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Paper, board, pulps and cellulosic nanomaterials — Determination of dry matter content — Oven-drying method —

Part 1:
Materials in solid form

ICS: 85.060; 85.040

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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

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Foreword

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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).

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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 6, *Paper, board and pulps*.

This third edition cancels and replaces the second edition (ISO 638:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Introduction of cellulosic nanomaterials and paper and board for recycling in the scope

— Split of the standard in two parts

— Technical revision of the procedure

— Editorial revision of the document

— Update of clause of precision

Introduction

Determination of dry matter content and moisture content are carried out for different purposes.

This part of International Standard ISO 638 (ISO 638-1) should be used when the dry matter content is needed to calculate the results for chemical analysis or physical testing, or to determine the moisture content of paper and board for recycling. An example of this is where the results of a chemical analysis for cadmium or manganese are required on the basis of the oven-dry mass of the sample.

Part 2 of International Standard ISO 638 (ISO 638-2) [1] is dedicated to the determination of the dry matter content or moisture content of cellulosic nanomaterials in the form of suspensions.

ISO 287 [2] should be used for the purpose of determining the average moisture content and the variation in moisture content (maximum and minimum values) of a lot. In the converting of paper and board, moisture content is important as it can have an effect on processes such as printing and copying. Moisture content can have an effect on curl and dimensional stability.

ISO 4119 [3] should be used in laboratory procedures or is referred to in other International Standards in which the concentration of an aqueous pulp suspension requires determination.

Paper, board, pulps and cellulosic nanomaterials — Determination of dry matter content — Oven-drying method —

Part 1: Materials in solid form

1 Scope

This document specifies an oven-drying method for the determination of the dry matter content in paper, board and pulp and cellulosic nanomaterials in solid form, which all may be produced from virgin and /or recycled materials.

It is also applicable to the determination of the dry matter content of paper and board for recycling.

The procedure is applicable to paper, board, and pulp and cellulosic nanomaterials which do not contain any appreciable quantities of materials other than water that are volatile at the temperature of 105 °C ± 2 °C. It is used, for example, in the case of pulp, paper, and board and cellulosic nanomaterial samples taken for chemical and physical tests in the laboratory, when a concurrent determination of dry matter content is required.

This method is not applicable to the determination of the dry matter content of slush pulp or to the determination of the saleable mass of pulp lots.

Note 1 ISO 638-2 [1] specifies an oven-drying method for the determination of the dry matter content in suspensions of cellulosic nanomaterials, ISO 287 [2] specifies the determination of the moisture content of a lot of paper and board; ISO 4119 [3] specifies the determination of stock concentration of pulps; ISO 801 (all parts) [4] specifies the determination of the saleable mass in lots.

Note 2 This document determines the total dry matter content of the sample, including any dissolved solids. If only the cellulosic material content free of dissolved solids is desired, dissolved solids should be removed prior to measuring the dry matter content e.g. by washing or dialysis, taking care to retain all cellulosic material; in cases where the sample is filterable without loss of cellulosic solids, ISO 4119 [3] can be used to determine the stock consistency (content of cellulosic material in solid form).

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 186, *Paper and board — Sampling to determine average quality*

ISO 287:2009, *Paper and board — Determination of moisture content of a lot — Oven-drying method*

ISO 7213, *Pulps — Sampling for testing*

EN 17085, *Paper and board – Sampling procedures for paper and board for recycling*

ISO/TS 20477:2017, *Nanotechnologies — Standard terms and their definition for cellulose nanomaterial*

ISO/TS 80004-1:2015, *Nanotechnologies — Vocabulary — Part 1: Core terms*

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.electropedia.org/

3.1
cellulosic nanomaterial
CNM
material composed predominantly of cellulose, with any external dimension in the *nanoscale (*3.5*),* or a material having internal structure or surface structure in the nanoscale, with the internal structure or surface structure composed predominantly of cellulose

Note 1 to entry: The term nanocellulose is an alternative to cellulosic nanomaterial.

Note 2 to entry: Some cellulosic nanomaterials can be composed of chemically modified cellulose.

[SOURCE: ISO/TS 20477:2017, 3.3.1, modified]

3.2
constant mass
mass of the test piece determined at the equilibrium condition after drying until the difference between two successive dryings and weighings, separated in time by at least half the initial drying period, does not exceed 0,1 % mass fraction of the test piece before drying

3.3
dry matter content
ratio of the mass of a test piece, after drying to constant mass at a temperature of 105 °C ± 2 °C under specified conditions, to its mass before drying

Note 1 to entry: to entry: The dry matter content is usually expressed as a percentage mass fraction.

3.4
moisture content
content of water in paper or board, i.e. the ratio of the loss of mass of a test piece, when dried at a temperature of 105 °C ± 2 °C under specified conditions, to its mass at the time of sampling

Note 1 to entry: to entry: The moisture content is normally expressed as a percentage mass fraction.

[SOURCE: ISO 287:2009, 3.1, modified]

3.5
nanoscale
length range approximately from 1 nm to 100 nm

Note 1 to entry: Properties that are not extrapolations from larger sizes are predominately exhibited in this length range.

[SOURCE: ISO/TS 80004 1:2015, 2.1]

3.6
solid form
form in which water is held immobile within the cell wall, and/or lumen and/or interstices between the cellulosic materials, and/or is adsorbed at the cellulosic material surface, and which behaves as a discrete or separate unit that does not of itself flow (or as a set of such units)

4 Principle

Test pieces taken from pulp, paper, or board or cellulosic nanomaterial samples in solid form are weighed before and after drying to constant mass.

From the mass of the test piece before and after drying, the dry matter content is calculated.

5 Apparatus

5.1 Balance, accurate to 1 mg or better, for weighing test pieces of 2 g and less; for larger test pieces, accurate to 0,05 % mass fraction of the original moisture-containing test piece.

5.2 Containers, water vapour-proof, with tightly fitting lids, and made from a material (e.g. glass or plastic) not affected by the conditions of test, previously dried to constant mass and weighed.

5.3 Drying oven, capable of maintaining the air temperature at 105 °C ± 2 °C, and suitably ventilated.

5.4 Desiccator.

6 Sampling

If the analysis is being done to evaluate a lot, obtain a representative sample of paper, board, or pulp as described in ISO 186 for paper and board or ISO 7213 for pulps delivered in bales or rolls. For paper and board for recycling, sampling shall be in accordance with EN 17085.

If the tests are made on another type of sample, make sure the test pieces taken are representative of the sample received

In all cases take special precautions to avoid any change in moisture or water content of the material that will be tested.

7 Preparation of test pieces

7.1 General

Protect the test pieces from evaporation. Do not use bare hands to handle the test pieces. Handle the test pieces and weighing containers with clean and dry plastic or rubber gloves or adapted tools (for example tweezers). For determination of the dry matter content of pulp, paper, board or cellulosic nanomaterial samples as received, place each test piece as soon as obtained in a water-vapour proof container and close it immediately as cellulosic materials and especially cellulosic nanomaterials are highly hygroscopic.

Prepare at least duplicate test pieces for each sample.

7.2 Paper and board for recycling

For paper and board for recycling, the test piece mass can be varied from 200 g (for homogeneous mix of paper and board for recycling) up to 500 g (for less homogeneous mix of paper and board for recycling), for manually sampled paper for recycling, depending on the composition of the grade of paper and board for recycling.

7.3 Paper, board, pulp and cellulosic nanomaterial in solid form

From the paper, board, pulp or “film-form” cellulosic nanomaterial (e.g. “nanopaper”, handsheets, or free-standing films) sample, select test pieces of the required mass which are representative of the