Labthink Instruments Co.,LTD
144 Wuyingshan Road, Jinan, China
Tel: +86-531-85811021 85864214
Fax: +86-531-85812140
E-mail: trade@labthink.cn

Labthink Labs & Services---------Ultra-High&Low Temperature Lab

Abstract: This paper introduces the necessity of barrier capability test for packaging material under unconventional temperature and testing method in details; and Labthink Ultra-High & Low Temperature Lab and its services.
Key Words: unconventional temperature, barrier capability, oxygen permeation amount, test

At present, barrier capability tests of materials have been widely used in areas of plastic film manufacturing and its applications. With the popularization of tests and enhancement of testing accuracy, more and more attentions have focused on details of tests, and the affects of temperature variation to material barrier capability is the most attention-getting. It is especially emphasized that it is not the changing of temperatures that affect the testing procedures and results, but the differences of material barrier capabilities under different temperatures.

1. Testing Demands

Temperature not only affects the structure but also the permeation of materials. It leads to the diversity of material barrier capabilities affected by temperatures, that is, different trends of change towards different temperatures for different materials. We have conducted many tests of oxygen permeation at 0℃~70℃. We can see from figure 1 that, the ratios of barrier capability variation under different ranges of temperatures are different, so are the permeability ratios of various samples under the same temperature.

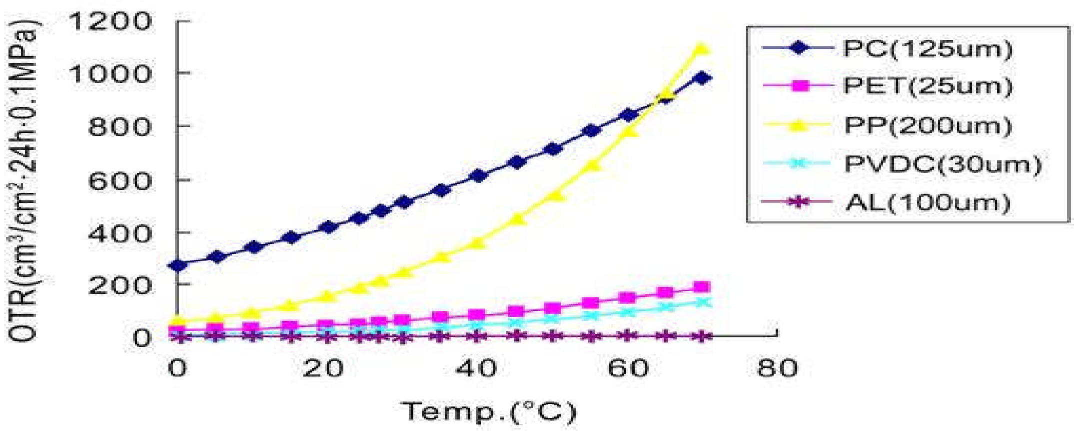

Figure 1 Temperature Effects to Oxygen Permeation Amount of Materials

Long term tests have proved that the relations between penetration coefficient, diffusion coefficient, solubility coefficient and temperature are all in accordance with Arrhenius equation. Penetration coefficient, diffusion coefficient and solubility coefficient change as temperature changes. The actual use temperatures and testing temperatures of packaging materials are often different, so there is probably a gap between packaging design

Labthink Instruments Co.,LTD
144 Wuyingshan Road, Jinan, China
Tel: +86-531-85811021 85864214
Fax: +86-531-85812140
E-mail: trade@labthink.cn

and prospective barrier capability in material selection and structure design. It reduces the qualities of packages and leads to economic and image losses.

2. Barrier Capability Tests Under Unconventional Temperatures

As for different specimens, the kinds and dosages of additives are hardly the same even if materials are the same, so it is impossible to expect the same performance of them in barrier capability tests. Besides, deducing from data of barrier capability of other materials under specific temperatures is even more impossible. Thus, the practical tests of materials are needed. The temperatures of many materials in practical applications are not within the ranges of normal temperatures of labs and manageable temperatures of instruments. For example, the temperatures for cold storage, high-temperature antisepsis and so on. And they are usually called unconventional temperatures. Of course, there will be any problems, if we could test barrier capabilities of materials under their actual use temperatures, but it is difficult to carry out in actual tests.

