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Polyurethane foam for seating of passenger car

乘用车座椅用聚氨酯泡沫

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Polyurethane foam for seating of passenger car

1 Scope

This standard specifies the grading, requirements, test methods, inspection rules as well as marking, packaging, transport and storage of cushions and backrests made from polyurethane foam for foamed seating (with fixed shape) of passenger car.

This standard is applicable to polyurethane foam used as antishock and comfort cushion materials for making cushions and backrests of seating of passenger car.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 2918-1998 *Plastics - Standard atmospheres for conditioning and testing* (ISO 291: 1997, IDT)

GB/T 3730.1-2001 *Motor vehicles and trailers - Types - Terms and definitions*

GB/T 6343-2009 *Cellular plastics and rubbers - Determination of apparent density* (ISO 845: 2006, IDT)

GB/T 6344-2008 *Flexible cellular polymeric materials - Determination of tensile strength and elongation at break* (ISO 1798: 2008, IDT)

GB/T 6669-2008 *Flexible cellular polymeric materials - Determination of compression set* (ISO 1856: 2000, IDT)

GB/T 6670-2008 *Flexible cellular polymeric materials - Determination of resilience by ball rebound* (ISO 8307: 2007, MOD)

GB 8410-2006 *Flammability of automotive interior materials*

GB/T 9640-2008 *Flexible and rigid cellular polymeric materials - Accelerated ageing tests* (ISO 2440: 1997, IDT)

GB/T 10807-2006 *Flexible cellular polymeric materials - Determination of hardness (indentation technique)* (ISO 2439: 1997, IDT)

GB/T 10808-2006 *Flexible cellular polymeric materials - Determination of tear strength* (ISO 8067: 1989, IDT)

GB/T 18941-2003 *Flexible cellular polymeric materials - Determination of fatigue by constant-load pounding* (ISO 3385: 1989, IDT)

GB/T 18942.1-2003 *Flexible cellular polymeric materials - Determination of stress-strain characteristics in compression - Part 1: Low-density materials* (ISO 3386-1: 1996, IDT)

5.1.1 The foam parts for seating must be fully extruded by roller, press, vacuum or some extrusion method on the production line to break the original cellular structure and ensure the compression characteristics and hand feeling of the holes, minimize the initial loss of bearing thickness during fatigue and ensure the dimensional stability of the whole part.

5.1.2 The adhesive strength of the material placed in the foaming mould and forming an integral part of the foam part during foaming shall be greater than that of the foam.

5.1.3 The adhesive used shall be the one that does no damage to the foam, and the bonding effect shall be at least as good as the foam itself. The adhesion between foams shall meet the requirements of flammability specified in GB 8410-2006. The adhesive must also meet the odor requirements.

5.1.4 Operate in accordance with normal production inspection and quality procedures. The product shall be allowed to be repaired with the foam for repair or correction having the same component and quality as the initial product. The foam for correction shall have no adverse effect on the performance and the amount of dimension and shape changed not exceed the given tolerance range.

5.1.5 There shall be no loose pellicle on the recognized important surface.

5.1.6 Polyurethane foam products shall meet the durability test requirements of the seating assembly and, after the durability test of the seating assembly, the foam parts shall not adversely affect the structure and appearance of the cover.

5.1.7 For the purposes of this standard, the materials limited by laws and regulations apply.

5.1.8 The product shall not irritate the skin after being completely solidified.

5.1.9 All products must bear identification such as part number, supply source and production date. The identification must be positioned in such a way that it does not affect the appearance of the finished product (at the lower surface of the cushion and the rear surface of the backrest) and must be legible and distinguishable. The letter height shall be indicated on the product drawing.

5.2 Physical property requirements

Table 2 lists the property requirements of four grades of polyurethane foam for seating of passenger car.

6.1.2 All test samples shall be placed under natural conditions for 72h after production. Before the test, the samples shall be conditioned under standard test conditions for 16h, which shall be free from deformation and distortion.

6.1.2 All specimens shall be cut from the indentation stress zone of the cushion and backrest of the foam sample for seating of passenger car.

6.1.4 All foam samples shall be pre-pressurized twice to 70%~80% of their thickness before conditioning or testing.

6.1.5 For each test, there shall be not less than 3 specimens. The arithmetic mean from 3 tests shall be recorded. The test results of each specimen shall meet the required values set forth in this standard.

