

## The R&D Progress of Reference Films in the Domestic Permeability Test Field

**Abstract:** this article states the present data status of the permeability test field, points out the importance and necessity of the unification of permeability test data system, and introduces the present domestic status and progress in the R&D of permeability reference films.

**Key Words:** reference films, calibration, comparison, permeability, transmission rate calibration system

Plastic films have been widely applied in the product packaging of food, medical, cigarette, chemical, electronic, military and other industries. Whether the permeability of the plastic films is suitable is the key point to guarantee product quality. Yet, the permeability technologies of different countries are not uniform. A clear evidence is that the test data of different instruments are not unified. Through extensive investigations and analyses, it has been discovered that a lack of unified and universal calibration method is the main cause for the discrepancy of the data.

### 1. The Present Status of Data in the Permeability Test Field

The discrepancy of different data systems has long been the obstacle in the development of permeability test in our country, which has direct link to the manufacturer's data system and the different calibration methods of the instruments. This problem has not been resolved since the mid-twenties, that is, from the beginning of the permeability test.

Though this discrepancy is known to the industry, the severe influence can not be offset, especially with the stricter and clearer quantitative requirements in the national standards for the permeability of packaging materials, such as food and pharmaceutical packaging materials. Some materials, especially those with the permeability near the upper limit or the lower limit of the standard requirements, would obtain different test data with permeability instruments from different manufacturers. Furthermore, complete contradictory test results of qualified and non-qualified can be obtained with different instruments.

In the proficiency project named Plastic Packaging Materials' Permeability Test—Oxygen Transmission Quantity and Water Vapor Transmission Quantity Test, which was organized by the Certification and Accreditation Administration of the People's Republic of China, this problem has already been completely exposed: more than 20% of the 70 participating labs provided with much higher test data. The labs include several domestic labs with the third-party accreditation function. Thus, the unification of permeability test data system has become extremely urgent.

### 2. Progress in Domestic Unification of Permeability Test Data System

Through long-term test and data comparison, we have concluded that, though the test data provided by different manufacturers are inconsistent, agreement or fewer discrepancies can be realized with the help of calibration. According to CNAS-CL06, Requirements for Measurement Traceability, the discrepancies of permeability test data systems can be effectively resolved by producing instruments of the highest standards and the reference films.

A common method is to make test data traceability with reference materials. If the films can maintain their characters stably, the uncertain errors in their manufacturing processes can be within control, and if the permeability (gas transmission rate and water vapor transmission rate, etc.) of them are obtainable, technologically, there is feasibility for films to be the data transmission materials. However, the data transmission accuracy and

influence of this method are questioned owing to the lack of effective manufacturing process of reference films and accredited transmission rate calibration device. Actually, the data calibration method commonly for permeability instruments is to test the reference films, and to calibrate the data system according to their permeability data. Yet, all the reference films are provided by the manufacturers as the individualized activity, and the permeability data of those reference films are not accredited by the national measurement systems both at home and abroad.

Owing to the fact that the permeability performance of the packages directly links to the packaging safety of food and pharmaceuticals, there has been great demand for the unification of permeability data systems from the testing institutions, research institutions and the packaging market. Since 2009, Shandong Bureau of Quality and Technical Supervision and Labthink have jointly initiated the gas transmission rate reference films for plastic films and have developed, based on domestic and international testing methods and standards, the ultra high-accuracy transmission rate calibration devices which are far beyond the standard performance and index requirements. In this way, the data transmission and traceability functions can be realized with the help of gas transmission rate reference films. On the other hand, the standard data of gas transmission rate reference films can be obtained from transmission rate calibration device. Thus, the data accuracy is guaranteed, and the calibration of gas transmission rate instruments is accomplished.

The R&D of reference films and transmission rate calibration devices has drawn high attention of the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ). In AQSIQ's 2009 science and technology plan, two project has been specially set up to pave the way for reference film manufacturing and application, as well as solutions to the data traceability of those films. The two projects are as follows:

1. 2009 AQSIQ Science and Technology Plan (Quality and Technology Supervision Section) Project – R&D of Reference Films for Plastic Film Gas Transmission

Start Date: August, 2009

Accomplish Date: December, 2010.

Group: Measurement & Testing Group

Declaration/Recommendation Institution: Shandong Bureau of Quality and Technical Supervision

Project Output: Reference Film for Plastic Film Gas Transmission Rate

2. 2009 AQSIQ Science and Technology Plan (Quality and Technology Supervision Section) Project – R&D of Transmission Rate Calibration Device

Start Date: October, 2009

Accomplish Date: October, 2011

Group: Measurement & Testing Group

Declaration/Recommendation Institution: Shandong Bureau of Quality and Technical Supervision

Project Output: Transmission Rate Calibration Device

The proposals of those two projects are based on the detailed analysis of the outstanding issues in packaging material test field. We have made a long-term investigation of data calibration methods of the permeability instruments, instrumental working conditions and the key indexes in test. We have also carried out instrumental data comparisons, as well as the investigation of standard execution status of various instrument manufacturers with the detailed analysis for the present technological difficulties. Thus, we have established the foundation for reference films' R&D requirements and the design and the calibration method of transmission rate calibration device. As to the transmission rate calibration device, the sensitivity, repeatability and stability should be guaranteed, and the accuracy of the device should be higher than the existing gas transmission rate instruments.

The fundamental requirements for reference films are stable and even.

### **3. The significance and Progress in the R&D of Reference Films**

The R&D of the reference films for plastic film gas transmission rate can provide a unified basis for the calibration of gas transmission rate instruments, so as to achieve standardized, practical and traceable calibration of the gas transmission rate instruments. It should be pointed out that this reference film is the first unified traceability method for plastic film gas transmission test data system that fills the gap in the world. It will improve the authority and the power of discourse of China in the world permeability test field, and will establish the foundation for unifying water vapor transmission rate data system.

Shandong Bureau of Quality and Technical Supervision and Labthink have made verification and technological breakthroughs in the R&D of reference film and transmission rate calibration device. The R&D project of plastic film gas transmission rate reference film will be accomplished in December, 2010. Then, with the transmission rate calibration device, the plastic film gas transmission rate reference film will provide calibration services to the varied gas transmission rate instruments.