

Effects of Temperature and Relative Humidity on High-Barrier Material Films and Packages

Barrier Film Testing

O₂ Transmission Rate vs. Temperature

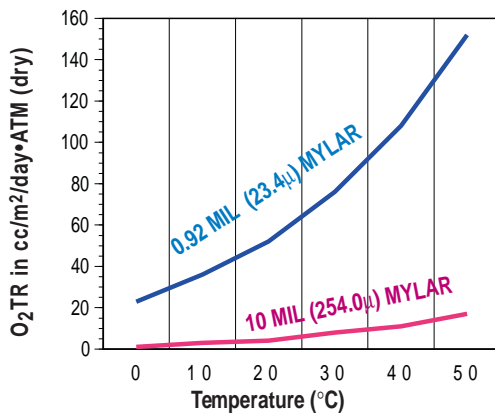


Figure 1. The thicker the material (MYLAR® shown here), the better barrier to oxygen transmission. The answers documented during testing will tell you how thick and what barrier material will best suit your project. Incoming quality control will also have a specification to measure vendor performance.

High Barrier Film Testing Comparisons

O₂ Transmission Rate vs. Relative Humidity

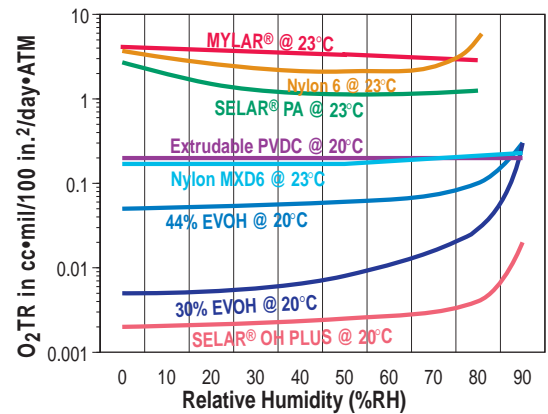


Figure 2. Relative humidity also affects the O₂ transmission rate of a variety of materials as shown above. A variety of combinations of materials, thicknesses, temperatures, and relative humidity can be tested on the OX-TRAN 2/21 System.

Package Testing

O₂ Transmission Rate vs. Relative Humidity

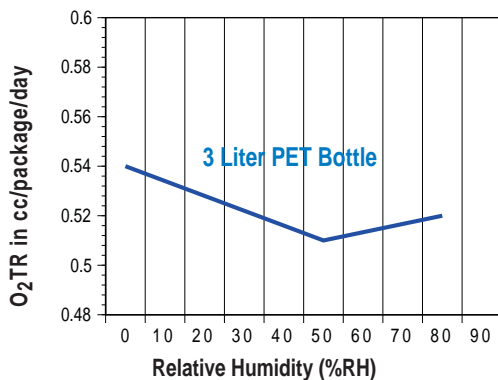


Figure 3. Complete packages can be tested for varied parameters including the effect of relative humidity on O₂ transmission rates. The Package Environmental Chamber (PEC) allows for very flexible package testing considerations.

Analytical Software Tools

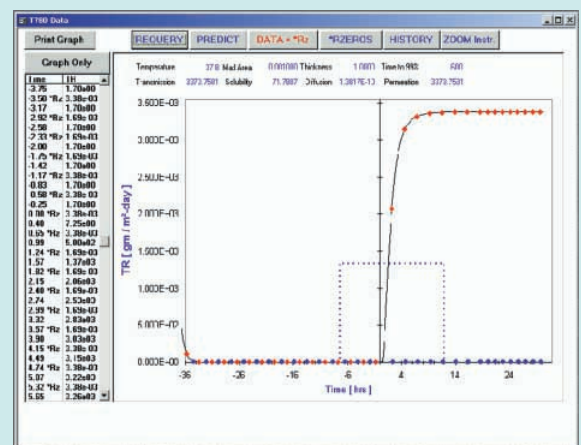


Figure 4. The OX-TRAN 2/21 System utilizes software which provides a variety of reporting formats to fit your needs. Sophisticated, yet easy to use, transmission rate software for system operation and control will produce test results such as graphs, tables, or numerical listings as you desire.