6.2 Fatigue performance by constant-load pounding

It shall be tested in accordance with GB/T 18941-2003. Under a constant load of 750N, 80,000 times of uninterrupted pressure cycles shall be carried out to carry out the constant load impact fatigue test.

6.3 Indentation hardness

6.3.1 The Method A in GB/T 10807-2006, 7.2 shall be used for testing the indentation hardness. Unless otherwise specified on the part drawing, the indentation hardness shall be tested on the whole specimen.

a) In the indentation hardness test, the indenter shall be operated at a constant speed of (100±20) mm/min;

b) Measure the initial thickness under a contact force of 5^{0}_{-1} N after prepressing;

c) On the long foam parts for rear seating, the measured indentation hardness values at the left and right measuring points shall not change by more than 10%.

6.3.2 The sample used for indentation hardness test shall be supported by a rigid support plate which shall fully fill the obvious depressions on the foam bottom surface (Surface B). The test surface of the foam supported by the support plate shall be parallel to the tester base in horizontal position. The minimum size of the rigid support plate used for support shall be 380 mm× 380 mm. The testing position of indentation hardness shall be marked on the part drawing and the upper surface of foam sample.

6.4 Combustion performance

6.20 Compression deformation after damp heat ageing (50%)

The damp heat ageing test shall be carried out in accordance with GB/T 9640-2008, 7.2, with a test temperature of 105℃ and a relative humidity of 100% or keeping at the condition with supersaturated steam for 3h.

6.21 Compression stress change after damp heat ageing

The damp heat ageing test shall be carried out in accordance with GB/T 9640-2008, 7.2, with a test temperature of 105℃ and a relative humidity of 100% or keeping at the condition with supersaturated steam for 3h. Then the compression stress change test shall be carried out in accordance with GB/T 18942.1-2003.

6.22 Rebound rate

It shall be tested in accordance with GB/T 6670-2008, 5.2.

7 Inspection rules

7.1 Inspection classification

7.1.1 End-of-manufacturing inspection

The end-of-manufacturing inspection items shall include density, appearance and hardness.

7.1.2 Type inspection

The type inspection items shall include all the items given in clause 5. In case of any of the following conditions, type inspection shall be carried out:

a) trial production and stereotyping appraisement of new product;

b) significant changes take place in structure, raw material and process after formal production which may affect the product property;

c) type inspection is conducted annually under normal production;

d) the production is resumed after a long-term shutdown (half a year);

e) the result of end-of-manufacturing inspection is greatly different from the previous type inspection result;

f) the national quality supervision organization requires to carry out type inspection.

7.2 Sampling

The sampling method shall be in accordance with the documents approved through the specified procedures.

7.3 Judgment rules

7.3.1 Where the dimensional deviation and appearance of 3 pieces are acceptable, this batch is acceptable. If any item of any sample is rejected, remove the rejected pieces from the whole batch and sample again and, if any sample is still rejected, this batch is rejected.

7.3.2 If any item of physical property is rejected, double samples shall be taken from the original batch and the rejected item shall be re-inspected, and the arithmetic mean from the double samples shall be taken as the result of re-inspection. If it is still rejected, this batch of products shall be judged as rejected.

8 Marking, packaging, transport and storage

8.1 The product marking and certification shall be put in each packaging, with the content covering product name, trademark, specification, model, color, net weight, production date, batch number, manufacturer name and address, inspector’s seal, etc.

8.2 The products shall be packed in plastic bags or woven bags.

8.3 During the transport of products, smoking or open flames shall be strictly prohibited, sunlight, rain, long-term compression and mechanical damage shall be avoided.

8.4 The products shall be stored in a clean, ventilated and dry warehouse and shall not be close to heat sources or contact with chemicals.

E_G — the total carbon volatilization, μg *C*/g (indicating μg *C* carbon is contained per gram of sample);

$K(G)$ — the calibration coefficient for acetone calibration;

2 — the coefficient, related to "g specimen", and calculated by filling 1g of sample or 2μL of correction solution in a 10-mL bottle;

0.6204 — the coefficient, indicating the carbon content in acetone.

