

Standard Test Methods of Polyurethane Raw Materials: Determination of the Polymerized Ethylene Oxide Content of Polyether Polyols¹

This standard is issued under the fixed designation D4875; 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 *Test Method A*—Proton Nuclear Magnetic Resonance Spectroscopy (¹H NMR) measures polymerized ethylene oxide (EO) content of ethylene oxide (EO) propylene oxide (PO) polyether polyols used in flexible polyurethane foams and non-foams. It is suitable for diols initiated from glycols of EO or PO containing EO percentages >5. For triols initiated with glycerol (glycerin) and trimethylolpropane, an uncorrected EO value is obtained since both initiators have protons that contribute to the EO measurement.

1.2 *Test Method B*—Carbon-13 Nuclear Magnetic Resonance Spectroscopy (¹³C NMR) measures the polymerized EO content of EO-PO polyether polyols used in flexible polyurethane foams and non-foams. It is suitable for diols and triols made from the commonly used initiators and containing EO percentages >5.

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ These test methods are under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.22 on Cellular Materials - Plastics and Elastomers.

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2. Referenced Documents

2.1 *ASTM Standards*:²

D883 Terminology Relating to Plastics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E2977 Practice for Measuring and Reporting Performance of Fourier-Transform Nuclear Magnetic Resonance (FT-NMR) Spectrometers for Liquid Samples

3. Terminology

3.1 *Definitions*—For definitions of terms that appear in this method refer to Terminology D883 and Practice E2977.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *heteric polyol, n*—a polyether polyol in which ethylene oxide and propylene oxide units are randomly arranged.

3.2.2 *initiator, n*—a substance with which ethylene oxide or propylene oxide reacts to form a polyether polyol.

3.2.2.1 *Discussion*—One initiator unit is incorporated into each polymer or oligomer molecule.

3.2.3 *EO capped polyol*—a polyol that contains a terminal block of ethylene oxide units

4. Summary of Test Methods

4.1 *Test Method A*—The ¹H NMR spectra of polyether polyols show two groups of resonance peaks. The first group corresponds to the methyl protons of propylene oxide (PO). The second group corresponds to the methylene and methine protons of PO and the methylene protons of EO. The EO peak area is obtained by subtracting the area of the PO methyl peaks from the area of the methylene and methine peaks. Initiators other than glycols of EO and PO give systematic errors (see Note 2).

NOTE 2—The initiator error can be estimated by calculating the

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.

*A Summary of Changes section appears at the end of this standard