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Textiles — Measurement of exothermic and endothermic properties of textiles under humidity change

Textiles — Mesurage des propriétés exothermiques et endothermiques de textiles sous conditions d'humidité changeantes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 16533 was prepared by Technical Committee ISO/TC 38, *Textiles*.

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Introduction

The thermal properties of textile materials contribute to wearer's physiological comfort, product's durability, etc. Hence, there are many kinds of products with specific thermal performances and various test methods for them have been developed and standardized. But these tests should be conducted in certain humidity. The method for thermal properties in elevated or reduced humidity has not been standardized.

All materials generate heat when absorbing moisture and absorb heat when releasing moisture. The heat of absorption varies according to material, for example, the heat of absorption in wool fibre is much bigger than that in common synthetic fibre. With this property, recently, some heat generating textiles have been developed and applied to various products such as outdoor wear, sport wear, inner wear, special working wear and health-care wear. Therefore the test for hygroscopic and exothermic property of textiles is needed for both producers and customers. Despite these needs, the accurate and reliable information about hygroscopic and exothermic property of textiles cannot be offered by absence of standard test method.

The exothermic and endothermic properties of textiles under the condition that environmental humidity is changed can be measured with this proposed test method and apparatus.

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Textiles — Measurement of exothermic and endothermic properties of textiles under humidity change

1 Scope

This standard method specifies method for the measurement of exothermic and endothermic properties by moisture absorption and desorption in sheet-like textiles, e.g. fabrics, knit or nonwovens for clothing, bedding, upholstery and similar textile products.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*.

ISO 3801:1977, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area*.

3 Terms and Definitions

For the purposes of this standard, the following definitions apply.

3.1

exothermic property

property of material whereby it releases heat to the surroundings

3.2

endothermic property

property of material whereby it absorbs heat from the surroundings

3.3

hygroscopic and exothermic property

property of material whereby it generates heat by absorbing moisture and releases the generated heat to its surroundings where relative humidity changes from low to high over time.

3.4

hygroemissive and endothermic property

property of material whereby it loses heat and cools down by releasing moisture through evaporation to its surroundings where relative humidity changes from high to low over time.

4 Symbols and units

T_A is ambient temperature in [temperature and humidity controlled chamber](#), in [degrees Celsius](#).

- RH_A is ambient relative humidity in temperature and humidity controlled chamber, in percent.
- RH_1 is relative humidity in first constant humidity container, starting humidity, in percent.
- RH_2 is relative humidity in second constant humidity container, target humidity, in percent.
- T_{peak} is peak temperature determined using temperature sensor with or without test specimen mounted on sensor probe in second constant humidity container during hygroscopic and exothermic property test, in degrees Celsius.
- T_{bottom} is bottom temperature determined using temperature sensor with or without test specimen mounted on sensor probe in second constant humidity container during hygroemissive and endothermic property test, in degrees Celsius.
- ΔT_{exo} is the difference in the peak temperature determined between with and without test specimen mounted on sensor probe during hygroscopic and exothermic property test, in degrees Celsius.
- ΔT_{endo} is the difference in the bottom temperature determined between with and without test specimen mounted on sensor probe during hygroemissive and endothermic property test, in degrees Celsius.

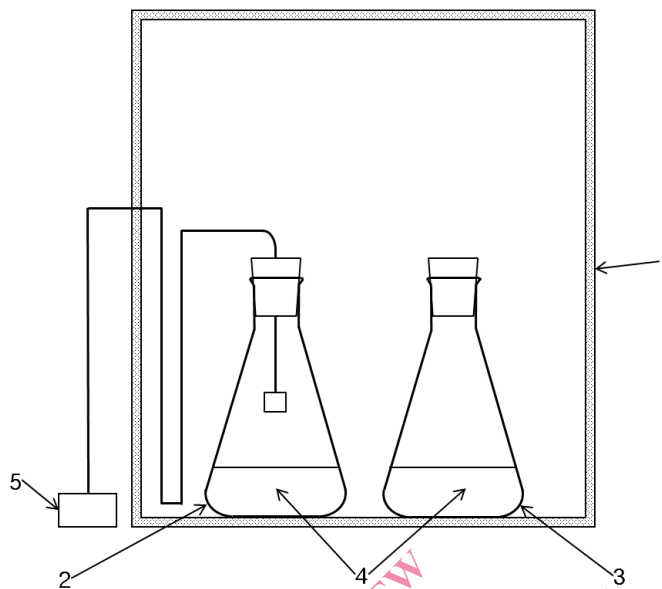
5 Principle

A test specimen is placed in a low humidity atmosphere and then exposed to a high humidity atmosphere, or then other way round. The temperature of test specimen is measured over time with a temperature sensor. The exothermic and endothermic properties of the test specimen are determined from the difference in temperature measured with the temperature sensor between with and without test specimen mounted on the sensor probe.

6 Apparatus

6.1 Testing apparatus,

as shown in Figure 1 and 2, this apparatus is composed of a temperature and humidity controlled chamber 1, and small containers in which the humidity is controlled by chemicals and the test specimens are set through the rubber plugs.



- 1 temperature and humidity controlled chamber
- 2 constant humidity container (first)
- 3 constant humidity container (second)
- 4 humidity control material
- 5 data collecting unit

Figure 1 — Configuration of the testing apparatus



- 6 outer door
- 7 inner door
- 8 arm hole

Figure 2 — A photo of the testing apparatus