Labthink Instruments Co., Ltd.
144 Wuyingshan Road, Jinan, P.R.China
Phone: +86 531 85068566
FAX: +86 531 85812140

Labthink Lab & Service---------Ultra-High&Low Temperature Lab

Abstract: This paper introdeced the necessity of barrier capability test for packaging material under unconventional temperature and testing method in details, and Ultra-High&Low Temperature Lab of labthink 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 plastical manufacture and application. With the popularization of tests and enhancement of testing accuracy, more and more attentions have focused on details of tests, and the effection of tempurature variation to material barrier capability is the most attention-getting. It is specially emphasize that it is not the changing of temperatures that affect the proceduces and results of tests, but the differences of material barrier capabilities in different tempertures.

1. Testing Requirements

Temperature not only affects the structure but also the permeation of materials. It leads to the diversity of material barrier capabilities affected by temperatures. Different trends of changing toward different temperatures for different materials. We had conducted many tests of oxgen permeation at 0℃~70℃. We can see from figure 1 that, the ratios of barrier capability variation under different ranges of temperatures are different, as for same materials and different materials alike.

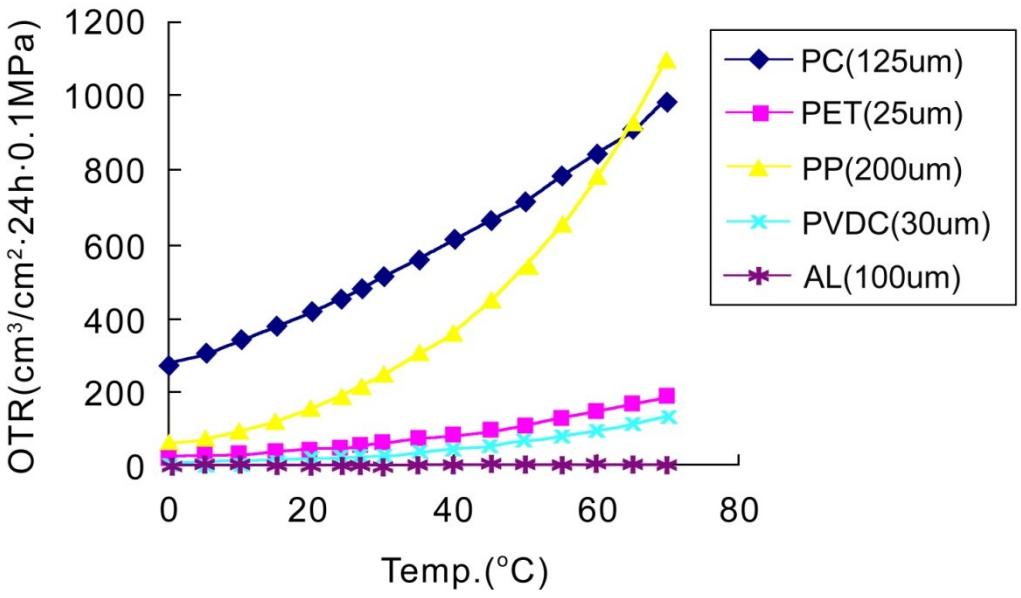

Figure 1 temperature effects to oxgen permeation amount of materials

Long term tests proves that the relations of penetraion coefficient, diffusion coefficient and solubility coefficient with temperature all obey Arrhenius equation. Penetraion coefficient, diffusion coefficient and solubility

coefficient change as temperatures change. The practical and testing tempuratures of packaging materails are often different, so there is probably exists a gap between packaging design and prospective barrier capability in material choosing and structure designing. It reduces the qualities of packages and leads to losses of economies and reputations of corporations.

2. Barrier Capability Test Under Unconventional Temperature

As for different specimens, the kinds and dosages of additives are hardly the same as each other even if materials are the same, so it is impossible to expect the same performance of them in barrier capability tests and deduce from datas of barrier capability of other materials under specific temperatures, 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 managable temperatures of machines, for example, the temperatures that usually called unconventional temperatrues such as cold storage, high temperature antisepsis and so on. Of course, there will not exist any problemes, if we could test barrier capabilities of materials under temperatures of their practical applications, but it is hard to carry out in practical tests.

First, the high cost. Due to the areas differences of manufacturings and sellings, and effects of bounds, purposes and cycles of sellings, there are tremendous differences of temperatures of packaging materials in practical applications. In the manufacture of a machine,we need to consider high temperature and low temperature tests at the same time, this would lead to huge increases in costs(including manufacturing costs and resourses used in tests).

Second, the efficiencies of tests under unconventional temperatures are lower than that under normal temperatures. Not only because the complicated structures of machines of unconventional temperatures but also the probability of practical operatings, therefore times spends on coolings and warmings can not be ignored.

Third,lack of operating conveniences. Operators usually can no bear the unconventional temperatures,so whenever it comes to unconventional temperature, whatever the operation is, it only available to be conducted until temperature becomes normal again.

To satisfy the increasing demands of barrier capability parameters from market, labthink developed DCFP (Data Curve Fitting in Permeation) to solve these problems. DCFP is based on theories of Fick Law, Henry Law, Arrhenius Equation and so on. We could get gas permeation amount, permeation coefficient, diffusion coefficient and solubility coefficient from analyze the datas of barrier capability under different temperatures in normal conditions. We get datas of barrier capability under unconventional temperatures easily, conveniently and economically with DCFP technology. But every material has its temperature character and different materials have different degrees of barrier capability variations as temperatures change, thus DCFP technology is not available in compound material test.

3. Ultra-High&Low Temperature Lab

Labthink is the first testing machine manufacturer of barrier capability in our country, and deeply investigated the affections of temperatures to barrier capabilities of materials. Labthink realized that to many products of high barrier property packages, temperatures not only act as qualifications of choosing barrier

capability materials but also the key factors of successful packages. In the area of material barrier capability testing under unconventional temperatures, the DCFP of labthink has advantage in monolayer plastic film testing under special temperatures, but with the wide application of multilayer films, there is still a high demand of barrier capability testings under practical temperatures(such as cold storage and bactericidal temperature).

In order to investigate the relations between composite materials and temperatures, accumulate abundant datas of material tests, and provide more professional services to customs, labthink estabilished Ultra-High&Low Temperature Lab at the beginning of 2008. The lab mainly deals with the barrier capabilty tests under unconventional temperatures and can complete barrier capability tests of inorganic gases such as oxygen, nitrogen, carbon dioxide and air in the range of -20℃~150℃, and get diffuse coefficient and solubility coefficient of materials to gases in the test of permeation coefficient of inorganic gases to materials. Labthink has collaborated with Supervise Bureau of Quality & technology of Shandong and Quality Supervision & Test Center of 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, datas validation of DCFP technology of 10℃~50℃ has finished, and testing datas are highly consistent with fitting datas. The fitting datas validation of -20℃~150℃ has been conducted by Ultra-High&Low Temperature Lab. Like Permeability Analysis Lab, Ultra-High&Low Temperature Lab also provides services of specimens tests for customs to accumulate datas to enrich data base of barrier capability of labthink.

4. Summary

Properly using of barrier capability materials in product packaging can extend the shelf life of product 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 choosing. The estabilishment of Ultra-High&Low Temperature Lab is based on common attentions to temperature problems. We can provide efficient suggestions and helps to packaging material choosing under different temperatures and properly design of packaging structures by the professional service of barrier capability test.