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Plastics — Instrumented micro-indentation test for hardness measurement

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National foreword

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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 61, *Plastics*, Subcommittee SC 2, *Mechanical behaviour*.

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.

Introduction

This document was developed in response to a demand to define an instrumented indentation hardness test method in the micro scale for quality control of plastics materials and material selection. The test conditions are defined to ensure reproducibility and comparability of test results.

The Rockwell hardness method (ISO 2039-2) and the ball indentation method (ISO 2039-1) have been formulated for determining the indentation hardness of plastics. These test methods use different scales depending on the hardness of the material and it is difficult to compare hardness values of materials when they are measured on different scales.

The Vickers hardness test method (ISO 6507-1), used for metallic materials, is a method that does not use different scales. The Vickers hardness is calculated as the ratio of indentation load and the residual area of contact of the indenter. However, when this method is applied to plastics materials, it is difficult to measure the residual area of contact of the indenter because the edge of the indentation cannot be specified.

The instrumented indentation hardness test method (ISO 14577-1) is intended for hardness measurement in the range from nano-indentation to macro-indentation. In this method, since the contact area of the indenter is directly determined from the indentation depth, the above-mentioned problem is solved. It is therefore possible to determine the indentation hardness of the plastic materials.

In this document, in order to avoid errors due to detection of initial contact, a test force that can result in sufficient indentation depth within the range of micro-indentation is specified. For example, the range of indentation depth under this condition, which is from 10 µm to 50 µm in the case of the four types of materials described in this document, also corresponds to the dimension (scale) of the diagonal length range of 0,020 mm to 1,400 mm specified by the Vickers hardness test method (ISO 6507-1). In this document, the measurement time of a single condition is specified similarly to the Rockwell hardness method (ISO 2039-2).

TECHNICAL SPECIFICATION **ISO/TS 19278:2019(E)**

Plastics — Instrumented micro-indentation test for hardness measurement

1 Scope

This document specifies a hardness test method for plastics using instrumented indentation in the micro scale with one clearly defined test condition to ensure reproducibility and comparability of test results.

The test method is selectively suitable for use with the following materials:

— moulding, extrusion and cast thermoplastic materials; rigid and semi-rigid thermoplastics sheets;

— rigid and semi-rigid thermosetting moulding materials; thermosetting sheets.

This test method could also be utilized for nanometric filled system, considering the fillers are distributed uniformly in the polymer matrix.

This test method allows dumbbell type specimen, strip type specimen, platens and specimen cut from any finished parts or products.

This test method is useful for quality control, material selection, and screening of new formulations.

NOTE This document does not aim to describe all scientific or technical aspects of microhardness testing on plastics in general.

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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 2602, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 14577-1, *Metallic materials — Instrumented indentation test for hardness and materials parameters — Part 1: Test method*

3 Terms and definitions

No terms and definitions are listed in this document.

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/