

## Further Improvements on Performance of Weighing Method Water Vapor Transmission Rate Tester

**Abstract:** weighing method is the basic testing method for water vapor transmission rate measurement. After realizing automatic testing of water method, Labthink has made a series of innovative improvements on weighing method water vapor transmission rate tester with higher testing efficiency and better capability for extension. Thus, customized demands for desiccant method testing and inverted water method testing, as well as testing demands for special samples can be met.

**Key Words:** water vapor transmission rate, WVTR, weighing method, testing efficiency, inverted water method

Weighing method has long been the basic testing method for water vapor transmission rate testing with the widest applications, which can be subcategorized into desiccant method and water method, etc. The method needs manual operation in its early stage to accomplish the testing; yet, the relevant instruments are low in automation. Since high efficiency and multi-function are the trend for instrumental development, Labthink has, after introducing the first water method water vapor transmission rate tester of the world in 2003, made a series of innovative improvements on weighing method water vapor transmission rate instruments, and introduced Labthink PERME W3/031 Water Vapor Transmission Rate System with strengthened extension capability. Customized demands for desiccant method testing and inverted water method testing, as well as testing demands for special samples can be met.



### 1. Higher Testing Efficiency

Commonly, it's mistakenly held that weighing method is low in testing efficiency. No matter which method is applied, there is not much difference in time to realize permeation equilibrium between the sides of the sample. This is because the permeation performance of the sample is definite, and the only influential factor would be the fluctuation of ambient environment. Therefore, what truly influence the testing duration is the testing interval selected by the operator and the permeation equilibrium determined by the operator; of which, the latter is more influential.

Generally, instruments of weighing method are in strict accordance with the testing standards in determining permeation equilibrium. In other words, permeation equilibrium would be considered to have been realized when the changing rate is lower than a certain rate. It's usually applied by the sensor method instruments with a fixed

testing duration, after which the instrument would be assumed to have achieved equilibrium. In practice, slight changes during permeation process would greatly influence the judgment on proportion mode, and no influence on fixed duration testing mode. However, it's doubtful for the latter to achieve permeation equilibrium when the test ends.

The barrier properties of all the samples to be tested would also influence the testing efficiency. Though each sample is tested individually in the multi-chamber weighing method instrument, the testing result could only be issued when the tests on all the samples have finished. Thus, testing efficiency depends on the sample with the best barrier property among the samples. Such low testing efficiency would be further influenced by the diversity of samples in the multi-chamber instruments, a problem more serious when testing results are in urgent need.

As it's required by the standards, the reliable testing results can only be issued after 3 testing data for each sample are obtained. Thus, Labthink specially develops a three-chamber testing instrument: Labthink PERME W3/031 Water Vapor Transmission System. The instrument has perfectly realized independent three-chamber testing with its patent weighing mechanism. Individual testing data for three samples can be obtained in one test. Meanwhile, since samples of the same material would not fluctuate much, the issuing time of testing data would be quite near. Therefore, higher testing efficiency can be realized when the three chambers are testing samples of the same material.

## 2. Better Testing Accuracy

Weighing method is the arbitral method for water vapor transmission rate testing, whose data accuracy is of vital importance. The structural optimization and most excellent components have guaranteed Labthink PERME W3/031 Water Vapor Transmission Rate System to realize highest testing accuracy in the world. Meanwhile, its humidity and temperature control capability are far superior to requirements of standards. It has better wind speed regulating function and faster calibration means. All those guarantees the wide applications of W3/031 for the water vapor transmission rate measurement of plastic films, composite films, sheets, high barrier materials, back sheets, foils, waterproof materials, thermal insulation materials and other materials applied in construction, medical and other fields. Thus, the testing subjects have expanded from packaging materials to textile, rub and building materials as well as new materials such as corrugated paper and back sheets applied in solar cell.

## 3. Supporting Inverted Cup Method

Inverted cup method, a subtype of weighing method, is to clamp the film or sheet sample in the cup, with distilled water on the upper surface and a certain humid environment at the lower surface of the sample. When the distilled water permeates through the sample and into the humid environment, water vapor transmission rate can be obtained by measuring cup weight at intervals.

Though rarely applied, inverted cup method is not new to the industry. The term, inverted cup method, states once ASTM E96, *Standard Test Methods for Water Vapor Transmission of Materials*. In GB 1037, *Test Method for Water Vapor Transmission of Plastic Film and Sheet—Cup*, the Chinese adoption of ASTM E96, only the desiccant method is introduced. Thus, there is not proper attention on inverted cup method domestically. Now, with increasing demands and international trading, testing demands for inverted cup method has found gradual increase. Unfortunately, the existing instrumental structure of weighing method cannot completely satisfy the needs for inverted cup method testing, especially in the process of cup inversion and the structure of the cup. Such needs has been taken into consideration in the design of Labthink PERME W3/031 Water Vapor Transmission Rate System; the testing of inverted cup method can be realized with customized cup. At the same time, this instrument can realize water method testing with certain functional expansions.

#### **4. More Powerful Software**

Permeability test is more sensitive to data produced in process, which sets high requirements for software performance. Otherwise, data accuracy would be seriously affected. Labthink world leading software for permeability testing, based on its complete functions and convenient operation, can provide complete and rapid whole course monitoring, as well as innovations in authority setting and testing process recording. Meanwhile, language selection and operational help have been improved.

#### **5. Conclusions**

Weighing method is widely applied as the basic testing method for water vapor transmission rate. As a result, every technological innovation of weighing method tester would bring great influence to the whole industry. Now, the new patented structure of Labthink weighing method instrument has accomplished a thorough upgrading in testing efficiency, testing accuracy and functional extensions, which make it more outstanding when compared with various kinds of sensor method water vapor transmission rate testing instruments so as to help customers' purchase objectively and scientifically.