Designation: D7131 – 09

StandardTest Method for Determination of Ion Exchange Capacity (IEC) in Grafted Battery Separator[1]

This standard is issued under the fixed designation D7131; 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 evaluates an important characteristic of polyolefin or other fibrous nonwoven sheet material intended for use in alkaline battery separator applications. The hydrophilic properties of the material are enhanced by grafting a functional group onto the polyolefin, and this test method is the primary test method to determine the treatment level, that is, level of monomer grafted to the base polymer. This test method can also be used for film or membranes

1.2 This test method is intended primarily for testing copolymer-grafted polyolefin materials used as battery separators, but could be used for any grafted material. These separators have radiation-initiated grafting of acrylic acid monomer (for example) onto a polyolefin base-web material to generate hydrophilic sites on the material. This process is a method for surface modification of polymer materials, and is used to make separators hydrophilic. Grafting can be accomplished by irradiation on common polymers such as polyethylene, polypropylene and fluoropolymers with various forms of energy, such as UV, gamma rays, electron beams (EB) or X-rays..

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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 and health practices and to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D1711 Terminology Relating to Electrical Insulation

E438 Specification for Glasses in Laboratory Apparatus

E1272 Specification for Laboratory Glass Graduated Cylinders

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of textile terms, refer to Terminology D123.

3.1.2 For definitions of electrical terms, refer to Terminology D1711.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *grafted battery separator, n*—a sheet material whose fiber surface has been grafted to add a functional group to the base polymer of the fiber by some form of radiation, whereas these grafted sites are hydrophilic, thus increasing the sheet material's hydrophilic properties.

3.2.2 *ion-exchange capacity, n*—the number of ionic sites on the separator fiber surface that can participate in the exchange process. The exchange capacity is expressed in milliequivalents per gram.

4. Summary of Test Method

4.1 A predetermined amount of separator in its acid form is added to a bottle with a potassium hydroxide (KOH) solution. The specimens are conditioned under a controlled temperature for 2 h. After being allowed to cool, the amount of grafted monomer functionality of the grafted surface in the sample can be determined by titration.

4.2 Results are calculated as milliequivalents per gram (meq/g) using the appropriate equations.

4.3 Sampling must be determined based on experience with the separators uniformity and consistency of the grafting process.

5. Significance and Use

5.1 Nickel-metal hydride (Ni-MH) cells/batteries have a tendency to exhibit high rates of self-discharge that may be caused by contamination within a battery cell. The contamination source has been shown to originate from electrode impurities. Grafted separators can trap and hold these

[1] This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.19 on Dielectric Sheet and Roll Products.

Current edition approved Oct. 1, 2009. Published November 2009. Originally approved in 2005. Last previous edition approved in 2005 as D7131 – 05. DOI: 10.1520/D7131-09.

[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**