~~Designation:D4920–98 (Reapproved 2003)~~ Designation: D4920 – 08

Standard Terminology Relating to ~~Moisture in Textiles~~Conditioning, Chemical, and Thermal Properties[1]

This standard is issued under the fixed designation D4920; 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 ~~terminology~~standard is ~~a~~the compilation of definition~~s~~ of technical terms related to ~~moisture~~conditioning, chemical, and thermal properties in textiles. Terms that are generally understood or adequately defined in other readily available sources are not included.

1.2 For other ASTM defined conditioning terms, refer to Terminology E 41. For other terms associated with textiles, refer to Terminology D 123, Relating to Textiles.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 123 Terminology Relating to Textiles
E 41~~Terminology Relating to Conditioning~~ Terminology Relating To Conditioning
D 578 Specification for Glass Fiber Strands
D 579 Specification for Greige Woven Glass Fabrics
D 580 Specification for Greige Woven Glass Tapes and Webbings
D 581 Specification for Glass Fiber Greige Braided Tubular Sleeving
D 885 Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers
D 1776 Practice for Conditioning and Testing Textiles
D 1907 Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
D 2118 Practice for Assigning a Standard Commercial Moisture Content for Wool and its' Products
D 2494 Test Method for Commercial Mass of a Shipment of Yarn or Manufactured Staple Fiber or Tow
D 2970/D 2970M Test Methods for Testing Tire Cords, Tire Cord Fabrics, and Industrial Yarns Made From Glass Filaments
D 3887 Specification for Tolerances for Knitted Fabrics
D 4772 Test Method for Surface Water Absorption of Terry Fabrics (Water Flow)

3. Terminology

3.1 *Definitions:*

absolute humidity, *n*—the mass of water vapor present in a unit volume of air.

DISCUSSION—Common units of measure for absolute humidity are grams per cubic metre or grains per cubic foot. The amount of water vapor is also reported in terms of mass per unit mass of dry air, for example, grams per kilogram, or grains per pound, of dry air. This value differs from values calculated on a volume basis and should not be referred to as **absolute humidity**. It is designated as humidity ratio, specific humidity, or **moisture pick-up**.

absorption, *n*—a process in which one material (the absorbent) takes in or absorbs another (the absorbate); as the absorption of moisture by fibers. (See also **adsorption**, and **moisture equilibrium for testing**. Compare **desorption** and **resorption**.) **D 4772**

~~[1] This terminology is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.51 on Chemical Conditioning and Performance.~~

~~Current edition approved Oct. 10, 1996. Published February 1997. Originally published as D4920–89. Last previous edition D4920–96b.~~

[1] This terminology is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.51 on Conditioning and, Chemical and Thermal Properties.

Current edition approvedJuly 1, 2008. Published August 2008 . Originally approved in 1989. Last previous edition approved in 2003 as D 4920 – 98 (2003).

~~[2] Annual Book of ASTM Standards, Vol 07.01.~~

[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.

adsorption, *n*—a process in which the surface of a solid takes on or adsorbs in an extremely thin layer molecules of gases, of dissolved substances, or of liquids with which it is in contact. (See also **absorption** and **moisture equilibrium for testing**. Compare **desorption** and **resorption**.)

atmosphere for testing, *n*—air at ambient conditions of relative humidity and temperature in which tests or experiments are conducted. (See also **standard atmosphere for testing** .)

DISCUSSION—In the hierarchy of terms, *atmosphere* is the generic term where the air is ambient with conditions "controlled" by local weather and therefore variable. **Atmosphere for testing** is a delimited term in which the use of the atmosphere is restricted for a certain purpose. In a **standard atmosphere for testing** , the conditions are specified (standardized) and controlled for routine testing and for testing reproducibility. On this basis, there is no real reason for not referring to the specified atmospheres that have been traditionally used for testing glass textiles or tire cords, etc., as **standard atmospheres for testing** those materials.

bicomponent fiber, *n*—a fiber consisting of two polymers which are chemically different, physically different, or both.

birefringence (double refraction), *n*— a property of anisotropic materials which manifests itself as a splitting of a light ray into components having different vibration directions which are transmitted at different velocities.