A.2 Test method for amine volatilization

A.2.1 Sampling

The specimen shall have a dimension of 50mm×50mm×20mm, with the quantity of 1 piece. The specimen shall be taken from polyurethane foam materials which are produced no more than 3 days.

A.2.2 Test equipment

A sealed glass bottle with a bottle cap, a volume of about 1.0L, a bottle mouth diameter of about 75mm, and a height from bottle bottom to bottle mouth of about 150mm.

PVC standard surface, using that with an article number of 6 025 373 produced by Benecke-Kaliko company. The validity period of PVC standard surface shall be 6 months.

A.2.3 Test

Place the specimen of flexible polyurethane foam materials at the bottom of a 1-L glass bottle. Cover the PVC standard surface with a diameter of 80 mm to 85 mm on the glass bottle mouth, with the front of the PVC standard surface facing the specimen of flexible polyurethane foam materials, and then seal the glass bottle cap. Place the glass bottle containing the specimen in a circulating air thermostat at 100℃ for 72 h.

A.2.4 Identification

After 72 hours of storage, take out the glass bottle, check for peculiar amine odor, and visually evaluate the color change of PVC standard surface.

A.3 Test method for formaldehyde emission

Formaldehyde emission is the tendency of polyurethane foam to emit formaldehyde during storage in specified climate and temperature.

A.3.4.2 Determination of formaldehyde content in water-based solution (using photometric method of acetylacetone method).

Take 4mL of acetylacetone and pure it into a 1,000-mL volumetric flask, then add distilled water to the 1,000mL scale. The solution must be tightly sealed, protected from light and stored for 4 weeks.

Weigh 200g of acetamide and pure it into a 1,000-mL volumetric flask and dissolve it into 1,000mL with distilled water.

Pipette 10mL of water-based solution from 6 polyethylene bottles respectively and put them into six 50-mL bottles and add 10mL of acetylacetone solution and 10mL of acetamide solution into each bottle. Shake the solutions well and heat them in a 40℃ pool for 15min. Protect them from light and cool to room temperature (about 1h). Adjust the wavelength of the spectrophotometer to 412nm. Add distilled water and measuring solution into two cuvettes with optical path of 1cm respectively, and measure the absorbance of the 6 groups of solutions with distilled water as reference.

A.3.4.3 Calibration curve

Prepare the calibration curve with formaldehyde standard solution.

a) Formaldehyde standard solution

Pure about 1g of formaldehyde solution (concentration of 35% to 40%) into a 1,000-mL volumetric flask and dilute to 1000mL scale with distilled water.

Mix 20mL of formaldehyde standard solution with 25mL of iodine solution (0.05mol/L) and 10mL of sodium hydroxide solution (1mol/L), place the mixed solution in the dark for 15min, add into 15mL of sulfuric acid solution (1mol/L), and back titrate the remaining iodine with sodium thiosulfate solution (0.1 mol/L). After titration is nearly finished, add a few drops of starch solution (1％m/m) as indicator, then continue to drop the sodium thiosulfate solution (0.1mol/L) into the mixed solution until it becomes colorless, and record the volume V of the sodium thiosulfate solution used. Carry out the blank test in the same way with distilled water.

Calculate the formaldehyde content using Formula (A.3).

$$Q = (V_0 - V) \times 15 \times c(Na_2S_2O_3) \times 1000/20 \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (A.3)$$

where,

V_0 — the volume of sodium thiosulfate solution used in the blank test;

V — the volume of sodium thiosulfate solution;

$c(Na_2S_2O_3)$ — the concentration of sodium thiosulfate solution, mol/L.

b) Formaldehyde calibration solution (colorimetric glass layer thickness: 1cm)

Take out the solution containing 15mg of formaldehyde from the formaldehyde standard solution, add distilled water to the 1,000mL scale, and dilute to 1mL. This solution contains 15μg of formaldehyde. Take 0 mL, 5 mL, 10mL, 20mL, 50mL and 100mL of this solution and drop them into 100-mL volumetric flasks respectively, and add distilled water to the scale. Analyze by spectrophotometry 10mL of each diluted solutions above using the test method in A.3.4.2. Determine or calculate the calibration factor graphically.

