

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Materials for printed boards and other interconnecting structures –  
Part 4-19: Sectional specification set for prepreg materials, unclad (for the  
manufacture of multilayer boards) – High performance non-halogenated epoxide  
woven E-glass prepreg of defined flammability (vertical burning test) for lead-  
free assembly**

<https://standards.iteh.ai/catalog/standards/sist/14a9a528-e0c4-417c-8563-0f982fc54db5/iec-61249-4-19-2013>

**Matériaux pour circuits imprimés et autres structures d'interconnexion –  
Partie 4-19: Série de spécifications intermédiaires pour matériaux préimprégnés,  
non plaqués (pour la fabrication des cartes multicouches) – Tissu de verre  
époxyde préimprégné non halogéné de type E à haute performance,  
d'inflammabilité définie (essai de combustion verticale), pour les assemblages  
sans plomb**



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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

N

ICS 31.180

ISBN 978-2-8322-1167-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MATERIALS FOR PRINTED BOARDS  
AND OTHER INTERCONNECTING STRUCTURES –**

**Part 4-19: Sectional specification set for prepreg materials,  
unclad (for the manufacture of multilayer boards) –  
High performance non-halogenated epoxide woven E-glass prepreg  
of defined flammability (vertical burning test) for lead-free assembly**

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

FDIS	Report on voting
91/1126/FDIS	91/1148/RVD

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

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

A list of all parts of the IEC 61249 series, under the general title *Materials for printed boards and other interconnecting structures*, can be found on the IEC website.

The committee has decided that the contents of this publication 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

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## MATERIALS FOR PRINTED BOARDS AND OTHER INTERCONNECTING STRUCTURES –

### Part 4-19: Sectional specification set for prepreg materials, unclad (for the manufacture of multilayer boards) – High performance non-halogenated epoxide woven E-glass prepreg of defined flammability (vertical burning test) for lead-free assembly

#### 1 Scope

This part of IEC 61249 gives requirements for properties of prepreg that is mainly intended to be used as bonding sheets in connection with laminates according to IEC 61249-2-40 when manufacturing multilayer boards according to IEC 62326-4. Multilayer boards comprised of these materials are suitable for lead-free assembly processes. This material may be also used to bond other types of laminates.

Prepreg according to this standard is of defined flammability (vertical burning test). The flammability rating on fully cured prepreg is achieved through the use of non-halogenated fire retardants contained as an integral part of the polymeric structure. After curing of the prepreg according to the supplier's instructions, the glass transition temperature is defined to be 170 °C minimum.

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#### 2 Normative references

[IEC 61249-4-19:2013](#)

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61189-2:2006, *Test methods for electrical materials, interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 61249-2-40, *Materials for printed boards and other interconnecting structures – Part 2-40: Reinforced base materials clad and unclad – High performance, non-halogenated epoxide woven E-glass laminate sheets of defined flammability (vertical burning test), copper-clad for lead-free assembly*

IEC/PAS 61249-6-3:2011, *Materials for printed boards and other interconnecting structures – Part 6-3: Reinforcements – Woven fibreglass fabrics*

ISO 9000:2005, *Quality management systems – Fundamentals and vocabulary*

ISO 11014:2009, *Safety data sheet for chemical products – Content and order of sections*

ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*

#### 3 Materials and construction

##### 3.1 General

The prepreg consists of a reinforcing E-glass fabric which is impregnated with high performance, non-halogenated epoxide resin, partially cured to the B-stage. The flammability



rating is achieved through the use of non-halogenated flame retardants reacted into the polymer. Inorganic fillers may be used. Contrast agents may be added to enhance processing such as automated optical inspection (AOI).

Its flame resistance is defined in terms of the flammability requirements of 4.3.2.

### 3.2 Reinforcement

Woven E-glass as specified in IEC/PAS 61249-6-3: woven E-glass fabric (for the manufacture of prepreg and copper-clad laminate).

### 3.3 Resin system

High performance, non-halogenated epoxide with a glass transition temperature after curing according to the manufacturer's instructions of 170 °C minimum. The flammability rating is achieved through the use of non-halogenated flame retardants reacted into the polymer. Inorganic fillers may be used. Contrast agents may be added to enhance processing such as automated optical inspection (AOI). The maximum total halogens contained in the resin plus reinforcement matrix is 1 500 ppm with a maximum chlorine of 900 ppm and maximum bromine being 900 ppm.

## 4 Properties

### 4.1 Properties related to the appearance of the prepreg

#### 4.1.1 General

The prepreg shall be substantially free from defects that may have an impact on the material's fitness for use for the intended purpose. IEC 61249-4-19:2013

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For the following specific defects the requirements given shall apply when inspection is made in accordance with IEC 61189-2 test method 3V01.

#### 4.1.2 Dewetted areas (fish eyes)

Dewetted areas with a diameter > 10 mm are not permissible.

Dewetted areas with a diameter ≤ 10 mm are permitted to an extent of a maximum 10 fish eyes in any 300 mm × 300 mm area of the prepreg.

#### 4.1.3 Broken filaments

When judging the presence of broken filaments their sizes and frequency of occurrence are important for assessing acceptability but also the flow characteristic of the prepreg shall be taken into consideration. The acceptance conditions for broken filaments shall be as agreed upon between the user and supplier.

#### 4.1.4 Distortion

When the prepreg is tested in accordance with test method 2M29 (under consideration) of IEC 61189-2, the distortion or non-perpendicular orientation of the fill or weft yarns in the glass fabric shall not exceed 10 % measured over any 300 mm test distance.

#### 4.1.5 Creases

Creases caused by handling of the prepreg where only a negligible loss of resin has occurred are permitted.

Creases where the glass yarns are exposed due to loss of resin are not permitted.

