

Environmental Requirements for Material Testing of Package

Abstract: According to the standard of GB/T 2918, this article attempts to give a detailed explanation on the influence of test environment on physical property of flexible package.

Keywords: test environment , GB/T 2918 ,flexible package , physical property

1.test environment

Test environment in this article refers to the lab environment for physical property testing of flexible package such as film, not including special environment used for some unusual testing and material or the simulating of specified climate condition. Generally speaking, it mainly refers to the following three indexes: ambient temperature, humidity and flow rate of lab air cycling. Among that, temperature and humidity have significant influence on testing result of physical property of flexible polymer material.

2.GB/T 2918-1998

GB/T 2918-1998 State Adjustment and Standard Test Environment of Plastic Specimen is the most broadly used domestic standard relating test environment, which is equal to the international standard ISO 291 : 1997 Plastic-State Adjustment and Standard Test Environment , which touches upon specifications about state adjustment and standard test environment of various plastic and specimen under constant environment that is equivalent to average lab environment conditions. The purpose for specimen state adjustment is to reconstruct the equilibrium state between specimen and state adjustment environment or between temperatures or between temperature and moisture content.

Two standard environments are provided in the standard. Please refer to table 1.

Table 1. Standard environment

Standard environment Code number	Air temperature °C	Relative humidity U %	Note
23/50	23	50	Use this standard environment unless there is special specification
27/65	27	65	Can be used in tropic area when both sides come to an agreement

Note: values in table one are suitable for absolute elevation where the atmospheric pressure is between 86kPa and 106kPa and suitable for situations where air circulating rate is less than or equal to 1m/s.

If humidity has no influence on the property to be tested or the influence can be ignored, relative humidity may not be controlled. The corresponding environments are referred to as 'temperature 23' and 'temperature 27'.

The cycle of state adjustment should be specified in relating standards of the material. Otherwise, the following

cycle should be used:

- For standard environment 23/50 and 27/65, not less than 88h.
- for room temperature between 18 ~ 28 °C , not less than 4h.

Unless there is other specification, specimen that has completed state adjustment should be tested in an environment or at a temperature similar to that of the state adjustment.

3.Influence of Temperature Fluctuation on Polymer Permeability

According to its molecular arrangement, solid high polymer can be divided into crystallized, noncrystalline and orientative polymer. Most of the crystallized polymer is hemicrystalline with both crystallized and noncrystalline parts, in which the only difference is its degree of crystallization.

The longer the polymer molecule chain, the more its conformation. When temperature is increased, conformation changing of molecule chain will be accelerated as a result of thermal motion and this in turn will decrease the extent of polymerization. Certain property (such as mechanical property, electricity property and permeability property) of high polymer is related with temperature to a great extend. And their relation is prominently remarkable when there is transformation of aggregation state in polymer.

For example, as to the tensile testing of mechanical property, stress-strain curve (important index of polymer material's mechanical property) of thermal plastic resin will rise with temperature, transferring from hard brittle to sticky elastic. Extensibility of crystallized macromolecule has a significant change between 1 % ~ 1000 % with the change of temperature and its tensile strength changes within tenfold. The influence of humidity on the testing of plastic with smaller water-absorbing capacity is not obvious. Stress-strain curve will change obviously for material that has a strong water-absorbing capacity, such as polyamide. These water molecules function as plasticizer of polyamide and soften the material

Impact property testing of the material is closely related with temperature. Under low temperature, impact strength will sharply decrease. While under higher temperature, it has an obviously increase. Impact strength will decrease with the decreasing of temperature. Humidity can also influence the impact strength of material. For example, impact strength of nylon plastic increases significantly with a relatively big humidity while becomes very small in an absolute dry condition.

Temperature and humidity controlling of lab environment, especially the temperature controlling, has a remarkable influence on specimen permeability testing. Readers can refer to the article Influence of Temperature Fluctuation on Material Permeability updated on January 21st 2005 at Languang Lab Forum. Generally speaking, the influence of humidity on material property (not including moisture absorbing material) is not as obvious as that of temperature fluctuation. Therefore, there is not too much requirement about the environmental humidity and it is enough to control the temperature alone under normal condition.

4.current status of domestic labs

Inspection centers of flexible package in China are mainly national inspecting centers, teaching research centers and various quality inspection institutions. But environmental conditions in these laboratories vary significantly. Some can reach the demand of accurate temperature controlling; others perform a bit poorer in temperature

controlling.

The common methods of temperature controlling are to adopt full set of laboratory environmental control system (which is very rare in domestic labs) and to use air conditioner to control the temperature (common method being used). Temperature controlling effect of the former method is very good while effect of the latter is relatively poor, especially in spring and summer when there is smaller temperature difference between inside and outside and it is difficult to control the temperature. Temperature fluctuation will bring remarkable influence on physical property testing of flexible package. Temperature that is not well controlled will result in bigger fluctuation of the testing data for the same index, which usually appears as data instability. Under such a testing environment, the evaluating of precision and data repeatability for certain testing instrument doesn't make any sense. Controlling the temperature through air conditioner can achieve more ideal result if the wall of the laboratory is thick and relatively large and the temperature fluctuation of the present position is relatively small (such as shaded side room).

5.the necessity of test environment

According to the requirement of GB/T 2918, testing of the plastic should be performed under specified standard environment. Otherwise, there must be some difference between the tested result and the standard environment result. Results gained under different test conditions have no comparability. The regulation of standard environment has two meanings: one is to specify the testing environment and the other is to make test results of various inspection institutions comparable. Therefore, it is very necessary to control the test environment accurately.

However, lab environment may be realized not by controlling lab environment. Choosing instrument with automatic controlling function of temperature and humidity is also very effective. Those instrument introduced by Labthink such as VAC-V1 Auto Gas Permeability Tester, Water Vapor Permeability Tester TSY-T1, TSY-T1 and TSY-T1 have temperature auto-control function from room temperature to 50 °C .