New ASTM Standard F3136

ASTM recently released standard F3136, the first new film permeation standard to be published in seven years. This standard details a procedure for determining the oxygen transmission rate (OTR) through plastic film, sheeting, laminates, coated or uncoated papers, and fabrics using Dynamic Accumulation (DA) methodology and a fluorescence-based sensor. When tested against an instrument that complies with ASTM D3985, the coulometric test method for measuring OTR through plastic films, the DA method described in ASTM F3136 showed comparable test results to the level of statistical significance when testing low oxygen barriers. This new standard corresponds with MOCON's OpTech®-O_2 Model P when used in conjunction with a test cell.

The method described in ASTM D3985 uses the isostatic method, where the sample being tested is inserted into a test cell with O_2 flowing on one side and the carrier gas (usually N_2) on the other. In instruments with coulometric sensors, 100% of the oxygen than passes through the film is sent to the sensor for analysis; with non-coulometric sensors only a portion of the oxygen goes to the sensor.

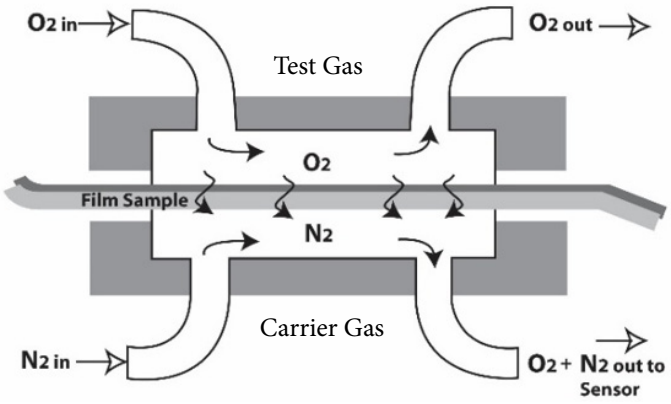

Figure 1. A test cell that uses the isostatic method.

Both gases flow constantly once the side with the carrier gas has been purged of oxygen, and even when the instrument is not being used for analysis it is necessary to continually purge the test cell with N_2 to protect the sensor from being consumed by atmospheric oxygen.

Unlike the isostatic method, the DA method does not involve a constant gas flow. The accumulation side of the test cell is purged with N_2, then the flow of nitrogen is shut off for the remainder of the test. An opaque window with an oxygen sensor is embedded into the test cell. The instrument emits fluorescent light, and as oxygen permeates through the barrier and accumulates inside the test cell, the fluorescence given off by the instrument is quenched by the oxygen in proportion to its concentration.

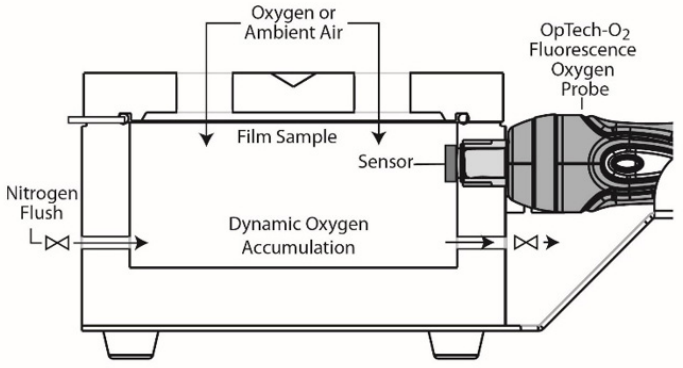

Figure 2. A test cell that uses the dynamic accumulation method.

Previous versions of a DA method have involved extracting oxygen from the test chamber for analysis using a gas chromatograph, consuming some of the oxygen in the test chamber. This is not ideal because each time a sample is taken it changes the concentration of oxygen in the test cell and could lead to inaccurate results. The DA method described in ASTM F3136 does not consume oxygen, and so offers a more accurate way to measure OTR over GC techniques.

Because this method does not require a constant flow of carrier gas, it is ideal for measuring the OTR of perforated packaging such as that used in the food industry. The cost associated with operating an instrument that uses the DA method is low because it requires significantly less nitrogen gas due to the fact that there is not a steady flow of nitrogen during testing and there is no flow when the instrument is not in use. Fluorescence-based sensors cost less to operate and require less frequent replacement because the sensor is not consumed upon exposure to oxygen. The initial cost of the sensors is also

low, making this a cost-effective option for testing low oxygen barriers.

The sensors used in fluorescence-based OTR testing can be made with either platinum or ruthenium. MOCON's OpTech-O_2 instrument is the only one that uses platinum sensors, which are ten times more sensitive than ruthenium sensors. Not only does this allow the instrument to detect smaller changes in OTR with greater accuracy, platinum sensors are less affected by changes in temperature and have a greater usable lifetime than ruthenium sensors.

The low cost associated with fluorescence-based instruments make them an excellent alternative to the traditional steady state method instruments for testing high oxygen transmitters.

This new ASTM standard is of great benefit to the packaging film marketplace since it will support the further development of fluorescence-based OTR instruments.

For more information about ASTM F3136 or the OpTech-O_2, visit our website or contact your MOCON representative.

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