IEC 62788-1-6

Edition 1.1 2020-05

FINAL VERSION

VERSION FINALE

colour inside

Measurement procedures for materials used in photovoltaic modules – Part 1-6: Encapsulants – Test methods for determining the degree of cure in Ethylene-Vinyl Acetate

Procédures de mesure des matériaux utilisés dans les modules photovoltaïques –
Partie 1-6: Encapsulants – Méthodes d'essai pour déterminer le degré de durcissement dans l'éthylène acétate de vinyle

IEC 62788-1-6:2017-09/AMD1:2020-05 CSV(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

MEASUREMENT PROCEDURES FOR MATERIALS USED IN PHOTOVOLTAIC MODULES –

Part 1-6: Encapsulants – Test methods for determining the degree of cure in Ethylene-Vinyl Acetate

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.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62788-1-6 edition 1.1 contains the first edition (2017-01) [documents 82/1197/FDIS and 82/1231/RVD] and its amendment 1 (2020-05) [documents 82/1691/FDIS and 82/1720/RVD].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 62788-1-6 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

A list of all parts in the IEC 62788 series, published under the general title *Measurement procedures for materials used in photovoltaic modules*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

MEASUREMENT PROCEDURES FOR MATERIALS USED IN PHOTOVOLTAIC MODULES –

Part 1-6: Encapsulants – Test methods for determining the degree of cure in Ethylene-Vinyl Acetate

1 Scope

This part of IEC 62788 defines the terminology, test equipment, test environment, specimen preparation, test procedures, and test report for measuring the degree of cure of Ethylene-Vinyl Acetate (EVA) encapsulation sheet used in photovoltaic (PV) modules. The differential scanning calorimetry (both residual enthalpy and melt/freeze protocols) and gel content methods are included herein. This procedure can be used by material- or module-manufacturers to verify that the cross-linking additive is present and is active. The procedure can also be used to verify the module manufacturing (lamination) process for the purposes of quality- and process-control. The procedure can also be used to assess the uniformity of the EVA formulation within a roll as well as to compare variation of the EVA formulation from roll to roll. This procedure can be applied to uncured or recently cured EVA sheet as well as uncured or recently cured EVA from PV modules.

This test procedure can also be applied to cross-linking ethylene co-polymers other than EVA. The temperatures identified for the calorimetry measurements in this procedure have been optimized for EVA. Therefore, if the test procedure is applied to other encapsulation materials, the range of the test temperatures can have to be adjusted based on the active temperature of the curing agent and/or the melt/freeze temperature of the base material.

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 61215-1, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements*

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

ISO 291:2008, *Plastics – Standard atmospheres for conditioning and testing*

ISO 6427:2013, *Plastics – Determination of matter extractable by organic solvents (conventional methods)*

ISO 6721-1, *Plastics – Determination of dynamic mechanical properties – Part 1: General principles*

ISO 11357-1:2009, *Plastics – Differential scanning calorimetry (DSC) – Part 1: General principles*

ISO 10147:2011, *Pipes and fittings made of crosslinked polyethylene (PE-X) – Estimation of the degree of cross-linking by determination of the gel content*