DISCUSSION—The vibration directions of the components are the principal axes of the material and the corresponding indices of refraction are its principal (maximum of minimum) refractive indices. Numerically, birefringence is the difference between the maximum and minimum refractive indices.

bulk density, *n*—apparent mass per unit volume.

DISCUSSION—In testing the termal transmittance of fabrics, bulk density is calculated from the fabric weight per unit area and the thickness value used to calculate thermal conductivity.

clo, *n*—unit of thermal resistance defined as the insulation required to keep a resting man (producing heat at the rate of 58 W/m^2) confortable in an environment at 21°C, air movement 0.1 m/s, or roughly the insulation value of typical indoor clothing. (Syn. intrinsic clo).

DISCUSSION—Numerically the clo is equal to 0.155 $K \cdot m^2/W$.

commercial allowance (CA), *n*—an arbitrary value, equal to the commercial moisture regain, plus a specified allowance for finish, used with the mass of scoured, oven-dried yarn, to compute (1) yarn linear density, (2) the commercial or legal mass of a shipment or delivery of any specific textile material (see also *commercial moisture regain*), or (3) the mass of a specific component in the analysis of fiber blends. ~~D1907, D2494, D3887~~ **D 1907, D 2494, D 3887**

commercial mass, *n*—billed mass as determined by a generally accepted method or as agreed upon between the purchaser and seller. **D 2494**

commercial moisture content, *n—in wool*, the moisture calculated as a percentage of the mass of the wool, top, noils, yarn, fabric, etc., in the "as-is" condition; that is, containing whatever moisture, oil, grease, or other extraneous matter that may be present. **D 2118**

commercial moisture regain (CMR), *n*— a formally adopted, arbitrary value, to be used with the oven-dried mass of textile fibers, when calculating the commercial mass of a shipment or delivery.

DISCUSSION—The assigned commercial moisture regain value is usually higher than the experimental moisture regain value for the same material.

condition, *v*—to bring a material to moisture equilibrium with a specified atmosphere.

density, *n*—mass per unit volume.

DISCUSSION—Due to the volume of included air, the apparent density of fibers and yarns will differ from the densities of the materials of which the fibers and yarns are composed. Test results for fiber density will also vary depending on the test method used. Density is commonly expressed as grams per cubic centimetre (g/cm^3), but the preferred term in the International System of Units is kilograms per cubic metre (kg/m^3). Multiply g/cm^3 by 1000 to obtain kg/m^3 and mulitply lb/ft^3 by 16.018 to obtain kg/m^3.

desorption, *n*—a process in which a sorbed material is released from another material, as the desorption of moisture from fibers; the reverse of absorption, adsorption, or both.

dew point, *n*—the temperature below which condensation of water vapor begins to take place when the atmosphere is cooled.

DISCUSSION—As air is cooled, the amount of water vapor which it can hold decreases. If air is cooled sufficiently, the saturation water-vapor pressure becomes equal to the actual water-vapor pressure and any further cooling beyond this point will normally result in the condensation of moisture.

effective insulation ratio, *n*—indicates the increase in insulation afforded by the fabric in comparison to the uncovered test plate under specified conditions of test.

extractable matter, *n*—nonfibrous material in or on a textile not including water, which is removable by a specified solvent or solvents as directed in a specified procedure.

DISCUSSION—Nonfibrous material is usually oily, waxy, resinous, or polymeric in nature, but may also include other material, such as protein, particularly if ethyl alcohol is used, or in, the extracting solvent.

fiber birefringence, *n*—the algebraic difference of the index of refraction of the fiber for plane polarized light vibrating parallel

to the longitudinal axis of the fiber and the index of refraction for light vibrating perpendicular to the long axis.

DISCUSSION—Fiber birefringence may be either positive or negative, and is not necessarily referred to the principal optical axes of the material.

fiber density, *n*—mass per unit volume of the solid matter of which a fiber is composed, measured under specified conditions.

