Designation: D4102 – 82 (Reapproved 2015)

Standard Test Method for Thermal Oxidative Resistance of Carbon Fibers[1]

This standard is issued under the fixed designation D4102; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the apparatus and procedure for the determination of the weight loss of carbon fibers, exposed to ambient hot air, as a means of characterizing their oxidative resistance.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units which are provided for information only and are not considered standard.

1.3 *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 determine the applicability of regulatory limitations prior to use.* For specific hazard information, see Section 8.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C613/C613M Test Method for Constituent Content of Composite Prepreg by Soxhlet Extraction

3. Definitions

3.1 *carbon fibers*—fibers containing at least 90 % carbon by weight made by pyrolysis from synthetic polymeric or pitch fibers and having moduli ≥70 GPa (≥10^7 psi).

3.2 *precursor*—organic fiber from which carbon fibers are prepared via pyrolysis. Polyacrylonitrile (PAN), rayon, and pitch are commonly used.

3.3 *fiber finish*—surface coating applied to fibers to facilitate handling or provide better wetting and compatibility of fiber and matrix, or both.

4. Summary of Test Method

4.1 The test method is composed of two parts. The first one specifies exposure conditions for an accelerated measurement, determining weight loss of the carbon fiber after 24 h in air at 375°C (707°F). The second part specifies conditions for an extended measurement, determining the weight loss resulting from 500-h exposure in air at 315°C (600°F).

5. Significance and Use

5.1 The test is used to determine the oxidative resistances of carbon fibers as a means of selecting the most stable fibers for incorporation in high-temperature fiber-reinforced composite systems. It can be used for quality control, material specification, and for research and development of improved carbon fibers. Factors that influence the oxidative resistance and should be reported are fiber identification, precursor type, fiber modulus, and any information on impurities, particularly metals. Also note that the presence of finish on the fiber can affect the oxidative resistance, and thus, alternative specimen preparations that enable the evaluation of finish effects are included.

6. Apparatus

6.1 *Balance,* capable of weighing to the nearest 0.1 mg.

6.2 *Vacuum Oven,* capable of providing vacuum of 10 torr (1.3 kPa) or less at 80°C (177°F).

6.3 *Circulating Air Oven,* with sufficient flow rate and capability to change the ambient air in the chamber once a minute, while maintaining the temperature within 10°C (18°F) over the 25°C (77°F) to 375°C (707°F) range.

6.4 *Glass Beakers,* borosilicate, 250-mL (8.45 oz) or other size, appropriate for the oven (one per sample).

6.5 *Wire Mesh Covers,* for the beakers to reduce excessive air turbulence during the exposure.[3]

6.6 *Boiling Flasks or Erlenmeyer Flasks,* borosilicate glass, 250- or 500-mL (8.45- or 16.91-oz) size, with standard-taper joint.

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[1] This test method is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.03 on Constituent/Precursor 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] 20-mesh nickel-chromium wire gauze from Fisher Scientific Co. has been found satisfactory for this purpose.