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Paints and varnishes - Overview of test methods on hardness and wear resistance of coatings

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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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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*.

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 determination of the hardness and of the wear resistance is one of the most important preconditions for evaluating the resistance of coatings to mechanical stress.

The procedures and numerical data given in this document provide a rough overview; detailed information is found in the applicable standards.

For all of the methods for the evaluation of the hardness and of the wear resistance the visco-elastic properties have a wide influence on the test result. Consequently, the time between testing and evaluation are agreed and observed.

Mechanical properties of coatings depend on, among others, temperature and moisture content. Consequently, the tests should be carried out immediately after the conditioning phase.

The tests are preferably carried out in the climatic chamber.

Each method has its specific application. An unsuitable method may lead to false conclusions. All of the test methods require a certain expertise of the test person. For most of the test methods the test results depend on, among others, the film thickness of the coating to be tested.

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Paints and varnishes - Overview of test methods on hardness and wear resistance of coatings

1 Scope

This document provides an overview for selecting the most suitable test method regarding the evaluation of the hardness and the wear resistance of coatings.

Annex A gives a summarized list of test methods for the evaluation of the hardness and of the wear resistance of coatings for different stresses.

Methods for testing cross-linking (wear test in connection with solvents) and abrasion tests with multiple impacts are not covered by this document.

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*

3 Terms and definitions

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

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

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

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

3.1
hardness
ability of a dry film or coat to resist indentation or penetration by a solid object

[SOURCE: ISO 4618:2014, 2.136]

3.2
wear
irreversible change of a coating which is caused by the mechanical impact of moved objects

3.3
stylus
scratching tool with specified geometry

[SOURCE: ISO 22557:2019, 3.1]

3.4
scratch
line-shaped damage of a coating which is caused by the impact of a loaded object being moved over the coating

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3.5
mar
blemish on the surface of a coating, extending over a particular area of the coating and visible due to the difference in the light-reflection properties of the area affected compared with the light-reflection properties of adjacent areas

[SOURCE: ISO 4618:2014, 1.152]

3.6
abrasion
wear (3.2) which is caused by removal of coating material on a surface

3.7
repeatability conditions
conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time

[SOURCE: ISO 5725-1:1994, 3.14]

3.8
repeatability limit
r
the value less than or equal to which the absolute difference between two test results obtained under *repeatability conditions* (3.7) may be expected to be with a probability of 95 %

[SOURCE: ISO 5725-1:1994, 3.16]

3.9
reproducibility conditions
conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment

[SOURCE: ISO 5725-1:1994, 3.18]

3.10
reproducibility limit
R
the value less than or equal to which the absolute difference between two test results obtained under *reproducibility conditions* (3.8) may be expected to be with a probability of 95 %

[SOURCE: ISO 5725-1:1994, 3.20]

4 Hardness tests

4.1 Indentation tests with resting indenter

4.1.1 Indentation test with Buchholz indenter

— **Description**

An indenter made of hardened steel, the shape and dimensions of which are specified in accordance with Buchholz, impacts the coating under a load (500 g, corresponding to 4,96 N) for 30 s and produces an indentation. After a resting time of 35 s the indentation length (mm) is determined under specified lighting conditions using a measuring microscope (×20 magnification).

Figure 1 shows the test device and Figure 2 shows the Buchholz indenter. Figure 3 illustrates the microscopic measurement of the indentation.

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