

The Temperature Factor and New Trends for the Sealing Performance Test of Flexible Packages

Abstract: this article introduces the sealing performance test methods of flexible packages and the critical factors. Meanwhile, a detailed introduction of new test technological progress and applications is put forward as per market demands.

Key Words: leakage, sealing, package, storage, broken package

There are many indexes to be considered when choosing flexible packaging forms and materials. For example, the barrier property of package against light and gas, the volume of headspace, the costs for package, transportation and storage, the convenience of application and the environmental- friendly properties of the materials, etc., should all be considered. The comprehensive evaluation of those indexes is the foundation for the choice of the best packages. However, the sealing performance tests, or such tests with specimens that have undergone simulation tests as aging tests and vibration tests, etc., is the veto of flexible package evaluation. Therefore, sealing performance is the premise for the realization of package functions. It's also the comprehensive embodiment of matching performance between the flexible packaging materials themselves, and with the mechanical, thermological and optical properties of the choiced packaging forms. The inferior sealing performance packages would lead to content deterioration owing to gas or liquid transmission through the packages, and would probably lead to pollution to the environment and the surrounding subjects. As to functional packages, the leakage would lead to failure of the packaging functions and losses to the users.

1. Sealing Performance Testing Methods for Flexible Packages

There are commonly two flexible sealing performance testing methods, namely, the positive pressure method and the negative pressure method. The positive pressure method fills the specimen with gas to increase the inner pressure, and determines leakage according to the changes of the inner pressures. The negative pressure method puts the specimen into the water of the testing cell, and produces a pressure difference inside and outside the specimen by vacuum pumping the cell. Observe gas leakage or water permeance of the specimen so as to determine whether the sealing flaw really exists. Sealing performance test data is the important basis for test condition setup and result evaluation of the simulation tests, such as product storage, stack and vibration, etc.

Comparing with other test items, the most outstanding characteristic of sealing performance test is the varied kinds of test subjects that it applies to. The test subjects of other tests are usually singular. For example, the tensile test can only test films and sheets, the flex durability test can only test films, and headspace test can only test packages. Yet, sealing performance tests can not only test various packages, but the semi-finished packages as well. The specimen can be a finished package, or a sampling from any stage of the logistic process. Meanwhile, with accessories, more subjects with more sizes and shapes can be tested.

2. The Influencing Factors for Flexible Package Sealing Performance Test

The sealing performance test is the comprehensive embodiment of matching performance between the flexible packaging materials themselves, and with the mechanical, thermological and optical properties of the choiced packaging forms. The sealing performance of flexible packages is directly influenced by external forces, temperature changes and ray radiation, etc. Many factors can not influence the packages directly, but can lead to decrement of material strength and heat-seal layer fastness, as well as the exudation of additive to the flexible

packaging materials, all of which come to affect the sealing performance of flexible packages. However, it should be emphasized that different influencing factors would result in different influences, and if the actual influencing result of each factor is to be analyzed, the workload and costs would be greatly increased. Therefore, it is not realistic to take all the influencing factors into consideration. Only those influential ones should be emphasized, or regarded as one of the test conditions. Otherwise, the practicability of the test results would be limited.

Previous tests indicate that temperature is the key factor for sealing performance of flexible packages during storage and transportation. On the one hand, as to heat-sealed packages, the heat seal temperature would directly affect the strength of sealed mouth, and the evenness of pouches would also be deformed, as a result of which, the actual sealing performance would be worsened. On the other hand, as to the finished flexible packages, ambient temperature also plays an important role in those packages' sealing performances. This is because the common flexible materials are laminated films, or the compound of polymer, metal, paper and other materials, whose heat performances are varied.

When the ambient temperature changes, the coefficients of expansion of different materials would lead to layer separation or deformation, or strength decrement, and thus, the sealing strength of the package mouth would be greatly reduced. So, the sealing performance test data of many flexible packages in high and low temperatures would be much lower than that in normal temperatures. The package leakage caused by this factor is nothing new. Therefore, when testing the sealing performance of flexible packages, the influence of ambient temperature changes should be especially considered; and it's necessary to control the temperature of specimen during sealing performance tests so as to realize test under a designated temperature.

3. The New Trends in Sealing Performance Tests

Now, many new forms of packages have been introduced, and there have been more emphasis on the requirements for flexible package sealing performance tests. For the purposes of both brand image and costs, manufacturers are unwilling to lose the product package functions caused by leakage, especially the expensive packages. Therefore, it's of critical importance to strengthen the test means for packaging sealing performance. In order to meet the market demands, there have been great improvements of the sealing performance instruments in their testing condition control and precision.

Firstly, sealing performance instruments with temperature controls have been introduced. As mentioned above, changes of the ambient temperature during testing would make great influences on the sealing performance testing results, which have been noticed by the package designers. A case in point is that the long distance transportation makes it possible for the products to undergo remarkable temperature changes during the storage, transportation and distribution processes. Some of those products would undergo temperature fluctuation and some would be kept in high or low temperature. However, it's not rare to see that the packages that have passed the tests in lab environment are sometimes found to be leaking in usage. Now, we can pre-condition the specimens or control the test cell temperature by simulating the temperature changes so as to realize accurate test of the flexible package sealing performance. Since temperature and the package inner pressure change simultaneously, it is more valuable to control the test cell temperature to obtain test data in the simulated environment. At present, we have realized the uniform temperature control of the test cell from ambient temperature to 60°C, and this can meet the requirements of most products for their logistic environment simulation.

Secondly, test precision and quantitative test indexes have been improved. Sealing performance test is a kind of destructive test and cannot be applied to all the products. Therefore, it's very important to make full use of the

limited specimens to obtain accurate and effective sealing performance test data. In the previous sealing performance tests, qualified and non-qualified are the only conclusions without any further valuable referential data. Thus, in the severer storage and transportation environment, the leaking packages may be greatly increased.

Now, the positive pressure method instruments can accurately obtain max. burst resistance pressure of flexible packages, as well as the max. lasting time before breakage under certain pressure. Besides, the sealing performance tests of specific parts can be realized with the help of fixtures, which can effectively improve the practicability of the test data and analyze the vulnerable segments in the package structure so as to provide basis for structural improvement, material selection and more accurate critical breakage conditions for stack, storage, transportation, impact and many other simulation test models.

4. Conclusions

As one of the important test items for flexible packages, there has been remarkable improvement of sealing performance instrument in its test environment control and precision, and this has greatly strengthened the practicability of the data, so that the data plays greater role in flexible package structural improvement and material selection. With the diversification of packaging forms, the sealing performance test for flexible packages will surely be further developed, and will, together with other test indexes, play more important role in the flexible package evaluation.