

FINAL VERSION

VERSION FINALE



**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**

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Principle	8
5 DSC secondary method	8
5.1 Instrument and equipment for the secondary method	8
5.1.1 General	8
5.1.2 Electronic balance	8
5.1.3 Differential scanning calorimeter	8
5.1.4 Instrument calibration	9
5.2 Specimen preparation for the secondary method	9
5.2.1 Sampling and storage	9
5.2.2 Preparation procedures	9
5.3 Test requirements for the secondary method	10
5.3.1 Environment requirements	10
5.3.2 Parameter settings (residual enthalpy method)	10
5.3.3 Parameter settings (melt/freeze method)	10
5.3.4 Parameter settings (combined enthalpy and melt/freeze method)	10
5.4 Test procedure for the secondary method	11
5.5 Calculation and expression of the result for the secondary method	11
5.5.1 Enthalpy method	11
5.5.2 Melt/freeze method	12
5.6 Uncertainty of measurements for the secondary method	16
6 The primary method	16
6.1 Principle for the primary method	16
6.2 Instrument and equipment for the primary method	17
6.2.1 Electronic balance	17
6.2.2 Soxhlet extractor	17
6.2.3 Thimble	17
6.2.4 Heating apparatus	17
6.2.5 Handling apparatus	18
6.2.6 Solvent	18
6.3 Specimen preparation for the primary method	18
6.3.1 Sampling and storage	18
6.3.2 Preparation procedures	18
6.4 Test requirements for the primary method – Environment requirements	19
6.5 Test procedure for the primary method	19
6.6 Calculation and expression of the results for the primary method	19
7 Test report	19
8 Indentation secondary method	20
8.1 General	20
8.2 Principle	21
8.3 Instrument and equipment for the indentation method	21
8.4 Instrument calibration	22

8.5	Correlation of the degree of cure.....	22
8.6	Specimen preparation for the indentation method	22
8.7	Test procedure for the indentation method	23
Annex A (informative) Limitations of the primary and secondary measurement methods.....		24
Bibliography.....		26
Figure 1 – Example result for the DSC residual enthalpy method		12
Figure 2 – Location of temperatures and temperature ranges used in the melt/freeze DSC method		13
Figure 3 – Example of the temperature bounds applied for an automated software integration algorithm		15
Figure 4 – Representation of the measurement profile for an EVA test specimen.....		16
Figure 5 – Example of the correlation applied between G_i (indentation) and G_g (gel content)		22
Table 1 – Summary of the results for the example measurements shown in Figure 2		14

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

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IEC 62788-1-6 edition 1.1 contains the first edition (2017-01) [documents 82/1197/FDIS and 82/231/RVD] and its amendment 1 (2020-05) [documents 82/1691/FDIS and 82/1700/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.

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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.

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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*