

TESTING OF MOTOR NON-METAL MATERIALS

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Abstract: The paper introduces some testing items of non-metal materials in motor, which include inner decorating materials fogging on the windscreen, gas permeability capability of fuel tank, gas permeability capability of seat materials, gas barrier capability of inner tube and safe airbag, and so on. Besides these, there are testing aims of these testing items, testing methods and testing standards etc.

Key Words: motorcar, non-metal materials, testing

1. Overview

As the performance and processing technology of non-metal materials are advancing by leaps and bounds, non-metal materials are being applied to motorcars with an unprecedented speed. The average consumption of non-metal materials per car has increased from 68.4 kg in 1981 to the present 150~180kilos . With the expanding application of non-metal materials in automobiles, requirements on corresponding properties of these materials are put forward. For example, the emitting of hazardous and noxious substances from auto's inner decoration materials is harmful to health. The condensation of volatile materials on winder screen affects safety of driving. Gas permeability capability of fuel tank, gas permeability capability of seat materials, gas barrier capability of inner tube and safe airbag have much to do with the comfort of driver. Because of these problems, corresponding test methods, test standards, and test instruments are introduced in succession. The latter part is a brief introduction to relating test items.

2. Testing the Impact of Emitting Materials of Auto's Inner Decoration Materials on Windscreen

Auto's inner decoration materials, such as engineering plastics, textiles, leathers and non-woven fabrics, as well as various adhesives used to mount the former mentioned materials, containing volatile substances that emit under heat and condense on window or windscreen, causing poor visibility and affecting safety of driving. At present, relevant tests have appeared in foreign countries based on standards of DIN 75201、ISO 6452、SAE J1756 and etc. To improve product quality or to expand their oversea markets, some domestic auto manufactures and auto's inner decoration manufacturers also attach great importance to these tests.

Inner decoration of autos are tested in two methods: reflectometric method and gravimetric method. Reflectometric method measures the opaqueness variation of fogging layer on a glass plate surface to evaluate the fogging property of specimen. The gravimetric method measures the quantity of condensate that formed on aluminum foil surface to obtain the weight of fogging substances. In addition, the 'fogging value' or 'weight of fogging-condensation' obtained can also indicate the volatilization quantity of hazardous and noxious substances in specimen. With the fogging value of xenon vapor headlamp, users can evaluate the extent to which the fogging inside headlamp of automobile affect illumination.

At present, fogging test instruments on sale in domestic market are Germany Hake, Chinese Labthink and etc.

3. Permeability Test of Auto Plastic Fuel Case

Comparing with steel board fuel tank, Auto Plastic Fuel Case is featured by its safer property, corrosive resistance and longer lifespan. In addition to these advantages, plastic fuel tank is flexible in molding and lower in

cost. At present, the utility rate of plastic fuel tank in domestic autos has been up to 86%.

Despite its many advantages comparing to steel board fuel tank, the most obvious weak point of plastic fuel tank is its poor barrier property, which results in the penetrating permeation of oil. To select ideal materials of plastic fuel tank, barrier property testing of the materials becomes necessary. The traditional test procedures are: fill certain petrol oil into a tank and then seal the tank. Weigh the tank and note its weight as M1. Place it for sufficient time (generally exceeding 100 days) and reweigh it, note the weight as M2. calculate $\Delta M=M1-M2$, the result of which is the volatilization of petrol oil. Such method needs a long period and requires high-precision weighing device, thus encounters great difficulty to complete test.

ASTM D3985 offers another test method. Cut a plastic slice from a tank and test its oxygen transmission rate. Comparing this result with that of various plastic sheets so as to scientifically and quickly decide the plastic that possesses better property.

In ASTM F1307, test method for integral package testing is provided, with which the sealability testing of the whole package is realized.

4. Gas and Water Vapor Permeability Testing of Seat Materials

During the Long and arduous journey, drivers often sit in the car for several or even several dozens of hours. For this reason, the requirements on gas and water vapor permeability of seat materials are stricter than that of auto's other parts. Good cushion and seat pad should flexible with better gas and water vapor permeability so that drivers' sweat can goes out smoothly.

GB/T10655-2003. Test procedures of gas permeability are as below: place the specimen of specified dimension inside test chamber and evacuate one side of specimen so that there is certain differential pressure formed on two sides of specimen. Then test the transmission quantity of test gas through specified area within certain time to obtain the transmission rate; or maintain the transmission rate through specimen and test the pressure difference on two sides of specimen to obtain resistance of airflow. This test method is in accordance to GB/T10655-2003.

ASTM E398. Test procedures for water vapor permeability testing are as below: place the specimen between dry and humid chambers at constant temperature. Then the sensor inside test chamber records the humidity variation inside and trace the time needed for the preset low limit value to reach upper limit value. With continuous testing and systematic analysis, water vapor permeation and water vapor permeability rate can be obtained. This method is in accordance with ASTM E398.

5. Gas Barrier Property Testing of Inner Tube and Safe Airbag

Materials of both Car inner tube and safe airbag are required to have good barrier property. The former guarantees that tube inflation will not be need during long journey while the latter guarantees that in the event of accidental collision moments, quick muster of safe airbag can ensure a certain degree of pressure.

In traditional test methods, the finished tube or air bag is inflated to a certain pressure and the value of pressure meter is recorded. After a period of time, observe the pressure drop of manometer to obtain the value of barrier property. For this method, a long period (sometimes a year) is needed to obtain test result, thus is difficult to complete such testing. However, it now can be completed with Labthink VAC-V2 gas permeability tester. First, take samples from materials to be tested and then attach the specimen to VAC-VA. Maintain a certain pressure difference on two sides of specimen. Test gas transmits through specimen and the pressure changes with time so that users can calculate barrier property of materials. With this instrument, the test generally can finish in 12 hours, thus greatly improving test efficiency.

6.Test Other Non-metal Materials of Automobile

Non-metal materials used in automobiles are various in kinds. In addition, there is different requirements on the same material that is used in different parts of autos, that is to say, various test items are needed, such as the testing of tensile strength, tear strength, hardness, bending strength, color, the coefficient of friction and etc.

Moreover, during the operation of automobile, a great amount of various adhesives are needed, the property of which imposes vital influence on car quality. Therefore, these non-metal materials also require the testing of shearing, tensile and tearing strength.

7.Conclusion

Non-metal material is light in weight, which can lighten the weight of autos so as to achieve energy saving purpose. The better processing technology of such materials enables auto manufacturers to design components and models of autos with more flexibility. As more and more non-metal materials are being applied to automobiles, property testing of materials will provide more effective supports to the safe and optimized application of materials.