

This is a preview - click here to buy the full publication



IEC 62899-201

Edition 1.0 2016-02

INTERNATIONAL STANDARD

**Printed electronics –
Part 201: Materials – Substrates**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.035.01; 31.180

ISBN 978-2-8322-3198-2

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions	11
4 Materials, structures and dimensions	13
4.1 Base materials	13
4.2 Structures of substrates.....	13
4.3 Dimensions of substrates.....	14
4.3.1 Outline.....	14
4.3.2 Sheet dimensions	14
4.3.3 Width and length (roll supply)	14
4.3.4 Substrate thickness.....	15
5 General descriptions of evaluation tests.....	15
5.1 Sampling.....	15
5.2 Preparation of test specimens	15
5.3 Atmospheric conditions for evaluation test	15
5.4 Conditioning.....	15
5.4.1 Polymer substrates	15
5.4.2 Glass substrates	15
5.4.3 Other materials	15
6 Characteristics and evaluation method of polymer substrates	16
6.1 Surface properties.....	16
6.1.1 Surface defects.....	16
6.1.2 Flatness.....	16
6.1.3 Surface condition	17
6.1.4 Edge condition	19
6.2 Mechanical properties	19
6.2.1 Elongation at break.....	19
6.2.2 Tensile strength	19
6.2.3 Tensile modulus	20
6.2.4 Minimum bending radius.....	20
6.2.5 Tear strength and tear propagation resistance	23
6.2.6 Edge strength	24
6.2.7 Hardness	24
6.3 Chemical properties	24
6.3.1 Resistance to chemicals.....	24
6.3.2 Halide contents	25
6.3.3 Volatile content	25
6.3.4 Gas transmission	26
6.3.5 Moisture absorption	27
6.4 Electrical properties	27
6.4.1 Measurement at ambient temperature.....	27
6.4.2 Measurement at high temperature	29
6.5 Thermal properties	29
6.5.1 Glass transition temperature	29

6.5.2	Coefficient of linear thermal expansion	29
6.5.3	Dimensional stability	30
6.5.4	Relative temperature index (RTI)	30
6.6	Optical properties	32
6.6.1	Method of testing the colour of the substrates	32
6.6.2	Refractive index	35
6.6.3	Retardation	35
6.6.4	Luminous reflectance	35
6.6.5	Haze	36
6.7	Flammability	36
6.7.1	Outline	36
6.7.2	Test method	36
6.7.3	Report of the results	36
7	Characteristics and evaluation method of glass substrates	37
7.1	Surface properties	37
7.1.1	Surface roughness	37
7.1.2	Chips and cracks	37
7.1.3	Foreign inclusions	37
7.1.4	Foreign substances on surface	38
7.1.5	Scratches	38
7.2	Mechanical properties	38
7.2.1	Young's modulus and Poisson's ratio	38
7.2.2	Density	38
7.2.3	Hardness	39
7.3	Chemical properties	39
7.3.1	Resistance to chemicals	39
7.3.2	Gas transmission	39
7.4	Thermal properties	39
7.4.1	Coefficient of linear thermal expansion	39
7.4.2	Strain point	39
7.5	Optical properties	40
7.5.1	Refractive index	40
7.5.2	Luminous transmittance	40
8	Characteristics and evaluation method of other materials (ceramics, metal, paper, others)	40
9	Storage	41
9.1	Storage conditions	41
9.1.1	Climatic conditions	41
9.1.2	Chemically active substances	41
9.1.3	Mechanically active substances	41
9.1.4	Other conditions	41
9.2	Storage period	41
10	Packaging and marking	41
10.1	Packaging	41
10.2	Marking	41
10.3	Traceability	41
11	Transportation	41
11.1	Transportation conditions	41

11.1.1	Climatic conditions	41
11.1.2	Chemically active substances.....	42
11.1.3	Mechanically active substances.....	42
11.1.4	Mechanical condition	42
11.1.5	Other conditions.....	42
11.2	Means of transportation.....	42
11.3	Vibration resistance	42
11.4	Impact resistance.....	42
Bibliography		43
Figure 1	– Example of bow.....	11
Figure 2	– Example of twist.....	11
Figure 3	– Structure of the flex resistance tester near the part where the specimen is attached	21
Figure 4	– Structure of the MIT instrument.....	22
Figure 5	– Example of a measuring electrode	28
Table 1	– Winding misalignment of the roll	14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRINTED ELECTRONICS –

Part 201: Materials – Substrates

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62899-201 has been prepared by IEC technical committee 119: Printed electronics.

The text of this standard is based on the following documents:

FDIS	Report on voting
119/87/FDIS	119/100A/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62899 series, published under the general title *Printed electronics*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

The IEC 62899-20x series relates mainly to evaluation methods for materials of printed electronics. The series also includes storage methods, packaging and marking, and transportation conditions.

The IEC 62899-20x series is divided into parts for each material. Each part is prepared as a generic specification containing fundamental information for the area of printed electronics.