A.3.5 Calculation and judgment

Determine the calibration factor and the total capacity of the water component in the absorption liquid (here, 10mL) according to spectrophotometry, and calculate the total amount of absorbed formaldehyde, in mg/kg.

Calculate the formaldehyde emission using Formula (A.4).

$$(A_S\text{-}A_B)\times f\times V\times(100+H)\times F/(m\times 1000)=\text{mgHCHO/kg absolutely dried specimen} \quad \text{(A.4)}$$

where,

A_S — the absorbance of the analyzed solution;

A_B — the absorbance analyzed with distilled water;

f — the calibration factor, μg/mL;

m — the mass of specimen, g;

H — the moisture content of specimen material, %;

V — the capacity of absorption solution (50ml);

F — the analysis result coefficient related to specimen mass (kg), F=10.

Judgment: in the results obtained, the amount of formaldehyde emitted is less than or equal to 10mg/kg.

Annex C

(Normative)

Test method for fogging characteristics of foam material for seating of passenger car

C.1 Test purpose

Evaluate the fogging characteristics of the foam material by determining the precipitation of volatile organic compounds produced by foam materials at high temperature on the cooling surface.

C.2 Sampling

Cut foam into specimens with a diameter of φ80mm and a thickness of 20 mm, and 2 specimens are considered as one group.

C.3 Test equipment

C.3.1 Atomization characteristics tester, which consists of a temperature controlled heater that can hold multiple beaker containers for oil-bath, and a system for cooling flat glass.

C.3.2 Drying cylinder.

C.3.3 Beaker, which is made of heat-resistant glass and used as the sample container.

C.3.4 Sealing ring, with the diameter matching with the edge of the beaker.

C.3.5 Cleaning equipment for laboratory use.

C.3.6 Ultrasonic cleaning equipment.

C.3.7 Gloss meter: an applicable 60° glossmeter.

C.3.8 Holder for gloss meter.

C.3.9 Glass plate: float glass plate with the thickness of 3.0mm±0.2mm shall be adopted and it shall be able to completely cover up the beaker. The surfaces of the glass plate, one tin-plated and the other non-tin-plated, may be identified by observing them in a dark room under ultraviolet light at a wavelength of 254nm. When exposed to the ultraviolet light, the tin-plated surface will

fluoresce a white or yellowish color and the non-tinned surfaces will be blue/purple. For the purpose of distinction, a mark shall be made on the tin-plated surface. During the test, the non-tin-plated surface is used as the working surface that faces the specimen.

C.3.10 Analytical balance: with an accuracy of 0.00001g.

C.3.11 Aluminum foil, which is 0.03mm in thickness and is cut into the size suitable for the fog film tester.

C.3.12 Measurement module.

C.4 Specimen preparation

The specimen shall be placed in a drying bowl for 24h.

C.5 Test

The test can be carried out by testing the atomization degree and the condensable component.

C.5.1 Atomization degree.

C.5.1.1 Clean and dry the glass plate, glass beakers and sealing ring.

C.5.1.2 Prior to the test, the reflectance of the glass plate shall be measured first: place the glass plate horizontally on a black matte surface, with the tin-plated surface facing down, and avoid touching the surface of the glass plate during operation. Place the gloss meter on the holder above the glass plate to measure the reflectance of 5 points, and record the readings. Calculate the average of the 5 readings and record R_{a1} in the test report.

C.5.1.3 Put the beaker into the atomization characteristic tester and start heating. Meanwhile, put the specimen into the beaker, and then place the sealing ring on the edge of the beaker. Cover the beaker with a clean glass plate, with the tin-plated surface facing the specimen and the seal ring. Place the aluminum foil on it, and cover the cooling plate. The temperature of the cooling plate shall be kept at 21℃±0.5℃.

C.5.1.4 The temperature used for oil-bath shall be 100℃±0.5℃. After the temperature reaches 100℃, it shall be kept for 3h±5min.

C.5.1.5 Remove the glass plate from the beaker, leave it for 60min±10min, and visually inspect it for any oil deposition. The test will be ended if oil stains are present.

C.5.1.6 The reflectance of the vaporous surface of the glass plate shall be measured: Place the 60° glossmeter on the holder above the glass plate to measure the reflectance of 5 points, and record the readings. Calculate the average of the 5 readings and record R_{b1} in the test report.

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