SLOVENSKI STANDARD
oSIST prEN ISO 19403-5:2019

01-julij-2019

Barve in laki - Omočljivost - 5. del: Določevanje polarnega in disperznega dela površinske napetosti tekočin prek merjenja stičnih kotov na trdnih telesih s samo disperznim delom površinske energije (ISO 19403-5:2017)

Paints and varnishes - Wettability - Part 5: Determination of the polar and dispersive fractions of the surface tension of liquids from contact angles measurements on a solid with only a disperse contribution to its surface energy (ISO 19403-5:2017)

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Beschichtungsstoffe - Benetzbarkeit - Teil 5: Bestimmung des polaren und dispersen Anteils der Oberflächenspannung von Flüssigkeiten aus Kontaktwinkelmessungen auf einem Festkä¶rper mit rein dispersem Anteil der Oberflächenenergie

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Peintures et vernis - Mouillabilité - Partie 5: Détermination des fractions polaires er disperses de la tension superficielle des liquides à partir de l'angle de contact avec un solide n'ayant qu'une contribution de dispersion à son énergie de surface (ISO 19403-5:2017)

Ta slovenski standard je istoveten z: **prEN ISO 19403-5**

ICS:

87.040	Barve in laki	Paints and varnishes

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2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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INTERNATIONAL STANDARD

ISO 19403-5

First edition
2017-06

Paints and varnishes — Wettability —

Part 5: Determination of the polar and dispersive fractions of the surface tension of liquids from contact angles measurements on a solid with only a disperse contribution to its surface energy

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Partie 5: Détermination des fractions polaires er disperses de la tension superficielle des liquides à partir de l'angle de contact avec un solide n'ayant qu'une contribution de dispersion à son énergie de surface

Reference number
ISO 19403-5:2017(E)

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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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This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

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Paints and varnishes — Wettability —

Part 5: Determination of the polar and dispersive fractions of the surface tension of liquids from contact angles measurements on a solid with only a disperse contribution to its surface energy

1 Scope

This document specifies a test method to determine the polar and dispersive fractions of the surface tension of liquids by optical methods. The method can be applied for the characterization of liquid coating materials.

The applicability can be restricted for liquids with non-Newtonian rheology[1)].

This document assumes that the information of surface tension of the liquid to be tested and the surface free energy of the dispersive reference solids is known.

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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.

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ISO 1409, *Plastics/rubber — Polymer dispersions and rubber latices (natural and synthetic) — Determination of surface tension by the ring method*

ISO 4618, *Paints and varnishes — Terms and definitions*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

ISO 19403-1, *Paints and varnishes — Wettability — Part 1: Terminology and general principles*

ISO 19403-2:2017, *Paints and varnishes — Wettability — Part 2: Determination of the surface free energy of solid surfaces by measuring the contact angle*

ISO 19403-3, *Paints and varnishes — Wettability — Part 3: Determination of the surface tension of liquids using the pendant drop method*

EN 14370, *Surface active agents — Determination of surface tension*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 and ISO 19403-1 apply.

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

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

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

1) This term is defined in DIN 1342-1.

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4 Principle

Step 1: The surface tension of the liquid to be tested is determined in accordance with ISO 19403-3, EN 14370 or ISO 1409.

Step 2: The surface free energy of a reference solid without polar fraction of the surface free energy is determined in accordance with ISO 19403-2.

Step 3: Measurement of the contact angle between the reference solid and the liquid to be tested is carried out in accordance with ISO 19403-2.

Step 4: The dispersive fraction of the surface tension of the liquid is calculated in accordance with Owens, Wendt, Rabel and Kaelble (OWRK) or in accordance with Wu.

Step 5: The polar fraction of the surface tension of the liquid is calculated from the dispersive fraction of the surface tension and the surface tension measured in step 1.

5 Reference solid

Sufficiently, chemically and topologically homogenous dispersive solid, e.g. made of paraffin or PTFE, shall be used.

NOTE For the application of this document, surfaces of solids with a polar fraction of <0,5 mJ/m^2 are sufficiently dispersive.

Sufficiently homogenous PTFE reference surfaces preferably have a surface free energy of (18,5 ± 0,5) mJ/m^2 in accordance with the OWRK method, whereas locally measured surface free energies on the reference surface for the determination of the standard deviation (see 8.1) are measured in accordance with 7.3. For the PTFE surfaces, as well as the paraffin surfaces, precise reference objects with a mean roughness value R_a[2)] of less than 0,3 µm are to be preferred. The paraffin reference surfaces preferably have a surface free energy of (25,5 ± 0,5) mJ/m^2 under the same conditions as the PTFE reference surfaces.

