



Designation: D7409 – 15 (Reapproved 2020)

Standard Test Method for Carboxyl End Group Content of Polyethylene Terephthalate (PET) Yarns¹

This standard is issued under the fixed designation D7409; 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 procedure is based significantly on the GRI GG7 test procedure, Carboxyl End Group Content of Polyethylene Terephthalate (PET) Yarns.

1.2 This test method is used to determine the concentration, in mmol/kg, of carboxyl end groups (CEG) found in poly(ethylene terephthalate) (PET) yarns by titration.

1.3 This test is applicable to geogrid yarns that are made from PET resin.

NOTE 1—This test is also applicable to high-strength geotextile yarns that are made from PET and are used in reinforcement applications.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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.*

1.6 *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.*

2. Referenced Documents

- 2.1 *ASTM Standards:*²
D123 [Terminology Relating to Textiles](#)

3. Terminology

3.1 Definitions:

¹ This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.02 on Endurance Properties.

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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.

3.1.1 *automatic titration, n*—a titration method in which a machine is used that automatically dispenses small volumes of the titrant and monitors the pH or the electrochemical potential of the solution.

3.1.2 *carboxyl end groups (CEG), n*—non-reacted carboxylic acid groups of terephthalic acid located at either end of a polymer chain.

3.1.3 *colorimetric titration, n*—a titration method that monitors the change in color of the solution as the titration proceeds. A chemical indicator sensitive to pH is added to create the color change.

3.1.4 *fibers, n*—a generic term for any one of the various types of material that form the basic structure of a geogrid (or geotextile), which are characterized by having a length at least 100 times its diameter.

3.1.5 *filaments, n*—a continuous fiber of extremely long length.

3.1.6 *potentiometric titration, n*—a titration method that monitors the change in electrochemical potential, expressed as mV, of the solution as the titration proceeds.

3.1.7 *titration, n*—titration is a standard laboratory method of quantitative chemical analysis which can be used to determine the concentration of a known reactant. Typically, the reaction is a neutralization reaction between an acid and a base.

3.1.8 *yarns, n*—a generic term for a continuous strand of fibers, filaments, or material in a form suitable for knitting, weaving, or otherwise intertwining to form a textile related geogrid (or geotextile).

4. Summary of Test Method

4.1 This method defines a specific procedure for the determination of carboxyl end groups (CEG) of PET by a titrimetric method.

4.2 PET yarns are dissolved in *o*-cresol at 80 °C. The solution is diluted with dichloro methane, and titrated against KOH dissolved in methanol, by either a potentiometric or colorimetric method. The amount of potassium hydroxide required to complete the titration with the PET solution is measured and used to calculate to the concentration of CEGs.