First, the high cost. Due to the different manufacturing and selling areas, as well as effects of selling scopes, purposes and cycles, there are tremendous differences of temperatures of packaging materials in actual applications. Therefore, it is obvious that in manufacturing such kinds of instrument, we need to consider high temperature and low temperature tests at the same time; and this would lead to great increases in costs (including manufacturing costs and energy losses).

Second, the testing efficiencies under unconventional temperatures are lower than those under normal temperatures. Not only because the complicated structures of unconventional temperature instruments, but also the probability of practical operations. Therefore cooling and heating time should not be ignored.

Third, inferior operative convenience. Operators usually can no bear the unconventional temperatures, so whatever the operation is, whenever it comes to be under unconventional temperature, it demands returning to normal temperatures before operation.

To meet the increasing market demands for barrier capability parameters, Labthink has developed DCFP (Data Curve Fitting in Permeation) to solve these problems. DCFP is based on theories of Fick Law, Henry Law, and Arrhenius Equation, etc. We could get gas permeation amount, permeation coefficient, diffusion coefficient and solubility coefficient from data analysis of barrier capability under different temperatures in normal conditions. We can get data of barrier capability under unconventional temperatures easily, conveniently and economically with DCFP technology. However, since every material has its temperature character, and different materials have different degrees of barrier capability variations as temperatures changes, thus, DCFP technology is not suitable for compound material testing.

3. Ultra-High & Low Temperature Lab

Labthink is the first testing instrument manufacturer of barrier capability in our country, and has deeply investigated the affects of temperature to barrier capabilities of materials. Labthink has realized that for many products with high barrier property packages, temperature acts not only as qualifications of selecting barrier capability materials but also the key factors of successful packages. In the field of material barrier capability testing under unconventional temperatures, the DCFP of Labthink has great advantages in monolayer plastic film

Labthink Instruments Co.,LTD
144 Wuyingshan Road, Jinan, China
Tel: +86-531-85811021 85864214
Fax: +86-531-85812140
E-mail: trade@labthink.cn

testing under special temperatures. But, with the wide application of multilayer films, there is still a high demand of barrier capability testing under actual use temperatures (such as cold storage and bactericidal temperature). In order to better investigate the relationship between composite materials and temperatures, accumulate abundant material testing data and provide more professional services to customers, Labthink has established Ultra-High & Low Temperature Lab at the beginning of 2008. The Lab mainly deals with the barrier capability tests under unconventional temperatures and can complete barrier capability tests of inorganic gases such as oxygen, nitrogen, carbon dioxide and air within the range of -20℃~150℃ as well as obtain diffuse coefficient and solubility coefficient of materials to gases in the test of permeation coefficient of inorganic gases to materials. Labthink has collaborated with Shandong Supervision and Inspection Institute for Product Quality and National Packaging Products Quality Supervision and Inspection Centre (Jinan) in DCFP project which has been listed as one of the science and technology projects of General Administration of Quality Supervision, Inspection and Quarantine of People's Republic of China. At present, data validation of DCFP technology between 10℃~50℃ has finished, and testing data are highly consistent with fitting data. The fitting data validation of -20℃~150℃ is now conducting by Labthink Ultra-High & Low Temperature Lab. Alike Permeability Analysis Lab, Ultra-High & Low Temperature Lab also provides services of specimen testing for customers to accumulate data to enrich database of barrier capability of Labthink.

4.Summary

Reasonable usage of barrier capability materials in product packaging can extend the shelf life of products and enhance quality of storage; however, with the wide application of barrier capability materials, temperature has become a key factor that affects barrier capability material selection. The establishment of Ultra-High & Low Temperature Lab is based on common attentions to temperature issues. We can provide the most efficient suggestions and helps for package material selection under different temperatures and proper package structure design through our professional services of barrier capability testing.