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6 Sampling

Take a representative sample of the liquid to be tested in accordance with ISO 15528.

7 Procedure

7.1 Test conditions

Carry out the test at (23 ± 2) °C and a relative humidity of (50 ± 5) % (see ISO 3270) and make sure that all test media have this temperature.

7.2 Determination of the surface tension of the liquid to be tested

Measure the surface tension of the liquid to be tested in accordance with ISO 19403-3, EN 14370 or ISO 1409.

2) The roughness value is defined in ISO 4288 and ISO 25178-2.

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7.3 Determination of the surface free energy of the reference solid

If the surface free energy of the reference solid is unknown, determine it in accordance with ISO 19403-2 using at least 10 drops of each of at least three test liquids indicated in ISO 19403-2:2017, Table 1. Calculate the surface free energy in accordance with ISO 19403-2:2017, 8.2 or 8.3.

NOTE Since a reference solid with predominantly dispersive interactions is used, it can be assumed that the dispersive fraction of the surface tension of the liquid can be determined from a single contact angle value.

7.4 Determination of the contact angle of the liquid to be tested on the reference solid

Clean, dry and condition the reference solid in accordance with ISO 19403-2. Measure the contact angle between the reference solid and the liquid to be tested in accordance with ISO 19403-2. Use at least 10 drops for this. Use the same method (static or dynamic) as in 7.3 for measurement the contact angle.

8 Evaluation

8.1 General

The standard deviations should not exceed the following values:

— for the surface tension of the tested surface: ±1 %;

— for the surface free energy of the reference solid: preferably 0,3 mJ/m^2, not exceeding 0,5 mJ/m^2;

— for the contact angles of the tested liquid on the reference solid: for the static method 1° and for the dynamic method 3°.

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8.2 Owens-Wendt-Rabel-Kaelble method (OWRK method)

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For reference surfaces with a surface free energy >20 mJ/m^2, calculate the dispersive fraction of the surface tension of the liquid, σ_l^d, in accordance with Formula (1):

$$\sigma_l^d = \frac{(1+\cos\theta)^2 \cdot \sigma_l^2}{4\sigma_s} \quad (1)$$

where

θ is the mean value of the measured contact angles between the tested liquid and the reference solid;

σ_l is the surface tension of the tested liquid, measured in accordance with 7.2;

σ_s is the surface free energy of the reference solid, measured in accordance with 7.3.

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8.3 Wu method

For reference surfaces with a surface free energy <20 mJ/m², calculate the dispersive fraction of the surface tension of the liquid, σ_l^d, in accordance with Formula (2):

$$\sigma_l^d = \frac{\sigma_l \sigma_s^d (1 + \cos\theta)}{4\sigma_s^d - \sigma_l (1 + \cos\theta)} \tag{2}$$

where

- θ is the mean value of the measured contact angles between the tested liquid and the reference solid;
- σ_l is the surface tension of the tested liquid, measured in accordance with 7.2;
- σ_s^d is the dispersive fraction of the surface energy of the reference solid.

8.4 Calculation of the polar fraction of the surface tension of the liquid

Calculate the polar fraction of the surface tension of the liquid, σ_l^p, in accordance with Formula (3):

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$$\sigma_l^p = \sigma_l - \sigma_l^d \tag{3}$$

where

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- σ_l is the surface tension of the tested liquid, measured in accordance with 7.2;
- σ_l^d is the dispersive fraction of the surface tension of the tested liquid.

9 Precision

At the time of publication, information on precision is not available.

10 Test report

The test report shall contain at least the following information:

a) all details necessary to identify the tested product;

b) a reference to this document, i.e. ISO 19403-5;

c) the surface tension of the liquid to be tested including all information in accordance with the test report of the method used;

d) the surface free energy of the reference solid including all information in accordance with the test report of the method used or reference and material and manufacturer, cleaning and preparation method of the reference solid, if applicable;

e) for the determination of the polar and dispersive fractions of the surface tension of the liquid:

   1) the information on whether it was measured statically or dynamically,

   2) the used drop volumes or volume range and dosing speed,

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