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# TECHNICAL SPECIFICATION

## Materials used in photovoltaic (PV) cells -
## Part 1: Specifications for electrical characteristics of crystalline silicon wafers

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IEC TS 63371-1 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

| Draft | Report on voting |
|---|---|
| 82/2523/DTS | 82/2563/RVDTS |

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

The language used for the development of this Technical Specification is English.

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This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63371 series, published under the general title *Materials used in photovoltaic (PV) cells*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

# INTRODUCTION

At the present time, while there are various test standards for each electrical characteristic, there is no relevant standard defining which test methods are to be used to characterize silicon wafers or bulk material. In most cases, the silicon wafer manufacturer decides what characteristics to provide according to their experience or by negotiation between the supplier and the customer. The purpose of this document is to establish a standardized specification for crystalline silicon wafers, defining their electrical characteristics, the applicable test methods, and the acceptable value ranges for those characteristics.

## 1 Scope

This part of IEC 63371 applies to crystalline silicon wafers for use as the substrates in making photovoltaic cells. It describes the methods for measuring the electrical characteristics of these silicon wafers. It does not provide mechanical information about these wafers. Annex A shows the widely accepted electrical characteristics values.

## 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.

SEMI MF42, *Test Method for Conductivity Type of Extrinsic Semiconducting Materials*

SEMI MF673, *Test Method for Measuring Resistivity of Semiconductor Wafers or Sheet Resistance of Semiconductor Films with a Noncontact Eddy-Current Gauge*

SEMI MF1535, *Test Method for Carrier Recombination Lifetime in Electronic-Grade Silicon Wafers by Noncontact Measurement of Photoconductivity Decay by Microwave Reflectance*

SEMI MF84, *Test Method for Measuring Resistivity of Silicon Wafers With an In-Line Four-Point Probe*

SEMI PV13, *Test Method for Contactless Excess-Charge-Carrier Recombination Lifetime Measurement in Silicon Wafers, Ingots, and Bricks Using an Eddy-Current Sensor*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

### 3.1

**conductivity type**

conductivity determined by the properties of majority carriers in the semiconductor materials

## 4 Sampling

### 4.1 Wafer measurement

The samples shall be processed in the following procedures after cutting: boiled in overflowing DI (deionized) water, boiled in cleaning agent, boiled in DI water, boiled in $H_2O_2$, boiled in overflowing and rinsing DI water, and dried for both n-type and p-type wafers. The samples shall be prepared with surface oxide and without obvious contamination, cracks or surface damage.