

## Proficiency Test of Barrier Property Testing for Plastic Packaging Materials

**Abstract:** this article gives a systematic introduction to Proficiency test of barrier property testing for packaging material. It describes the project in terms of its background, organization institutes, institutions cooperating, participating laboratories, specimen, test method and statistical data. This proficiency test not only completes the real situation assessment of domestic barrier property testing level, it is also a large-scale system and objective data comparison between various barrier property test methods for the first time in the world. The whole process is objective and fair.

**Key words:** barrier property, oxygen transmission rate, water vapor transmission rate, proficiency test, and statistic

Due to its obvious effects on preservation of products, barrier-packaging material has become one of the fastest growing functional materials in application. However, the development of its key technical parameter testing-barrier property testing is out of balance in our country. Actual testing instruments vary from each other to different degree, resulting in the inconsistent barrier property testing level and test data of various institutes. Therefore, cohesive test data are expected greatly in the market. A large number of laboratories including domestic authoritative testing institutions participated this proficiency test of barrier property testing for plastic packaging materials, which is undoubtedly the most objective, accurate and efficient way to make a census of the testing ability in the whole barrier property testing field.

### 1. Proficiency Test Requirements of the Certification and Accreditation Administration of China

To improve capacity-building of laboratories and to verify and enhance laboratory testing level in some focus fields that merits special attention, The Certification and Accreditation Administration of China (CNCA for short) decided to continue proficiency testing among laboratories in 2007.

In April 24<sup>th</sup>, 2007, CNCA issued Document Guo Ren Fa (2007) No. 60 *Notice Regarding 2007 Proficiency Test Plan*. According to opinions from relevant departments of quality inspection institutes and society, CNCA selects 22 among the 138 registered projects as the proficiency test plan of 2007, which are divided into 11 A and B respectively. The project 'barrier property testing of plastic packaging materials- determination of oxygen and water vapor transmission rate ' submitted by National Package Product Quality Supervision & Testing Center (Jinan) is listed as the third one in category A. As to A class projects of this notice, it is stipulated as follows: various quality supervision and testing centers having obtained metrology accreditation while possessing A class test proficiency product quality supervision , inspection institutes at provincial levels (including deputy provincial level city and city directly under State planning), government-controlled technical centers (labs) of Administrations for Entry-Exit Inspection and Quarantine, various relevant departments and ministries or industrial product quality inspection centers must participate relevant A class proficiency test. For excused absence, written report must be submitted to CNCA. As to B class projects, it is stipulated in the notice that ' laboratories can enter their name for B class proficiency test voluntarily according to their own needs. It is thus clear that the proficiency test this time is record-breaking in terms of test scale, testing level of participating labs and authority of organizers.

### 2. Introducing Proficiency Test

#### 2.1 Organizational Institute and Institutions Cooperating

National Packaging Product Quality Supervision and Testing Center is responsible for the scheme daily

operation and coordination of Proficiency test program 'barrier property testing of plastic package materials-determination of oxygen and water vapor transmission rate '. As a technical supporting institute, Labthink undertakes the work of selecting specimen, sampling, packaging, seal and pack, specimen uniformity and stabilization of testing.

## 2.2 Participating Laboratories

'Barrier property testing of plastic package materials- determination of oxygen water and vapor transmission rate ' belongs to A class project of 2007 proficiency test. Therefore, all eligible laboratories must participate the proficiency test. At the same time, local technical supervision system and laboratories of other relevant industries are encouraged for participation. To improve mutual technical understanding, laboratories of oversea testing institutions stationed in the mainland are also invited. There are altogether 69 laboratories participating oxygen transmission rate testing and 67 laboratories participating water vapor transmission rate testing.

## 2.3 Specimen Preparation

To investigate the difference between and within participating laboratories, that is, investigating the systematic error and random error respectively, and to secure the reliability of proficiency test data, split level" sample design is adopted, That is to say, samples are divided into A group and B group. There is subtle difference between the two groups of specimen and test results. However, samples of the two groups are of the same material.

Specimens for this proficiency test are PE films. During the selection of specimen, uniformity and stability of specimens are tested using single factor method analysis of variance as well as the test method stipulated in CNAS-GL03 *Evaluation Guide for Specimen Uniformity and Stability* in this Proficiency Test. The 108 uniformity test data and 44 stability test data received general consent from experts, indicating that the selected materials meeting requirements specified and can be used for the proficiency test. Specimen processing condition of stability evaluation is 38°C/50 %RH and 48°C/90 %RH, which better simulates the representative summer temperature and humidity of in most areas of our country. Test data prove that specimens can maintain stable barrier property during transportation.

## 2.4 Test Method

As to test method of the proficiency test, GB/T1037-1988 GB/T1038-2000 90 *Standard Test Method for Water Vapor Transmission Rate through Plastic Film and Sheeting Using Cup Method* and GB/T1038-2000 *Stand Test Method for Gas Transmission Rate Through Plastic Film and Sheeting Using Differential-pressure Method* are recommended by National Packaging Product Quality Supervision and Testing Center. However, since each projects has more than one test methods and other barrier property test method are actually used sometimes in our country (although some methods have not obtained international support), gravimetric method or differential pressure method is not regulated as the only methods for this proficiency test. Therefore, laboratories can use other test methods. But they must note the method used in their test report.

According to the summary of test methods adopted by laboratories for proficiency test, 10 laboratories did not use gravimetric method in water vapor permeability testing (6 used infrared sensor method and 4r used electrolytic sensor method). 16 laboratories did not use differential pressure method in oxygen transmission rate testing (13 used equal pressure method-oxygen sensor method)

## 2.5 Statistical Result of Proficiency Test

Data statistics are carried out in accordance with CNAS-GL02 *Evaluation Guide for Specimen Uniformity*

*and Stability in Proficiency Testing* using Robust method to evaluate testing ability of participators. Proficiency evaluation of labs mainly includes inter-lab ZB value and internal lab ZW value. The evaluation results also include seven comprehensive statistics: result data, median, IQR, CV, maximum value, minimum value and Range. In the proficiency test, there is no laboratory using test instruments based on gravimetric method or differential pressure method principle appears to be outlier, that is, system error of instrument is within allowable range of our country.

### **3. Conclusion**

Data analysis of the whole project shows that proficiency-test project-Barrier property testing of plastic package materials- determination of oxygen and water vapor transmission rate ' undertaken by National Packaging Product Quality Supervision and Testing Center achieves complete success. The important role Labthink plays in this project is highly appraised by relevant departments of the government. This proficiency test not only completes the real situation assessment of domestic barrier property testing level, it is also a large-scale system and objective data comparison between various barrier property test methods for the first time in the world. It points the way and provides sound data evidence for the unification of barrier property data system.