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INTERNATIONAL STANDARD



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRINTED ELECTRONICS -

Part 203: Materials - Semiconductor ink

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International Standard IEC 62899-203 has been prepared by IEC technical committee 119: Printed Electronics.

The text of this International Standard is based on the following documents:

FDIS	Report on voting	
119/226/FDIS	119/234/RVD	

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- · withdrawn,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

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

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INTRODUCTION

The IEC 62899 series deals mainly with evaluation methods for materials of printed electronics. The series also includes storage methods, packaging and marking, and transportation conditions.

The IEC 62899 series is divided into several parts according to each material. Each part is prepared as a generic specification containing fundamental information for the area of printing electronics.

The IEC 62899 series consists of the following parts:

Part 1: Terminology

Part 201: Materials - Substrates

Part 202: Materials - Conductive ink

Part 203: Materials - Semiconductor ink

Part 250: Material technologies required in printed electronics for wearable smart devices

Part 301-X: Equipment - Contact printing - Rigid master

Part 302-X: Equipment - Inkjet

Part 303-X: Equipment - Roll-to-roll printing

Part 401: Printability – Overview

Part 402-X: Printability – Measurement of qualities

Part 403-X: Printability - Requirements for reproducibility al)

Part 502-X: Quality assessment – Organic light emitting diode (OLED) elements IEC 62899-203:2018

Furthermore, sectional/specifications; ablankadetail/specifications)-and-detail specifications for each material will be based on these parts; c6/iec-62899-203-2018

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

PRINTED ELECTRONICS -

Part 203: Materials - Semiconductor ink

1 Scope

This part of IEC 62899 defines terms and specifies standard methods for characterisation and evaluation.

This document is applicable to semiconductor inks and semiconductive layers that are made from semiconductor inks.

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.

- IEC 62860, Test methods for the characterization of organic transistors and materials
- ISO 5-2, Photography and graphic technology Density measurements Part 2: Geometric conditions for transmittance density

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- ISO 5-3, Photographys and graphic technology descensity measurements Part 3: Spectral conditions d9a7b041d8c6/iec-62899-203-2018
- ISO 124, Latex, rubber Determination of total solids content
- ISO 291, Plastics Standard atmospheres for conditioning and testing
- ISO 304, Surface active agents Determination of surface tension by drawing up liquid films
- ISO 489:1999, Plastics Determination of refractive index
- ISO 758, Liquid chemical products for industrial use Determination of density at 20°C
- ISO 1183-1, Plastics Methods for determining the density of non-cellular plastics Part 1: Immersion method, liquid pyknometer method and titration method
- ISO 2555, Plastics Resins in the liquid state or as emulsions or dispersions Determination of apparent viscosity by the Brookfield Test method
- ISO 2592, Petroleum and related products Determination of flash and fire points Cleveland closed cup method
- ISO 2719, Determination of flash point Pensky-Martens closed cup method
- ISO 2811-1, Paints and varnishes Determination of density Part 1: Pyknometer method

ISO 2811-2, Paints and varnishes – Determination of density – Part 2: Immersed body (plummet) method

ISO 2884-1, Paints and varnishes – Determination of viscosity using rotary viscometers – Part 1: Cone-and-plate viscometer operated at a high rate of shear

ISO 3219, Plastics – Polymers/resins in the liquid state or as emulsions or dispersions – Determination of viscosity using a rotational viscometer with defined shear rate

ISO 3251, Paints, varnishes and plastics – Determination of non-volatile-matter content

ISO 3664, Graphic technology and photography – Viewing conditions

ISO 3679, Determination of flash no-flash and flash point – Rapid equilibrium closed cup method

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 13655, Graphic technology — Spectral measurement and colorimetric computation for graphic arts images

ISO 14488, Particulate materials - Sampling and sample splitting for the determination of particulate properties

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ISO 14782, Plastics Determination of haze for transparent materials - a63e-

ISO 15212-1, Oscillation-type density meters - Part 1: Laboratory instruments

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62860 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

NOTE The terms in italic font are those defined in Clause 3.

3.1

semiconductive material

ingredient of a printing or coating material, which itself is electrically semiconductive

3.2

semiconductor ink

liquid in which one or more particles, small molecules or polymers are dissolved or dispersed, and which becomes an electrically *semiconductive layer* through solvent removal or post treatment such as UV, photonic, or thermal processing

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semiconductive layer

film-like semiconductive body of material made of semiconductor ink (3.2), which is printed or coated on a substrate, followed, as necessary, by using a post treatment such as UV, photonic, or thermal processing

3.4

semiconductor film

substrate (sheet or roll) with semiconductive layer (3.3)

3.5

solid content

mass fraction of an ingredient which effectively functions as a semiconductive material dissolved or dispersed in a solvent to form a semiconductor ink (3.2)

Note 1 to entry: In some instances the ink may include insulating materials, sometimes referred to as binders, or other additives included to improve the film formation during coating or printing.

3.6

non-volatile content

mass fraction of residue obtained by evaporation of the volatile solvent under specific conditions, in *semiconductor ink* (3.2)

3.7

dispersion

heterogeneous system in which fine separated materials are distributed uniformly in other materials (standards.iteh.ai)

3.8

flash point

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lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in quantity such as to be capable of forming an ignitable vapour/air mixture

[SOURCE: IEC 60050-212:2010, 212-18-05]

3.9

field effect mobility

majority carrier mobility of semiconductive material derived through the transfer curve measurement of a fabricated TFT device

Note 1 to entry: The field effect mobility is usually derived from either saturation or linear approximations.

Note 2 to entry: Field effect mobility is given in units of cm²/V·s.

3.10

thin-film transistor

TFT

switching device made from three electrodes (source, drain and gate) and semiconducting and insulating layers wherein potentials applied to a gate electrode modulate charge carriers on the opposite side of the insulating layer situated between the gate and semiconductive layer

Note 1 to entry: The change in charge density in the semiconductive layer changes its conductivity, and this in turn allows a modulation in current flow between the source and drain electrodes for a given source-drain potential difference.

Note 2 to entry: TFTs are found in a wide variety of electronic devices such as integrated circuits and display backplanes.