IEC 62788-1-4

Edition 1.0 2020-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Measurement procedures for materials used in photovoltaic modules – Part 1-4: Encapsulants – Measurement of optical transmittance and calculation of the solar-weighted photon transmittance, yellowness index, and UV cut-off wavelength

Procédures de mesure des matériaux utilisés dans les modules photovoltaïques – Partie 1-4: Encapsulants – Mesurage du facteur de transmission optique et calcul du facteur de transmission photonique à pondération solaire, de l'indice de jaunissement et de la fréquence de coupure des UV

IEC 62788-1-4:2016-09/AMD1:2020-10(en-fr)

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FOREWORD

This amendment has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this amendment is based on the following documents:

FDIS	Report on voting
82/1767/FDIS	82/1791/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website 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- withdrawn,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.

1 Scope

In the second sentence of the second paragraph, replace:

around the edges

by:

at the periphery

4 Principle

In the last sentence, replace:

concentration

by:

optical concentration

6.1 Nominal (and unweathered) transmittance to the cell

In the fifth paragraph, replace:

The nominal thickness of the encapsulation specimens

by:

The nominal thickness of the encapsulant specimens

6.2 Weathering studies

Replace the existing third paragraph by the following:

The minimum size of 7,5 cm × 7,5 cm is recommended for weathering specimens based on previous examinations of poly (ethylene-co-vinyl acetate).

In the eighth paragraph, replace:

The nominal thickness of the encapsulation specimens

by:

The nominal thickness of the encapsulant specimens

6.3 Glass for superstrates/substrates

Replace the existing second paragraph by the following:

The solar-weighted transmittance of photon irradiance of silica glass, which may be used to verify that the composition of the glass is appropriate, is approximately (93 ± 1) % between 280 nm and 2 500 nm, because the reduction in transmittance comes from reflections at the surfaces. The UV cut-off wavelength for silica should be less than 225 nm. As in [1] and [12], the transmittance of the glass should be greater than 90 % at 280 nm.

Replace the existing fourth paragraph by the following:

Subsequent examination beyond that intended for the encapsulation material datasheet (including performance and weathering), such as for the purpose of quality control for production monitoring, may be performed according to this procedure using other superstrate and/or substrate materials that can incorporate other optical features, e.g., antireflective coatings, surface texture, and untempered soda-lime PV glass.

Add, at the end of the subclause, the following:

The process of solarization, where a redox reaction of trace impurities affects the UV cut-off wavelength and corresponding range of transmittance, can occur if glass other than silica is used [14]. It is therefore advised for weathering studies to UV condition substrate and superstrate materials, other than silica, prior to lamination.

NOTE Silica glass is more durable than soda-lime glass and will better resist glass corrosion in accelerated tests.

6.5 Preconditioning of specimens

In the title of the subclause, replace:

preconditioning

by

conditioning

In the first sentence, replace:

(23 ± 2) °C, (50 ± 5) % RH for at least 24 h, as recommended in ISO 291, prior to optical measurement.

by:

(23 ± 2) °C, (50 ± 10) % RH for at least 24 h, as specified per Class 2 in ISO 291, prior to optical measurement.

7.2 Specimen preparation

Replace the first sentence by the following:

Prior to measurement, specimens should be free of dust, grease or other contaminants. Specimens may be wiped with a solution of deionized water and mild soap for cleaning prior to measurement using a cleanroom wipe or lint free cloth.

7.4 Specimen measurements

In the first sentence of the fourth paragraph, replace:

durability

by:

weathering durability

7.5 Witness measurements

Add the following new subclause:

7.5.1 Witness specimen(s)

The witness specimens may include a traceable standard specimen, laboratory working witness specimen, or the silica superstrate/substrate material. Witness specimen(s) for control measurements may also include a non-weathered glass working witness specimen of the same construction used in module representative test specimen(s) or reference (glass or polymeric superstrate) specimen(s). When not being used for control measurements, a working witness specimen shall be stored in the dark at 23 °C and 50 % humidity as specified per Class 2 in ISO 291.

7.5.2 Procedure for the witness specimen prior to the test specimen(s)

After instrument equilibration and baselining, perform the transmittance measurements on a witness specimen at the beginning of each measurement session to ensure proper operation of the instrument and minimize the measurement error. Perform the transmittance measurements of the witness specimen using the same procedure that will be applied to the test specimen(s).

The verification wavelengths for the working reference shall be ± 50 nm from the instrument transitions for the source, detector, and gratings. Because of the limitations of measurement, including noise from scattering at short wavelengths, the verification wavelengths shall not extend below 225 nm. In the case of many commercial instruments where the source, detector, and grating transitions occur at 350 nm, 800 nm, and 800 nm, respectively, the verification wavelengths should include the ranges 250 nm to 300 nm, 400 nm to 750 nm and 850 nm to 2500 nm (in the case of standard measurements) or 225 nm to 300 nm, 400 nm to 750 nm and 850 nm to 2 500 nm (in the case of measurements of weathered specimens).

The transmittance at each of the verification wavelengths should be within 0,25 % of the known transmittance (or laboratory running average) for the witness specimen. If the transmittance at each verification wavelength is not within 0,25 % of the known transmittance, the instrument baseline shall be performed again (including as many as three times) and the witness specimen shall be remeasured. If the transmittance at each wavelength continues to be greater than 0,25 % of the known transmittance, the instrument should be maintenanced or repaired.

7.5.3 Measurement of the test specimen(s)

After the witness specimen has been verified, the test specimen(s) shall be measured.

7.5.4 Procedure for the witness specimen after the test specimen(s)

After the test specimen(s) have been measured, perform the transmittance measurements on a witness specimen at the end of each measurement session to ensure proper operation of the instrument through the measurement session. Perform the transmittance measurements of the witness specimen using the same procedure that will be applied to the test specimen(s). The transmittance at each of the verification wavelengths should be within 0,25 % of the known transmittance (or laboratory running average) for the witness specimen. If the transmittance at each verification wavelength is not within 0,25 % of the known transmittance, the measured data for the test specimen(s) shall be considered invalid and the test specimen(s) shall be measured again in a subsequent session.

8.1 Post-processing of data

Replace the last sentence by the following:

The variability shall be reported for each characteristic (weighted transmittance, yellowness index, and UV cut-off wavelength) as the range (difference of the maximum and minimum measurements) for the three specimens.

8.4 Calculation of the UV cut-off wavelength

In the first sentence, replace:

(to the nearest nm)

by:

(linearly interpolated to the nearest tenth of a nm)

10 Test report

Item f)

Replace:

characterization and condition

by:

characterization and state

and replace:

preconditioning

by:

conditioning

Item j)

Replace:

preconditioning

by:

conditioning

Bibliography

Replace:

[14] C.G. Reid, J.G. Bokria, J.T. Woods, UV aging and outdoor exposure correlation for EVA PV encapsulants, Proc. SPIE, 8825, 2013

by:

[14] W. Thiemsorn, K. Keowkamnerd, S. Phanichphant, P. Suwannathada, H. Hessenkemper, "Influence of glass basicity on redox interactions of iron-manganese-copper ion pairs in soda-lime-silica glass", *Glass Phys. Chem*., 34 (2008), 19-29