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Photovoltaic cells –
Part 4: Measurement of light and elevated temperature induced degradation of crystalline silicon photovoltaic cells

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IEC TS 63202-4 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
82/1994/DTS	82/2043/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.

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 https://www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at https://www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 63202 series, published under the general title *Photovoltaic 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- withdrawn,
- replaced by a revised edition, or
- amended.

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PHOTOVOLTAIC CELLS –

Part 4: Measurement of light and elevated temperature induced degradation of crystalline silicon photovoltaic cells

1 Scope

This part of IEC 63202 describes procedures for measuring the light and elevated temperature induced degradation (LETID) of crystalline silicon photovoltaic (PV) cells in simulated sunlight.

The requirements for measuring initial light induced degradation (LID) of crystalline silicon PV cells are covered by IEC 63202-1, where LID degradation risk of PV cells under moderate temperature and initial durations within termination criteria of 20 kWh·m^{-2} are evaluated.

Energy yield of PV modules is significantly affected by the inherent LETID performance of the PV cells, which are used in it. This LETID performance includes LID and other degradation mechanisms. The procedures described in this document are to evaluate the degradation behaviour of PV cells under elevated temperature and longer duration of light irradiation. The degradation rate, maximum degradation ratio and possible regeneration are determined by comparing the cell maximum power, P_{max}, at Standard Test Conditions (STC) during the light irradiation process with respect to the initial P_{max}. A P_{max} degradation profile with respect to cumulative irradiation is presented, which helps cell manufacturer to judge whether the cells are prone to LETID before being assembled into modules.

Different from some other standards which separate boron-oxygen induced LID from LETID or are limited to charge carrier injection induced degradation [1][1], the overall degradation under light irradiation at elevated temperature is included in the procedures described in this document. The overall degradation, determined using this procedure, is more relevant to various degradation mechanisms under field condition and gives a better evaluation of LETID risk. For cells with strong initial degradation within around 20 kWh·m^{-2}, the procedures to measure initial light induced degradation (LID) in IEC 63202-1 can be applied. Compared with module LETID detection method described in IEC TS 63342, higher injection level under open-circuit condition is used to shorten the test duration, while the temperature is identical.

The procedures described in this document can be used to detect the LETID risks of PV cells [2],[3] and to judge the effectiveness of LETID mitigation measures, e.g. quick test for production monitoring, thus helping improve the energy yield of PV modules.

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 60904-1, *Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics*

IEC 60904-2, *Photovoltaic devices – Part 2: Requirements for photovoltaic reference devices*

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1 Numbers in square brackets refer to the Bibliography.

IEC 60904-9, *Photovoltaic devices – Part 9: Classification of solar simulator characteristics*

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 63202-1:2019, *Photovoltaic cells – Part 1: Measurement of light-induced degradation of crystalline silicon photovoltaic cells*

IEC TS 63202-2:2021, *Photovoltaic cells – Part 2: Electroluminescence imaging of crystalline silicon solar cells*

IEC TS 63342*, Light and elevated temperature induced degradation (LETID) test for c-Si Photovoltaic (PV) modules: Detection*