#### 4.1.6 Edge conditions

Cut-to-size panels shall have even edges and shall not show loss of resin at the edge due to the cutting process more than 2 mm. Excessive occurrence of resin dust released during the cutting shall be removed before packaging for shipment.

### 4.2 Properties related to B-stage prepreg

#### 4.2.1 General

A number of characteristics can describe thickness, reactivity and rheology of B-stage prepreg. The choice of characteristics to be used as qualification and quality conformance testing as well as the nominal performance levels are as agreed upon between the user and supplier.

Several of the characteristics shown below are interrelated and should not be specified individually. Ordering requirements should preferably be restricted to the glass style, one characteristics marked (a) in combination with one characteristic marked (b). A maximum of one optional characteristic (c) of B-stage prepreg may be included.

Glass style

Thickness parameter **iTeh STANDARD PREVIEW**

- Resin content (a)
- Treated weight (a)

Reactivity/rheology parameter <https://standards.iteh.ai/catalog/standards/sist/14a9a528-e0c4-417c-8563-0f982fc54db5/iec-61249-4-19-2013>

- Resin flow (b)
- Scaled flow thickness (b)
- Melt viscosity (b)
- Cured thickness (b)

Optional parameter

- Volatile content (c)
- Gel time (c)

#### 4.2.2 Resin content

When tested in accordance with test method 2C03 or 2C10 of IEC 61189-2, the nominal resin content shall be as agreed upon between the user and supplier.

The tolerance around the ordered nominal value shall be  $\pm 3$  %, e.g.,  $(45 \pm 3)$  %.

#### 4.2.3 Treated weight

When tested in accordance with test method 2C03 of IEC 61189-2, the nominal treated weight shall be as agreed upon between the user and supplier.

The tolerance around the ordered nominal value shall be  $\pm 3$  %, e.g.  $(350 \pm 10,5)$  g.

#### 4.2.4 Resin flow

When tested in accordance with test method 2M09 of IEC 61189-2, the nominal resin flow shall be as agreed upon between the user and supplier.

The tolerance around the ordered nominal value shall be  $\pm 5\%$ , e.g.,  $(25 \pm 5)\%$ .

#### 4.2.5 Scaled flow thickness

When tested in accordance with test method 2M26 of IEC 61189-2, the nominal scaled flow and the tolerance shall be as agreed upon between the user and supplier.

#### 4.2.6 Melting viscosity

When tested in accordance with test method 2C09 of IEC 61189-2, the nominal melt viscosity shall be as agreed upon between the user and supplier.

The tolerance around the ordered nominal value shall be  $\pm 20$  mPa·s, e.g.,  $(240 \pm 20)$  mPa·s.

#### 4.2.7 Gel time

When tested in accordance with test method 2C02 of IEC 61189-2, the nominal gel time shall be as agreed upon between the user and supplier.

The tolerance around the ordered nominal value shall be  $\pm 20$  s, e.g.,  $(160 \pm 20)$  s.

#### 4.2.8 Volatile content

When tested in accordance with test method 2C04 of IEC 61189-2, the volatile content shall be 0,5 % maximum.

### 4.3 Properties related to prepreg after curing

#### 4.3.1 Electric strength

A total of 2 plies of prepreg of minimum size 300 mm × 300 mm shall be bonded together and cured in accordance with the manufacturer's recommendations whereupon the thickness shall be determined using a micrometer.

When tested in accordance with test method 2E11 of IEC 61189-2, the minimum electric strength shall be 25 V/μm.

#### 4.3.2 Flammability

A number of plies of minimum size 300 mm × 300 mm of the prepreg under test shall be bonded together and cured in accordance with the manufacturer's recommendations. The number of plies shall be chosen so that a specimen thickness of approximately 0,4 mm to 0,5 mm is obtained as measured with a micrometer.

When tested in accordance with test method 2C06 of IEC 61189-2, the flammability shall be as shown in Table 1.

**Table 1 – Flammability, vertical burning test**

Property	Test method (61189-2)	Requirement
		Designation
		FV-0
Flammability	2C06	
Flaming combustion time after each application of the flame for each test specimen		≤ 10 s
Total flaming combustion time for the 10 flame applications for each set of five specimens		≤ 50 s
Glowing combustion time after the second removal of the test flame		≤ 30 s
Flaming or glowing combustion up to the holding clamp		None
Dripping flaming particles that ignite the tissue paper		None

**4.3.3 Relative permittivity and dissipation factor**

A total of 2 plies of prepreg of minimum size 300 mm × 300 mm shall be bonded together and fully cured in accordance with the manufacturer’s recommendations whereupon the thickness shall be determined using a micrometer.

When tested in accordance with test method 2E10 of IEC 61189-2, the relative permittivity and dissipation factor at 1 MHz shall be 5,4 and 0,035 maximum respectively.

**4.3.4 Cured thickness**

The nominal thickness and the tolerance of the cured prepreg using the user’s lamination cycle shall be as agreed upon between the user and supplier. The test method shall be as agreed upon between the user and supplier.

**4.3.5 Glass transition temperature ( $T_g$ )**

The glass transition temperature of the cured prepreg using the user’s lamination cycle shall be 170 °C minimum as determined by test method 2M03 or 2M10 of IEC 61189-2.

**4.3.6 Decomposition temperature ( $T_d$ )**

The requirement for decomposition temperature is found in Table 2.

**Table 2 – Decomposition temperature requirements**

Property	Test method (IEC 61189-2)	Requirement
Decomposition temperature	2MXX <sup>a</sup>	≥ 340 °C
<sup>a</sup> Under consideration.		

**4.3.7 Time to delamination**

The requirements for time to delamination are found in Table 3. The temperature of each test may be found in the column labelled “property”.