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SLOVENSKI STANDARD
oSIST prEN IEC 61189-2-805:2022

01-januar-2022

Preskusne metode za električne materiale, tiskana vezja in druge povezovalne strukture in sestave - 2-805. del: Preskus X/Y CTE s termomehansko analizo (TMA) za tanke podložne materiale

Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 2-805: X/Y CTE Test for Thin Base Materials by TMA

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Méthodes d’essai pour les matériaux électriques, les cartes imprimées et autres structures d’interconnexion et ensembles - Partie 2-805: Essai à faible CDT X/Y par TMA pour matériaux de base minces

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Ta slovenski standard je istoveten z: **prEN IEC 61189-2-805:2021**

ICS:

31.180	Tiskana vezja (TIV) in tiskane plošče	Printed circuits and boards

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91/1755/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

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IEC TC 91 : ELECTRONICS ASSEMBLY TECHNOLOGY	
SECRETARIAT: Japan	SECRETARY: Mr Masahide Okamoto
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☐ SAFETY

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TITLE:

Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 2-805: X/Y CTE Test for Thin Base Materials by TMA

PROPOSED STABILITY DATE: 2027

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Test methods for electrical materials, printed board and other interconnection structures and assemblies–

Part 2-805: X/Y CTE Test for Thin Base Materials by TMA

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International Standard IEC 61189-2-805 has been prepared by subcommittee WG 10 of IEC technical committee TC 91

The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

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

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75 The committee has decided that the contents of this document will remain unchanged until the
76 stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to
77 the specific document. At this date, the document will be

78 • reconfirmed,

79 • withdrawn,

80 • replaced by a revised edition, or

81 • amended.

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Test methods for electrical materials, printed board and other interconnection structures and assemblies–

Part 2-805: X/Y CTE Test for Thin Base Materials by TMA

1 Scope

This part of IEC 61189 defines the method to be followed for the determination of the X/Y coefficient of thermal expansion of thin electrical insulating materials via the use of a thermomechanical analyser (TMA). This method is applicable to materials that are solid for the entire range of temperature used, and that retain sufficient rigidity over the temperature range so that so that irreversible indentation of the specimen by the sensing probe does not occur.

2 Normative references

IEC 60194, Printed board design, manufacture and assembly – Terms and definitions.

IPC-TM-650 Test Method 2.4.24.5 - Glass Transition Temperature and Thermal Expansion of Materials Used In High Density Interconnection (HDI) and Microvias -TMA Method

3 Terms and definitions

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For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Test Specimens

4.1 Preparation

The test specimen shall be between 0.01 and 0.5 mm thick. The effective length of the sample clamped in the fixture shall be “8 mm” and the recommended length of the sample is 60 mm, The sample width shall be “4 mm”.

Note: The test results will vary based upon the layup used, the resin to glass ratio and the ultimate cure of the laminated stack.

4.2 Number

One specimen shall be prepared unless noted otherwise for each direction X and Y.

4.3 Form

The test specimen shall be cut to the specified size using appropriate procedures and equipment to minimize thermal shock and mechanical stress. The edges shall be smooth and without tears.

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124 **4.4 Conditioning**

125 The specimens shall be preconditioned by baking for one hour ± 15 minutes.

126 After removal from the oven, the specimens shall be allowed to cool to room temperature
127 in a desiccator or drying cabinet capable of maintaining an atmosphere less than 30% RH
128 at 23°C.

129

130 ## 5 Apparatus and Materials

131 a) Thermomechanical Analyzer (TMA) capable of detecting dimensional change to within
132 ± 0,00250 mm margin over the specified temperature range. It is desirable to have a
133 TMA comprised of a data acquisition and analysis system as well as the thermal cell.
134 The TMA must have an environmental chamber capable of holding pure flush gas and
135 an ultimate temperature of 350°C.

136 b) Drying Chamber: Air Circulating Oven capable of maintaining 105 ± 2°C.

137 c) Desiccator of low humidity: drying cabinet capable of maintaining less than 30% relative
138 humidity at 23°C.

139 d) Specimen preparation: Etching system capable of complete removal of the metallic
140 cladding.

141

142 ## 6 Procedure

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143 a) Metal-clad samples shall be tested without the cladding. Etch and dry the samples using
144 appropriate procedures and equipment.

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145 b) Calibrate of the TMA instrument should be carried out according to the manufacturer's
146 instructions.

