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Paints and varnishes — Wettability —

Part 3: Determination of the surface tension of liquids using the pendant drop method

Peintures et vernis — Mouillabilité —

Partie 3: Détermination de la tension de surface des liquides par la méthode de la goutte pendante

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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.

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 document 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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 139, *Paints and varnishes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19403-3:2017), which has been technically revised.

The main changes are as follows:

— the Worthington number has been introduced in Annex B;

— the normative references have been updated.

A list of all parts in the ISO 19403 series can be found on the ISO website.

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.

Paints and varnishes — Wettability —

Part 3: Determination of the surface tension of liquids using the pendant drop method

1 Scope

This document specifies a test method to measure the surface tension of liquids with an optical method using the pendant drop. The method can be applied for the characterization of liquid coating materials. If applied to liquids with non-Newtonian flow behaviour (as defined in ISO 3219-1:2021, 3.22), restrictions can apply.

NOTE For other methods to determine the surface tension, see e.g. EN 14370 and ISO 1409.

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 2811-1, *Paints and varnishes — Determination of density — Part 1: Pycnometer method*

ISO 2811-2, *Paints and varnishes — Determination of density — Part 2: Immersed body (plummet) method*

ISO 2811-3, *Paints and varnishes — Determination of density — Part 3: Oscillation method*

ISO 2811-4, *Paints and varnishes — Determination of density — Part 4: Pressure cup method*

ISO 4618, *Paints and varnishes — Vocabulary*

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

ISO 19403-1:2022, *Paints and varnishes — Wettability — Part 1: Vocabulary and general principles*

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 terminology databases for use in standardization at the following addresses:

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

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

4 Principle

One drop of the respective liquids to be tested is captured hanging from a needle, where the drop shall deviate significantly from the spherical shape due to its own mass. The surface tension is calculated from the shape of the pendant drop in accordance with the Young-Laplace equation.

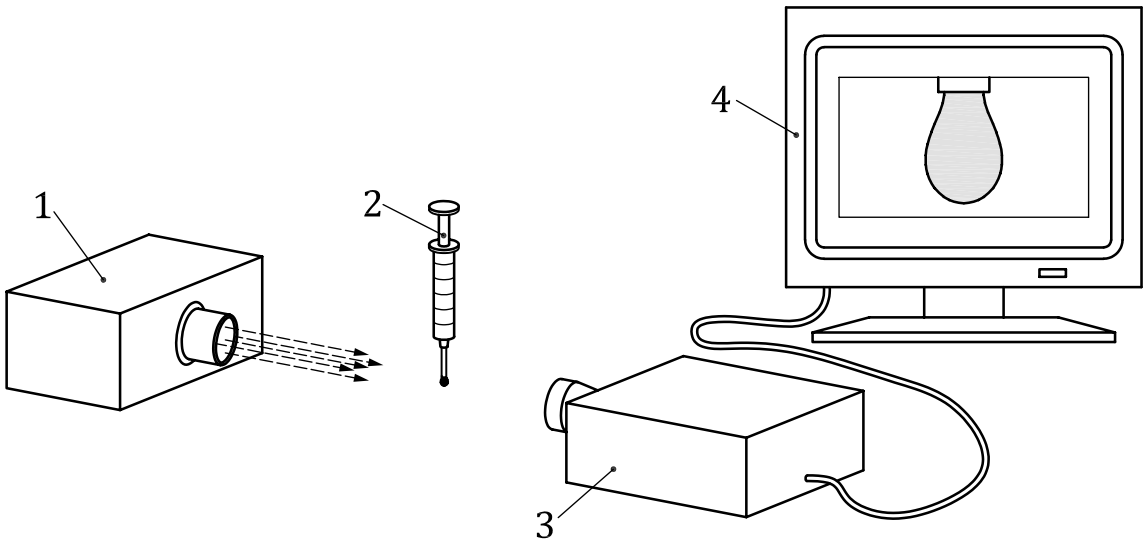
The polar and disperse fractions of the surface tension can be determined with at least two methods, which are specified in ISO 19403-4 and ISO 19403-5.

5 Apparatus and materials

Ordinary laboratory apparatus, together with the following shall be used.

5.1 Drop contour analysis system, for measuring the surface tension of pendant drops.

Any state-of-the-art drop contour analysis system with digital image capture and analysis can be used. Figure 1 shows a schematic example of a drop contour analysis system.



Key

1 light source
2 graduated micro syringe
3 optical system
4 screen

Figure 1 — Example of a drop contour analysis system

The image capturing system should be oriented in a way that the optimal image resolution ratio (ratio of width and height) can be used.

NOTE The device used can differ from the schematic diagram in Figure 1 regarding light path and the set-up of the components.

5.2 Dosing unit, which makes it possible to dose a pendant liquid drop, which deviates significantly from the spherical shape due to its own mass, on a circular-cylindrical needle with constant thickness within the detection area of the camera.

To measure the surface tension on the pendant drop, usually a larger outside diameter of the needle is needed than for measuring the contact angle on the horizontal drop. The outside diameters of the needle used shall be in the range between 0,5 mm and 2,5 mm. The outside diameter of the needle to be chosen depends on the relationship between the surface tension, σ, and the density difference of the liquid to the ambient phase, $\Delta\rho$. The higher the quotient $\sigma/\Delta\rho$, the larger the outside diameter of the needle shall be. The dependence of the outside diameter of the needle, d, on the quotient of surface tension and density difference of the phases involved $\sigma/\Delta\rho$ is illustrated in Figure 2.