INTERNATIONAL STANDARD

ISO 21232

First edition
2018-09

Textiles — Determination of moisturizing effect of textile materials by measurement of microclimate between textiles and simulated human skin using sweating guarded hotplate

Textiles — Détermination de l'effet hydratant des matières textiles par le mesurage du microclimat entre les textiles et la peau humaine simulée à l'aide d'une plaque chaude gardée transpirante

Reference number
ISO 21232:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Recently, new textile products have been developed to provide moisturizing effects on human skin. This is done through moisture management, or through containment of moisturizing ingredients (such as aloe vera, arginine amino acid, green tea extract). However, most of the accepted test methods to evaluate these new products use a hydrometer or Corneometer®[1)] to measure the water loss or water content on human skin through electrical conductivity. Therefore, a new test method was sought to specify a procedure for substantiating the moisturizing effect by measuring the microclimate between textiles and simulated human skin using the sweating guarded-hotplate specified in ISO 11092.

The sweating guarded-hotplate method in ISO 11092 simulates the heat and moisture transfer processes which occur next to human skin; however, the thermal and water vapour resistance are measured without taking into account the air layer (microclimate) which affects clothing comfort significantly. Hence, this test method has been developed to measure the relative humidity and water vapour resistance including the air layer between cloth and human skin using the sweating guarded-hotplate along with a specially designed device.

1) A Corneometer® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Textiles — Determination of moisturizing effect of textile materials by measurement of microclimate between textiles and simulated human skin using sweating guarded hotplate

1 Scope

This document specifies a test method which simulates the microclimate for determining the moisturizing effect of textile materials by measuring water-vapour resistance including air layer and relative humidity using a sweating guarded-hotplate. This test method can be applied to fabrics, films, coatings and leather including multilayer assemblies, for use in clothing system.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 11092:2014, *Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.elecropedia.org/

3.1
water-vapour resistance
R_{et}
water-vapour pressure difference between the two faces of a material divided by the resultant evaporative heat flux per unit area in the direction of the gradient

Note 1 to entry: It is a quantity specific to textile materials or composites which determine the "latent" evaporative heat flux across a given area in response to a steady applied water-vapour pressure gradient. The evaporative heat flux may consist of both diffusive and convective components.

Note 2 to entry: Water-vapour resistance is expressed in square metres pascal per watt.

[SOURCE: ISO 11092:2014, 2.2]

3.2
microclimate
climate of the small air layer (between the skin and the clothing or between textiles and sweating guarded hotplate)

Note 1 to entry: This microclimate has specific temperature and humidity characteristics.

3.3
water-vapour resistance including air layer
R_{et_al}
water-vapour pressure difference between the two faces of a material (separated from each other by 5 mm) divided by the resultant evaporative heat flux per unit area in the direction of the gradient

Note 1 to entry: Water-vapour resistance is measured under the simulated state in which the air layer exists between the skin and clothing.

Note 2 to entry: Water-vapour resistance including air layer is expressed in square metres pascal per watt.

3.4
hydration value
difference between the dielectric constant of water and other substances by measuring the capacitance of a dielectric medium

Note 1 to entry: A hydrometer or Corneometer® measures the change in the dielectric constant due to skin surface hydration changing the capacitance of a precision capacitor.

Note 2 to entry: Dielectric constant of water is 81.

Note 3 to entry: Hydration value is expressed in arbitrary unit (0~130).

4 Principle

Usually, clothing comfort depends on the environmental conditions (humidity, temperature) of the microclimate between the skin and the fabric when clothing is worn. The test method in this document simulates the moisturizing mechanism of textiles when they act as barriers to prevent the evaporation of moisture, as well as the capability of the textiles to keep the moisture balance between clothing and human skin.

In order to simulate the microclimate, a device was designed to keep the sample and hotplate separate from each other. This device includes a sensor to measure the relative humidity. A hotplate is covered by a non-porous hydrophilic breathable membrane which is water-vapour permeable but liquid-water impermeable in order to simulate the hydration of human skin. The moisturizing effect of textiles is determined by measuring the water-vapour resistance to the air layer (R_{et_al}) and the relative humidity between the hot plate and the sample.

5 Apparatus

5.1 Sweating-guarded hotplate. For the test device, the sweating guarded-hotplate (see Figure 1), specified in ISO 11092, is used with a device including temperature and humidity sensor (5.3).

The upper part is a measuring unit with temperature and water supply control and the lower part is a thermal guard with temperature control.

5.2 Sweating-guarded hotplate with a device including temperature and humidity sensor. The device including temperature and humidity sensor is positioned between the sweating guarded-hotplate and specimen (see Figure 2).

The sensor shall provide reliable data for the measurement of relative humidity (0 % < RH < 100 %) with measurement of uncertainty of ±2 % and for the temperature with the measurement range of 0 °C < T < 50 °C with the measurement of uncertainty of ±1 °C.

5.3 Device including temperature and humidity sensor, used to space for the air layer and the sensor inside of the device measures temperature and relative humidity between hotplate and specimen that mounted on thermal guard.

The device consists of an upper frame and a lower frame, both made of aluminium. Each frame is approximately (5,0 ± 0,2) mm thick with a minimum empty area of 0,033 m^2. The width of the frame shall be at least 20 mm (see Figure 3). The sensor shall not be in contact with either the textiles or the hot plate. The specimen shall be fixed by magnets between the lower and the upper frames. The lower frame includes a grid which should not block the flow of water vapour.

5.4 Non-porous hydrophilic breathable membranes. A water-vapour permeable but liquid-water impermeable non-porous breathable membrane with a thickness of approximately 10 µm to 30 µm and with a hydration value of 45 ± 5.

The measurement of hydration value shall be carried out as specified in Annex A.

5.5 Test enclosure of the sweating-guarded hotplate, meeting the requirements specified in ISO 11092:2014, 5.3.