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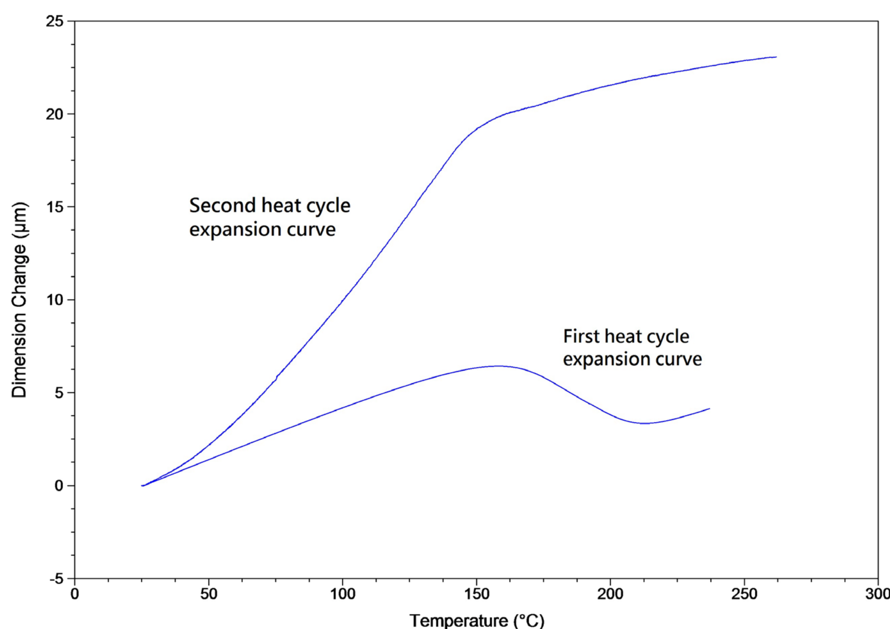
147 c) Remove the specimen from the desiccator and place the specimen using the thin film
148 fixture clamp of the TMA stage. The first test should be with the sample oriented in the
149 "X" direction.



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151 **Figure 1 – TMA expansion curves: first heat cycles and second heat cycles**

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152

153 d) Apply 0.03N of tension force and enclose the specimen.

154 e) Start a pure gas purge at the rate of 30-150 ml/min to the environmental chamber.

155 f) Start the temperature ramp (or scan) from room temperature or other specified
156 temperature.

157 g) Depending on the sample preparation, two heating cycles may be required to obtain
158 accurate CTE information. If the samples show unexpected shrinkage (see Figure 1),
159 the two heat test method is required. If need two heating cycles, perform procedure h)
160 i) j), if just scan once, perform procedure j). The heating rate shall be conducted at 10°C/
161 minute for both cycles.

162 h) The temperature excursion of first scan shall be until a temperature of 20°C above the
163 glass transition temperature (Tg) is observed. Hold the temperature for a minimum of 5
164 minutes or until the thermal relaxation has stopped. Avoid holding the temperature for
165 too long so as to avoid degradation of the specimen.

166 i) Cool the specimen to the initial temperature at 5-10°C / minute.

167 j) Repeat the procedure for the second heat cycle. The second heat cycle should end at
168 the temperature as specified.

169

170 ## 7 Evaluation

171 The TMA expansion curve should resemble the plot shown in Figure 2.

172

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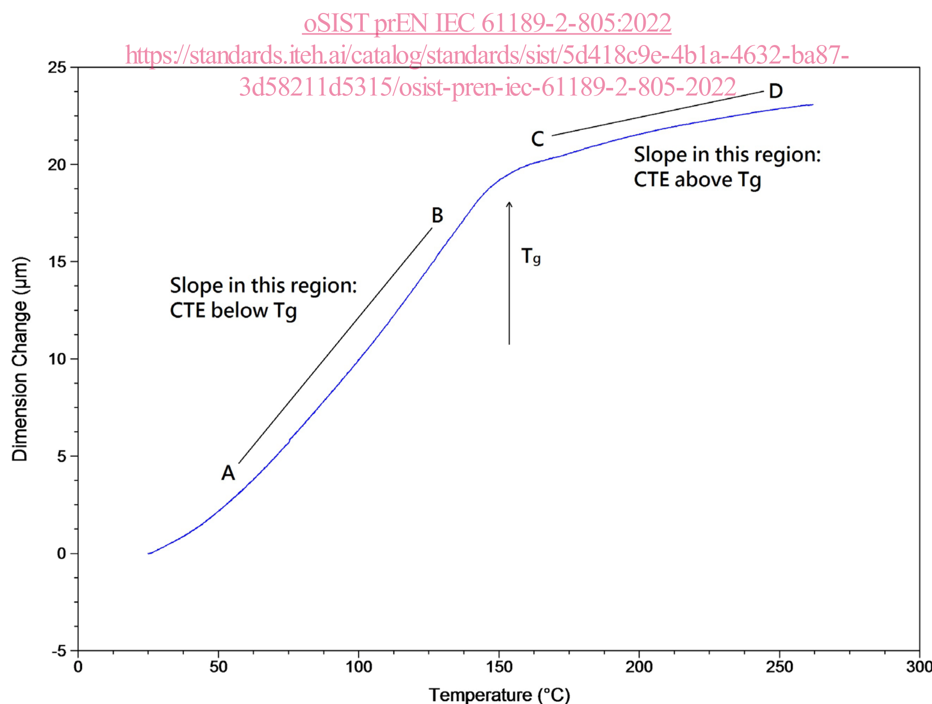