The IEC 62899-20x series consists of the following parts:

Part 201: Materials – Substrates

Part 202: Materials – Conductive ink

Part 203: Materials – Semiconductor ink¹

(Subsequent parts will be prepared for other materials.)

Furthermore, sectional specifications, blank detail specifications, and detail specifications for each material will follow these parts.

This part of IEC 62899 is prepared for substrate used in printed electronics and contains the test conditions, the evaluation methods and the storage conditions.

¹ Under consideration.

PRINTED ELECTRONICS –

Part 201: Materials – Substrates

1 Scope

This part of IEC 62899 defines the terms and specifies the evaluation method for substrates used in the printing process to form electronic components/devices. This international standard is also applied to the substrates which make surface treatment in order to improve their performance.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at www.electropedia.org)

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60216-1:2013, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60216-3, *Electrical insulating materials – Thermal endurance properties – Part 3: Instructions for calculating thermal endurance characteristics*

IEC 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60216-6, *Electrical insulating materials – Thermal endurance properties – Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method*

IEC 60243-1:2013, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60674-2:1988, *Specification for plastic films for electrical purposes – Part 2: Methods of test*

IEC 60674-2:1988/AMD1:2001

IEC 60674-3-1:1998, *Plastic films for electrical purposes – Part 3: Specifications for individual materials – Sheet 1: Biaxially oriented polypropylene (PP) films for capacitors*
IEC 60674-3-1/AMD1:2011

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50W horizontal and vertical flame test methods*

IEC 60721-3-1, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 61189-2:2006, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 61189-3:2007, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 3: Test methods for interconnection structures (printed boards)*

ISO 5-2, *Photography and graphic technology – Density measurements – Part 2: Geometric conditions for transmittance density*

ISO 5-3, *Photography and graphic technology – Density measurements – Part 3: Spectral conditions*

ISO 62, *Plastics – Determination of water absorption*

ISO 175:2010, *Plastics – Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 291, *Plastics – Standard atmospheres for conditioning and testing*

ISO 472, *Plastics – Vocabulary*

ISO 489:1999, *Plastics – Determination of refractive index*

ISO 527-1:2012, *Plastics – Determination of tensile properties – Part 1: General principles*

ISO 527-2, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-4, *Plastics – Determination of tensile properties – Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

ISO 527-5, *Plastics – Determination of tensile properties – Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*

ISO 868, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 2039-1, *Plastics – Determination of hardness – Part 1: Ball indentation method*

ISO 2039-2, *Plastics – Determination of hardness – Part 2: Rockwell hardness*

ISO 2578:1993, *Plastics – Determination of time-temperature limits after prolonged exposure to heat*

ISO 3274, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments*

ISO 3664, *Graphic technology and photography – Viewing conditions*

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

ISO 4288:1996, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Rules and procedures for the assessment of surface texture*

ISO 6383-1, *Plastics – Film and sheeting – Determination of tear resistance – Part 1: Trouser tear method*

ISO 6383-2, *Plastics – Film and sheeting – Determination of tear resistance – Part 2: Elmendorf method*

ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

ISO 7991, *Glass – Determination of coefficient of mean linear thermal expansion*

ISO 9773:1998, *Plastics – Determination of burning behaviour of thin flexible vertical specimens in contact with a small-flame ignition source*
ISO 9773:1998/AMD1:2003

ISO 11359-2:1999, *Plastics – Thermomechanical analysis (TMA) – Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ISO 11664-4, *Colorimetry – Part 4: CIE 1976 $L^*a^*b^*$ Colour space*

ISO 13468-1:1996, *Plastics – Determination of the total luminous transmittance of transparent materials – Part 1: Single beam instrument*

ISO 13468-2:1999, *Plastics – Determination of the total luminous transmittance of transparent materials – Part 2: Double-beam instrument*

ISO 13565-2:1996, *Geometrical Product Specification (GPS) – Surface texture: Profile method; Surfaces having stratified functional properties – Part 2: Height characterization using the linear material ratio curve*

ISO 13655, *Graphic technology – Spectral measurement and colorimetric computation for graphic arts images*

ISO 14782, *Plastics – Determination of haze for transparent materials*

ISO 15105-1, *Plastics – Film and sheeting – Determination of gas-transmission rate – Part 1: Differential-pressure methods*

ISO 15105-2:2003, *Plastics – Film and sheeting – Determination of gas-transmission rate – Part 2: Equal-pressure method*

ISO 15106-1, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 1: Humidity detection sensor method*

ISO 15106-2, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 2: Infrared detection sensor method*

ISO 15106-3, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 3: Electrolytic detection sensor method*

ISO 15106-4, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 4: Gas-chromatographic detection sensor method*

ISO 15184, *Paints and varnishes – Determination of film hardness by pencil test*

ISO 15512, *Plastics – Determination of water content*

ISO 15989, *Plastics – Film and sheeting – Measurement of water-contact angle of corona-treated films*