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Testing Method of Laminated Glass Interlayer Shear Modulus

夹层玻璃中间层材料剪切模量的测量方法

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Foreword

This Standard was drafted as per the rules specified in GB/T 1.1-2009.

This Standard was proposed by China Building Material Federation.

This Standard shall be under the jurisdiction of National Technical Committee for Standardization of Industrial Glass and Special Glass (SAC/TC 447).

Drafting organizations of this Standard: China Building Material Test & Certification Group Co., Ltd., Dupont China Holding Co., Ltd., and National Security Glass and Quartz Glass Quality Direct Examination Center.

Chief drafting staffs of this Standard: Zhang Congcong, Wang Lichuang, Zhou Zhen, Zhou Chunhua, Huang Xiaolou, Han Song, Maio Xiangyang, Bao Ji, Liu Jing, Liu Sheng, Liu Haitao, Zuo Huixia, Chen Lin, Zhang Jingling, Ding Zuoxin, and Zhang Rui.

Testing Method of Laminated Glass Interlayer Shear Modulus

1 Scope

This Standard specifies the terms and definitions, test device, specimen, test procedures, data analysis and test report of laminated glass interlayer shear modulus (*G*).

This Standard is applicable to the measurement of Polybutylene Butyral (PVB), Ethylene Vinyl Acetate Copolymer (EVA), laminated glass interlayer shear modulus including ionic interlayer film, and the measurement of other visoelastic material shear modulus can refer to this Standard.

2 Terms and Definitions

The following terms and definitions are applicable to this document.

2.1 Young's complex modulus

When material is in the elastic limit, the ratio between normal stress and normal strain, which is expressed by E^* in MPa.

NOTE: Young's complex modulus consists of real Young's storage modulus (expressed by E' in MPa) and imaginary Young's storage modulus (expressed by E'' in MPa); i.e.: $E^* = E' + iE''$, thereof i is the imaginary unit. The Yong's storage modulus indicates the energy stored by visoelastic material during the deformation due to elastic deformation. The Young's loss modulus indicates the energy loss of the visoelastic material during the deformation due to plastic deformation (irreversible).

2.2 Shear modulus

When material is in the elastic limit, the ratio between shear stress and shear strain, which is expressed by *G* in MPa.

2.3 Poisson's ratio

When material is dragged or compressed in one direction, the ratio between the absolute value of transverse positive strain and absolute value of axial positive strain, which is expressed by μ.

5.4 According to the tensile mode shown in Figure 1, measure it from the low to high temperature; obtain the original data: the Young's storage modulus E' and Young's loss modulus E'' of specimen under different temperature and different loading period.

5.5 Open the liquid nitrogen supply device for cooling till reach the lower limit of the set temperature.

6 Data Analysis

6.1 Analyze the original data obtained from 5.4, then draw the time-temperature equivalent principal curve for the interlayer material at different temperature.

6.2 According to the different temperature and time principal curve data, adopt linear interpolation method to select, on the principal curve, the Young's complex modulus value with corresponding temperature and load cycle. Prepare the table of Young's complex modulus corresponding to time and temperature, see Table A.1.

6.3 Use the mathematical relationship formula (1) among Shear Modulus *G*, Young's Complex Modulus *E**, and Poisson's Ratio μ, and calculate the Shear Modulus G of interlayer material. Obtain the table of shear modulus corresponding to time and temperature, see Table A.2.

$$G = \frac{E^*}{2 \times (1 + \mu)} \qquad \cdots\cdots (1)$$

NOTE: in the range of -40°C~80°C, the Value-μ of PVB, EVA and ionic interlayer film can be regarded as Constant 0.5.

7 Test Report

The test report shall contain the following contents at least:

a) Specimen situation: name, type and source;

b) Description of test device;

c) Specimen dimension and thickness;

d) Before test, the storage temperature, humidity and storage time of sample;

e) Temperature- rise procedures include initial and final temperature and temperature-rise step length;

f) Original test data;

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