DISCUSSION—Unless otherwise indicated, fiber density is understood to be measured by immersion (buoyancy) techniques, at 21 ± 1°C, excluding effects due to included air and swelling or dissolving of the fiber by the immersion fluid.

heat transfer coefficient, *n*—see thermal transmittance.

humidity, *n*—the condition of the atmosphere in respect to water vapor. (Compare **absolute humidity** and **relative humidity**.)

hygrometer, *n*—any instrument for measuring the humidity of the atmosphere.

intrinsic clo, *n*—see clo.

mean temperature, *n*—the average of the hot plate temperature and the temperature of the calm, cool air that prevailed during the test.

moisture, *n—as used with textiles*, water absorbed, adsorbed, or resorbed by a material. (See also **water**.)

moisture as-is, *n*—deprecated term. See **moisture content**.

moisture as-received, *n*—deprecated term. See **moisture content**.

moisture content, *n*—that part of the total mass of a material that is absorbed or adsorbed water, compared to the total mass. (Compare **moisture pick-up** and **moisture regain**.)

DISCUSSION—Moisture is usually expressed as a percentage and is calculated using the equation:

$$C = 100\,(A - D)/A$$

where:
C = moisture content, %,
A = mass of material before drying, and
D = mass of the dried material.

There is a relationship between **moisture content** and **moisture pick-up** since both may be calculated from the same data. The difference is in the bases used for calculating the percentages, original versus dried material mass. The relationship between moisture content and moisture pick-up is shown by the equations:

$$C = 100\,P/(100 + P)$$

$$P = 100\,C/(100 - C)$$

where:
C = moisture content, %, and
P = moisture pick-up, %.

moisture content, *n— at moisture-equilibrium*, the moisture content of a material in equilibrium with air of known, or specified, temperature and relative humidity.

DISCUSSION—A frequently prescribed condition for determining **moisture content** at moisture-equilibrium is use of a standard atmosphere, for example, 21 ± 1°C (70 ± 2°F) and 65 ± 2 % relative humidity, for textiles, both in establishing the equilibrium and as air supply for the drying oven.

moisture content (dry-basis), *n*—deprecated term. See **moisture pick-up**.

moisture (dry-basis), *n*—deprecated term. See **moisture pick-up**.

moisture equilibrium, *n*—the condition reached by a material when it no longer takes up moisture from, or gives up moisture to, the surrounding atmosphere. (Compare **moisture-free** .)

DISCUSSION—The establishment of equilibrium between a material and the surrounding atmosphere is dependent upon the exposure time, the difference in moisture levels between the material and the atmosphere, and motion of the air about the material. The level at which the moisture in the textile reaches equilibrium depends upon the side from which equilibrium is approached. Because of this difference, equilibrium for textiles should be approached from the dry (but not moisture-free) side which is faster. Equilibrium with air in motion is considered to be achieved when successive weighings at specified time intervals do not show a change in mass greater than the tolerance established for the material. If there is no established tolerance, consider 0.1 % of the mass after a 2-h exposure as satisfactory.

moisture equilibrium, *n— for preconditioning*, the moisture condition reached by a material during free exposure to moving air in the standard atmosphere for preconditioning. **D 1776**

moisture equilibrium, *n— for testing*, the condition reached by a material during free exposure to moving air in a specified atmosphere for testing. **D 885, D 885M, D 1776**

moisture-free, *adj— in textiles*, a descriptive term for a material that (1) has been exposed to a flow of desiccated air at a specified temperature until there is no further significant change in mass, or (2) has been treated by a distillation process using a suitable solvent. (Syn. **zero-moisture**.) (Compare **moisture equilibrium**.)

DISCUSSION—Moisture determinations frequently involve the change in mass of an oven-dried specimen. If the air in the oven contains moisture, the oven-dried specimen will also contain some moisture even though it no longer shows a significant change in mass. This is due to the establishment