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Part 6: Measurement of dynamic contact angle

Peintures et vernis — Mouillabilité —

Partie 6: Mesurage de l'angle de contact dynamique

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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).

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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*.

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

Introduction

Dynamic contact angles describe the processes on the interface liquid/solid during volume increase (advancing angle) or volume decrease (receding angle) of a drop in horizontal position. As an alternative to the static method (see ISO 19403-2), for the advancing angle always a surface area is wetted, which was previously unwetted. For the receding angle, the contact angle during dewetting is observed. The difference between advancing angle and receding angle is a sign of different chemical or physical homogeneity (morphology, topology) or roughness. The receding angle is not suitable for the determination of the surface energy.

Paints and varnishes — Wettability —

Part 6:
Measurement of dynamic contact angle

1 Scope

This document specifies a method to measure the dynamic contact angle with an optical method. The advancing and the receding angles are determined.

By means of this defined measurement, the wetting and dewetting properties can be characterized. It can also be concluded on the morphological and chemical homogeneity of interfaces.

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 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 free surface energy of solid surfaces by measuring the contact angle*

3 Terms and definitions

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

3.1
dynamic contact angle
contact angle, which is measured during advancing or receding of the three-phase point

Note 1 to entry: For the definition of "contact angle", see ISO 19403-1:2017, 3.1.9.

Note 2 to entry: The advancing or receding of the three-phase point can be achieved by changing the volume of the liquid drop to be measured, by relative movement (immersing and pulling out) of a solid body to an interface, or by moving the drop over the interface (e.g. rolling off).

3.2
advancing angle
θ_a
contact angle, which is measured during advancing of the three-phase point

Note 1 to entry: Generally, the advancing angle is used for the determination of the interface energy, in which case, the measurement should be carried out close to the thermodynamic equilibrium. This is approximately reached if there is no influence of, for example, the dosing speed on the contact angle.

3.3
receding angle
θ_r
contact angle, which is measured during receding of the three-phase point

3.4
contact angle hysteresis
θ_{ar}
difference between *advancing angle* (3.2) and *receding angle* (3.3)

3.5
polynomial method
<contact angle> image-analysing evaluation method for the contact angle which can also be applied when the dosing needle is still inside the drop

4 Principle

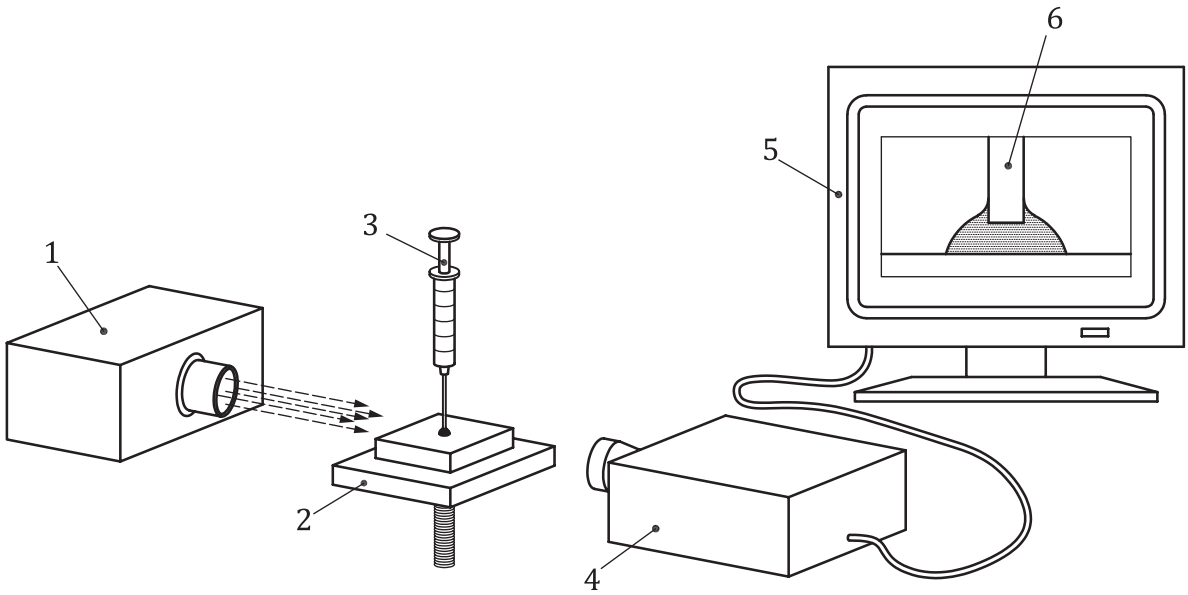
At least three drops of the respective test liquids are dosed onto the flat surface of a test specimen. The volume of the respective drop is continuously increased (advancing angle) or decreased (receding angle). The contact angle is preferably determined by means of the polynomial method, synchronously with the dosing. If the polar and dispersive fraction of the surface free energy is to be determined according to ISO 19403-2, the advancing angle shall be used.

5 Apparatus and materials

Ordinary laboratory apparatus, together with the following.

5.1 Contact angle measuring system.

Any state-of-the-art contact angle measuring device, preferably systems with digital image capture and analysis for measuring the contact angle. Figure 1 shows a schematic example of a contact angle measuring system.



Key

1 light source
2 specimen holder
3 system with microlitre syringe for continuous dosing
4 optical system
5 screen
6 needle positioned in the drop

Figure 1 — Schematic diagram of a contact angle measuring 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 regard to light path and the arrangement of the components.

5.2 Dosing unit.

Dosing unit, which makes it possible to continuously change the drop volume on the surface in the range of microlitres.

NOTE Typical dosing rates for test liquids for the determination of the surface energy are in the range of 10 µl/min.

5.3 Test liquids.

The test liquids shall not physically or chemically affect the surface. They shall not have a distinct yield point.

NOTE A notable yield value is shown when a lamella of the liquid teared with a needle does not level within a given time limit (e.g. 30 s).

The test liquids shall not crosslink during measuring, not form skins and not volatilize distinctly.

Liquids having a vapour pressure higher than water at 30 °C shall be measured in the saturated vapour phase.