



International  
Standard

**ISO 19403-5**

**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**

*Peintures et vernis — Mouillabilité —*

*Partie 5: Détermination des fractions polaire et dispersive de  
la tension superficielle des liquides à partir de mesurages de  
l'angle de contact avec un solide n'ayant qu'une contribution de  
dispersion à son énergie de surface*

**Second edition  
2024-10**

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

[ISO 19403-5:2024](https://standards.iteh.ai/catalog/standards/iso/b64924d9-6050-41e1-9aec-dd553d7c2fdf/iso-19403-5-2024)

<https://standards.iteh.ai/catalog/standards/iso/b64924d9-6050-41e1-9aec-dd553d7c2fdf/iso-19403-5-2024>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Principle</b> .....	<b>2</b>
<b>5 Reference solid</b> .....	<b>2</b>
<b>6 Sampling</b> .....	<b>2</b>
<b>7 Procedure</b> .....	<b>2</b>
7.1 Test conditions.....	2
7.2 Determination of the surface tension of the liquid to be tested.....	2
7.3 Determination of the surface free energy of the reference solid.....	2
7.4 Determination of the contact angle of the liquid to be tested on the reference solid.....	3
<b>8 Evaluation</b> .....	<b>3</b>
8.1 General.....	3
8.2 Owens-Wendt-Rabel-Kaelble method (OWRK method).....	3
8.3 Wu method.....	3
8.4 Calculation of the polar fraction of the surface tension of the liquid.....	4
<b>9 Test report</b> .....	<b>4</b>
<b>Bibliography</b> .....	<b>6</b>

iTeh Standards  
(<https://standards.itih.ai>)  
Document Preview

[ISO 19403-5:2024](https://standards.itih.ai/catalog/standards/iso/b64924d9-6050-41e1-9aec-dd553d7c2fdf/iso-19403-5-2024)

<https://standards.itih.ai/catalog/standards/iso/b64924d9-6050-41e1-9aec-dd553d7c2fdf/iso-19403-5-2024>

## 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](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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](http://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 19403-5:2017), which has been technically revised.

<https://standards.iteh.ai/catalog/standards/iso/b64924d9-6050-41e1-9aee-dd553d7c2fd/iso-19403-5-2024>  
The main changes are as follows:

- in [7.4](#), information on the dynamic contact angle measurement has been added;
- 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](http://www.iso.org/members.html).

# 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.

If applied to liquids with non-Newtonian flow behaviour (see ISO 3219-1:2021, 3.22), restrictions can apply.

## 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 1409, *Plastics/rubber — Polymer dispersions and rubber latices (natural and synthetic) — Determination of surface tension*

ISO 4618, *Paints and varnishes — Vocabulary*

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

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

ISO 19403-2, *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 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

The following steps apply.

- Step 1: The surface tension of the liquid to be tested is determined according to 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 according to ISO 19403-2.
- Step 3: Measurement of the contact angle between the reference solid and the liquid to be tested is carried out according to ISO 19403-2.

NOTE Measurements can be static or dynamic.

- Step 4: The dispersive fraction of the surface tension of the liquid is calculated according to Owens, Wendt, Rabel and Kaelble (OWRK)<sup>[5], [6], [7]</sup> or according to 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

Use a sufficiently, chemically and topologically homogenous dispersive solid, e.g. made of paraffin or PTFE.

NOTE 1 For the application of this document, surfaces of solids with a polar fraction of  $<0,5 \text{ mJ/m}^2$  are sufficiently dispersive.

Sufficiently homogenous PTFE reference surfaces preferably have a surface free energy of  $(18,5 \pm 0,5) \text{ mJ/m}^2$  according to the OWRK method. Surface free energies which are locally measured 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,  $R_a$ , of less than  $0,3 \text{ }\mu\text{m}$  are recommended. The paraffin reference surfaces preferably have a surface free energy of  $(25,5 \pm 0,5) \text{ mJ/m}^2$  under the same conditions as the PTFE reference surfaces.

NOTE 2 The roughness value ( $R_a$ ) is defined in ISO 21920-3 and ISO 25178-2.

<https://standards.iteh.ai/catalog/standards/iso/b64924d9-6050-41e1-9aee-dd553d7c2fdf/iso-19403-5-2024>

## 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  $(23 \pm 2) \text{ }^\circ\text{C}$  and a relative humidity of  $(50 \pm 5) \%$  (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.

### 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 from each of the three test liquids indicated in ISO 19403-2:2024, Table 1.

Calculate the surface free energy in accordance with ISO 19403-2:2024, 8.2 [method according to Owens, Wendt, Rabel and Kaelble (OWRK method) for determining the disperse components of the surface tension