
Paints and varnishes — Wettability —
Part 1:
Vocabulary and general principles

Peintures et vernis — Mouillabilité —

Partie 1: Vocabulaire et principes généraux

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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 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 of 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 www.iso.org/iso/foreword.html.

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 19403-1:2017), which has been technically revised.

The main changes are as follows:

- in the title, "Terminology" has been changed to "Vocabulary";
- text from the Scope has been moved to the Introduction;
- [3.1.5](#), [3.1.7](#), [3.1.8](#) and [3.1.9](#) have been slightly modified;
- the following terms and definitions have been added: hydrophobic, superhydrophobic, hydrophilic, superhydrophilic and superhydrophobic coating;
- Clause 4 has been moved to [Annex A](#);
- [Figure 1](#) and [Figure A.1](#) have been updated;
- the designation of the X-axis in [Figure A.2](#) has been corrected;
- the derivation of [Formula \(A.4\)](#) has been improved;
- [Formula \(A.6\)](#) has been corrected;
- bibliographic entries [1] and [12] have been added and cross-references 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.

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Introduction

The ISO 19403 series specifies optical test methods:

- for the measurement of the contact angle;
- for the determination of the surface free energy of a solid surface, including the polar and dispersive fractions;
- for the determination of the surface tension of liquids, including the polar and dispersive fractions;
- for the checking of the measurement arrangement with reference materials.

The ISO 19403 series can be applied for the characterization of substrates, coatings and coating materials.

The applicability can be restricted for liquids with non-Newtonian flow behaviour (see DIN 1342-1^[4]).

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Paints and varnishes — Wettability —

Part 1: Vocabulary and general principles

1 Scope

This document specifies general terms and definitions for wettability. Some general principles are described in Annex A. This document is intended to be used in conjunction with ISO 4618.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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/>

3.1 Terms relating to determination of the surface free energy

3.1.1 chemical homogeneity
chemically homogeneous composition of a surface to be examined

Note 1 to entry: The definition regards a purely qualitative assessment of the surface. Regarding the measurement of the contact angle, a surface is considered chemically and topologically sufficiently homogeneous if no significant differences of the contact angles can be determined when measuring on several locations on the surface. The significance limits can be specified by the user in accordance with standard laboratory methods.

3.1.2 topological homogeneity

uniformity of the macroscopic surface, including evenness and smoothness

Note 1 to entry: The definition regards a purely qualitative assessment of the surface. Regarding the measurement of the contact angle, a surface is considered chemically and topologically sufficiently homogeneous if no significant differences of the contact angles can be determined when measuring on several locations on the surface. The significance limits can be specified by the user in accordance with standard laboratory methods.

3.1.3 interfacial free energy
interfacial tension

σ

energy or tension resulting from intermolecular forces on interfaces

Note 1 to entry: The term interfacial energy pertains to the interaction with solid surfaces and is indicated as free energy in relation to the surface unit (mJ/m^2). The term interfacial tension pertains to the interaction with liquids and is indicated as force per length unit (mN/m). The respective indices “l” for “liquid” and “s” for “solid” indicate the phases involved.

3.1.4
surface free energy
free energy of the surface

σ_s
interfacial free energy (3.1.3) of a solid surface

Note 1 to entry: For detailed explanations of the principles for the determination of the surface free energy, see [A.1](#).

3.1.5
surface tension

σ_l
interfacial tension of a liquid surface

Note 1 to entry: The surface tension is indicated as force per unit length (mN/m). Its numerical value corresponds to the free energy of the interface or surface.

Note 2 to entry: The surface tension corresponds to the work which shall be done in order to enlarge a given surface by a specific value.

Note 3 to entry: If the liquid of a droplet is in equilibrium with its vapour phase, then the surface tension is thermodynamically defined. It is experimentally very challenging to ensure thermodynamical equilibrium during measurements. This would include constant temperature, constant pressure and saturated vapour phase. This does not mean that any violation of this condition does not allow to measure dynamic contact angles which shall be “near the thermodynamic equilibrium” (see ISO 19403-6:2017, 3.2, note 1) which is obviously not in equilibrium, yielding in dynamic surface tensions.

Note 4 to entry: For detailed explanations of the principles for the measurement of the surface tension at the pendant drop, see [A.2](#).

3.1.6
interfacial energy

σ_{sl}
energy on the phase interface between a solid and a liquid phase

3.1.7
three-phase point
contact point

point at which solid phase, liquid phase and vapour phase are in contact with each other

Note 1 to entry: See [Figure A.1](#).