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174 **Figure 2 – TMA expansion curve**

175

176 An ideal TMA curve has a linear section below the Tg and a linear section above the Tg. The
177 software of the TMA may provide a more normalized result by averaging the data.

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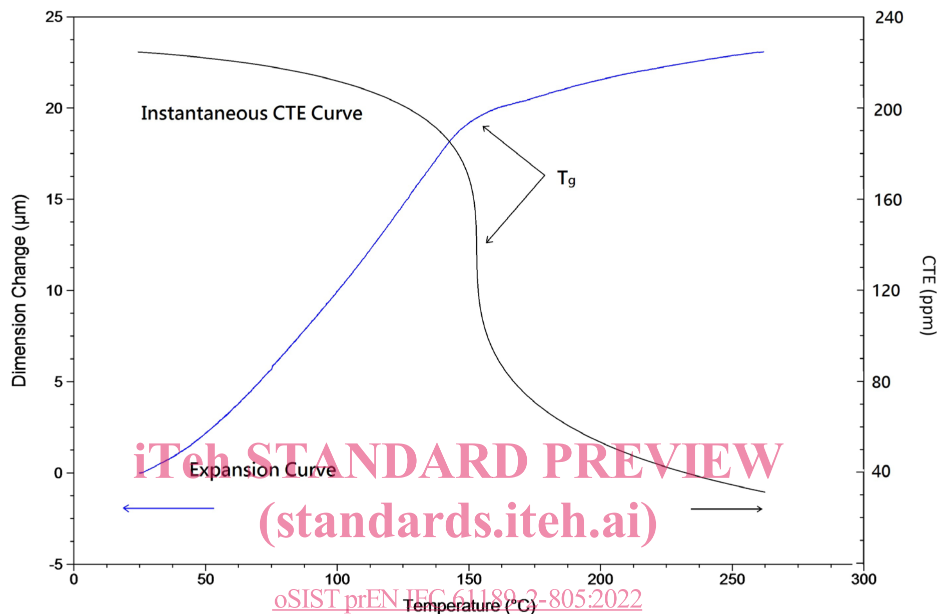
178 Examine all the specimens for signs of excessive loads, distortions, tears and other defects. If
179 any defects or specimen irregularities are found, discard the specimen and start over.

180 The analysis has to be repeated on the Y specimen. In most modern TMA instruments, the
181 calculations are handled by the system software.

182



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183

184 **Figure 3 – TMA expansion curve and instantaneous CTE curve**

185

186 7.1 Calculation of coefficient of thermal expansion curve

187 The average coefficient of thermal expansion α over the temperature interval of interest is
188 calculated as follows:

189 a) CTE below glass transition

190
$$\alpha_{(B-A)} = \frac{(C_B\text{-}C_A)10^6}{L_0(T_B\text{-}T_A)}$$

191 For most materials, this will be the range of 7ppm to 50 ppm (reinforced) or 30 ppm to 150
192 ppm (unreinforced)

193 b) CTE above glass transition

194
$$\alpha_{(D-C)} = \frac{(C_D\text{-}C_C)10^6}{L_0(T_D\text{-}T_C)}$$

195 For most materials, this will be the range of 50 ppm to 100 ppm (reinforced) or 150 ppm to
196 500 ppm (unreinforced). Any reinforced materials, where the reinforcement has negative
197 CTE, will shrink rather than expand when heated above Tg of the resin.

198 Where:

199 T_A = Temperature at point A in Figure 2

200 T_B = Temperature at point B in Figure 2