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StandardTest Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products[1]

This standard is issued under the fixed designation D3201; 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.

ε^1 NOTE—Note 2 was editorially added in October 2009.

1. Scope

1.1 This test method prescribes the procedure for determining the moisture content of fire-retardant-treated wood and wood-based product samples after exposure to a standard high relative humidity condition of 92 ± 2 % at 27 ± 2°C (81 ± 4°F).

1.2 The text of this test method references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this test method.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound values given in parentheses are for information only and are not considered 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 determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D9 Terminology Relating to Wood and Wood-Based Products

E176 Terminology of Fire Standards

3. Terminology

3.1 *Definitions*—Definitions used in this practice are in accordance with Terminologies D9 and E176.

4. Significance and Use

4.1 The hygroscopic properties of wood and wood-based products treated with fire-retardant chemicals are often greater than for untreated products. This is particularly true at the higher relative humidity conditions. This higher hygroscopicity sometimes is the cause for staining, decay, poor paint adhesion, and migration and exuding of chemicals and moisture at the high humidities. Corrosion of metal fasteners sometimes also occurs.

4.2 The results obtained with this standard are important in identifying treatments with low hygroscopic properties.

4.3 Results can be useful in determining exposure limitations in service for specific treated products.

4.4 Building codes and other specifications for fire-retardant-treated wood for interior use include requirements based on this test method.

5. Apparatus

5.1 *Conditioning* chamber with air circulation and capable of being maintained at 27 ± 2°C (81 ± 4°F) and a relative humidity of 92 ± 2 %.

5.2 *Oven,* air-circulated and vented, capable of maintaining a temperature of 103 ± 2°C (217 ± 4°F).

5.3 *Weighing Scale*—A scale or balance that will weigh a specimen within an accuracy of ±0.2 %.

6. Test Specimens

6.1 A minimum of five specimens shall be selected that represent the lot. Unless otherwise specified, specimens shall be full cross sections, no less than 25.4 mm (1 in.) along the grain, but longer as needed to provide a minimum volume of 33 000 mm^3 (2 in.^{3}).

6.2 The specimens shall be penetrated by the fire-retardant chemical to be representative for the treated product.

NOTE 1—The use of untreated specimens as control specimens is recommended to provide verification of the high-humidity conditions used.

[1] This test method is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.07 on Fire Performance of Wood.

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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.

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7. Procedure

7.1 All measurements of the specimen weight shall be to an accuracy of ±0.2 %.

7.2 The specimens shall be in moisture equilibrium with a laboratory ambient condition of 30 to 65 % relative humidity or shall be exposed for at least 7 days at such a condition prior to high-humidity exposure.

7.3 If the specimens will support fungal or mold growth during the high humidity exposure, then the specimens shall be sprayed with a suitable biocide just prior to the above exposure and allowed to air-dry for the seven days.

7.4 Weigh each specimen to obtain weight prior to high humidity exposure.

7.5 Expose all specimens under constant humidity conditions of 92 ± 2 % at 27 ± 2°C (81 ± 4°F) for 7 days. Specimens shall be suitably suspended so that all surfaces are exposed.

NOTE 2—In this test method, the samples are not exposed for sufficient duration to obtain equilibrium moisture content. This test method was developed for fire-retardant-treated wood. For the purpose of identifying treatments with low hygroscopic properties, the duration of seven days has been shown to be adequate for fire-retardant-treated wood. If the method is applied to other materials, the necessity for a longer duration of exposure needs to be investigated.

7.6 If the specimens exude moisture or chemicals or both under the exposure conditions, collect any drippings and include the weight with the specimen weight.

7.7 Weigh each specimen immediately, after its removal from the conditioning chamber to obtain the weight after high humidity exposure. Observe and record the general appearance of the specimens.

7.8 Dry each specimen in an oven at 103 ± 2°C (217 ± 4°F) until approximately constant weight is attained, and reweigh to obtain ovendry weight after high humidity exposure. Constant weight can be assumed when two consecutive readings taken 2 h apart agree within 0.2 %. Avoid drying for periods longer than necessary to achieve constant weight, since thermal decomposition of chemical or wood might occur reflecting a higher than actual moisture content.

8. Calculations

8.1 Calculate the moisture content of each specimen prior to high-humidity exposure (u_i) as follows:

$$u_i, \% = \frac{m_i - m_{od}}{m(od)} \times 100 \quad (1)$$

where:

m_i = weight of specimen prior to high-humidity exposure, and

m_{od} = ovendry weight of specimen after high-humidity exposure.

8.2 Calculate the moisture content of each specimen after high-humidity exposure (u_f) as follows:

$$u_f, \% = \frac{m_f - m_{od}}{m(od)} \times 100 \quad (2)$$

where:

m_f = weight of the specimen after high-humidity exposure, and

m_{od} = ovendry weight of specimen after high-humidity exposure.

NOTE 3—These methods of determining the moisture content do not correct for any volatilization of chemical during the ovendrying, which increases the calculated percent moisture content. Also, the calculation for percent moisture content is relative to the total specimen weight of wood and chemical. The percent moisture content relative to the wood weight alone is higher and this value can be estimated by reducing the m_{od} value in the divisor of the above equation by the known or assumed percentage of chemical in the treated specimen.

9. Report

9.1 Report the following information:

9.1.1 Complete identification of the fire-retardant product as to species of wood, wood product, and treatment.

9.1.2 Description of sampling procedure and number and dimensions of test specimens.

9.1.3 General description of humidity chamber and controls used for the test.

9.1.4 When data are available for untreated specimens exposed simultaneously with the treated specimens to the high-humidity condition, the report shall include the average moisture content of the untreated specimens at the end of the exposure.

9.1.5 The average of the moisture contents for the treated specimens before high-humidity exposure, as calculated by Eq 1, shall be reported.

9.1.6 The average of the moisture contents for the treated specimens after high-humidity exposure, as calculated by Eq 2, shall be reported.

9.1.7 Report any change in the appearance of the specimen during exposure, including surface wetness, chemical exudation, or crystals on surface.

10. Precision and Bias

10.1 There is insufficient data available to write a precision and bias statement.

11. Keywords

11.1 fire-retardant treated wood; hygroscopicity; moisture content

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