3.1.8
base line

straight or curved line at the interface between a solid and liquid phase which connects two *three-phase points* (3.1.7)

Note 1 to entry: See [Figure A.1](#).

3.1.9
contact angle

θ
angle to the *base line* (3.1.8) within the drop, formed by means of a tangent on the drop contour through one of the *three-phase points* (3.1.7)

Note 1 to entry: See [Figure A.1](#).

Note 2 to entry: The contact angle is preferably indicated in degrees (°). $1^\circ = (\pi/180)$ rad. If the system is in thermodynamic equilibrium, this contact angle is also referred to as thermodynamic equilibrium contact angle.

3.1.10
top-view angle

angle to the plane of the sample surface under which the drop is being observed

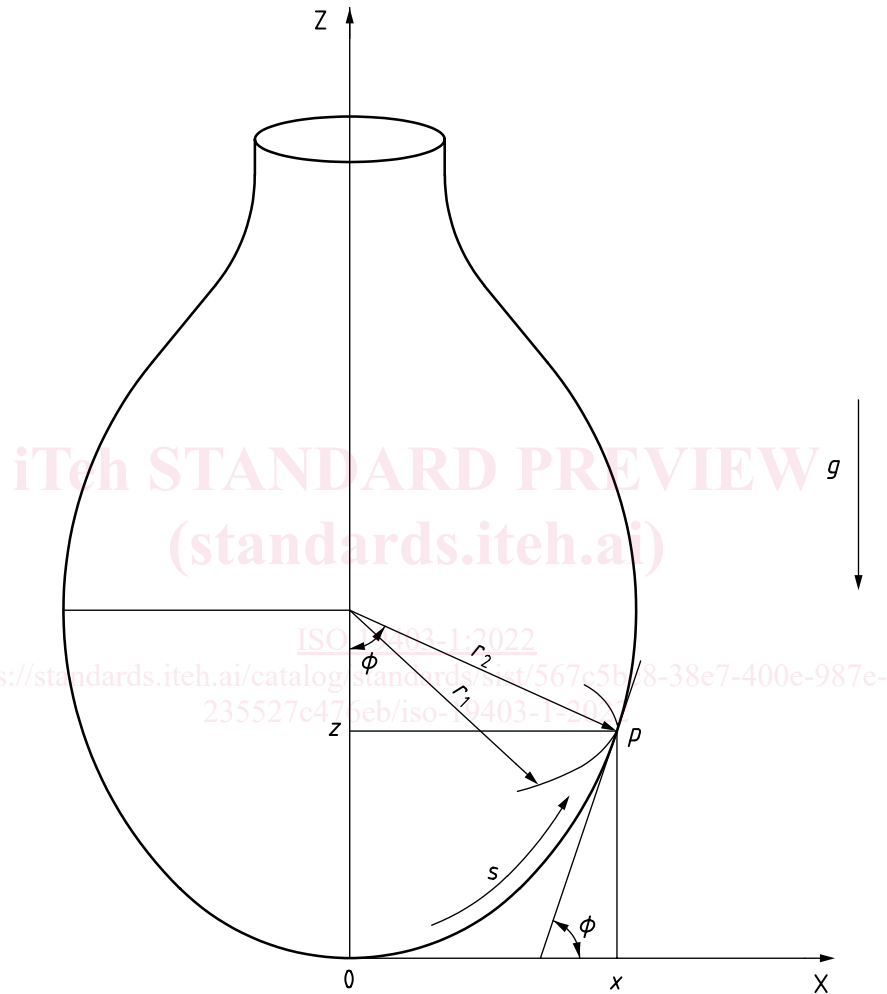
3.2 Terms relating to determination of the surface tension of liquids

3.2.1

pendant drop

drop hanging on a hollow needle

Note 1 to entry: The curvature of the contour of a pendant drop is generally determined by its own mass and its surface tension. The surface tension can be calculated from the shape and size of a pendant drop by means of drop contour analysis, provided that the drop is large enough (see ISO 19403-3) so that its shape significantly differs from a spherical shape due to its own mass. See [Figure 1](#).



Key

X, Z	axes of coordinates
p	point on the drop contour
x, z	cartesian coordinates of a drop contour point
s	arc length from the origin in the drop apex to the drop contour point p
r_1, r_2	main curvature radiuses of the drop surface in drop contour point p
ϕ	tangent angle in drop contour point p to the X -axis
g	gravity attraction

Figure 1 — Pendant drop