Product Selection Information



Module Choices for System Configuration

	MD	SD	MS	SS	MH	SH	ML	SL	MT	ST
O₂TR Test Range:										
Note 1 Below							X	X		
Note 2 Below	X	X	X	X	X	X				
Note 3 Below									X	X
Sensor:										
Red COULOX Sensor	X	X	X	X	X	X				
Blue COULOX Sensor							X	X		
Green COULOX Sensor									X	X
Test Temperature Range:										
20 C to 50 C	X	X								
5 C to 50 C			X	X						
10 C to 40 C					X	X	X	X		
10 C to 35 C									X	X
Standard Testing:										
Films - Dry or Ambient	X	X	X	X	X	X	X	X	X	X
Packages - Dry or Ambient	X	X	X	X	X	X	X	X	X	X
Films or Packages at Unknown Wet RH									X	X
Controlled RH Testing:										
Films - 0%, and 35% to 90% RH ±3%					X	X	X	X		
Packages - 0%, and 35% to 90% RH ±3%					X	X	X	X		
Test Samples Size:										
Films - 5 in. x 5 in. (12.7 cm x 12.7 cm)									X	X
Films - 4.25 in. x 4.25 in. (10.8 cm x 10.8 cm)	X	X	X	X	X	X	X	X		
Packages - Up to 3 liters per package	X	X	X	X	X	X	X	X		
Controlled RH - Up to 2 liters per package					X	X	X	X		
RH PLUS Easy RH Control					X	X	X	X		
Test Cells per Module, Two - 50cm ² Test Cells	X	X	X	X	X	X	X	X	X	X
Expandable up to 10 modules (20 test cells)	X		X		X		X		X	
Computer, Monitor, Printer and WinPerm™ Software	X	X	X	X	X	X	X	X	X	X
Automatic Temperature Monitor & Control	X	X	X	X	X	X	X	X	X	X
Barometric Pressure Compensator (optional)	X	X	X	X	X	X	X	X	*X	X

Specifications provided on request.

* Included in price on MT

	cc/m ² /day	cc/100 in ² /day	cc/pkg./day
Note #1	Unmasked	0.005 to 200	0.0003 to 13
	Masked	0.05 to 2,000	0.003 to 130
Note #2	Unmasked	0.05 to 200	0.00025 to 1.0
	Masked	0.5 to 2,000	0.03 to 130
Note #3	Unmasked	775 to 155,000	50 to 10,000

This instrument is ETL listed, Conforms to UL Std. 1262, is Certified to CAN/CSA C22.2 No. 151, and Complies with CE Product Safety, Electromagnetic Emission & Susceptibility

Possible OX-TRAN 2/20 System Configurations starting with Master Base Control System:



Copyright © 2002 MOCON, Inc. All rights reserved.

MOCON, OX-TRAN, and COULOX are registered trademarks and WinPerm is a trademark of MOCON, Inc. Windows and Excel are registered trademarks of Microsoft Corp.

U.S. Patent #4,973,395

MOCON reserves the right to change specifications without notice as part of our continuous program of product improvement.



7500 Boone Avenue North
Minneapolis, Minnesota 55428 USA

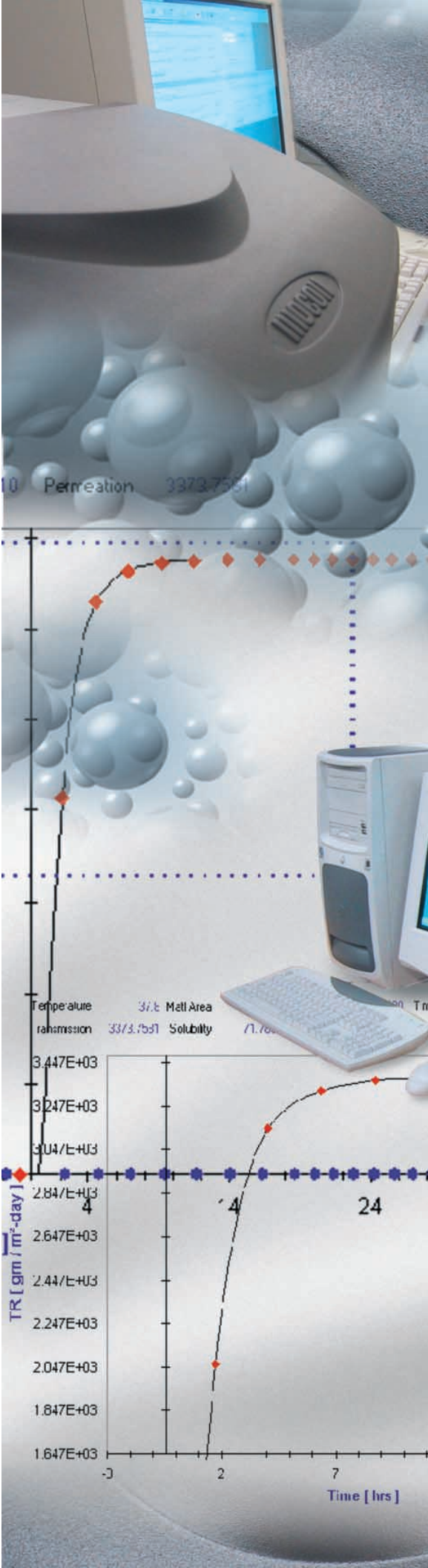
Telephone: 763-493-6370
Fax: 763-493-6358
Website: www.mocon.com

OX2/2104025M

OX-TRAN[®] Model 2/21

The Standard for Oxygen Transmission
Rate Testing of Flat Films & Finished
Packages

- Systems are Certified Traceable to N.I.S.T.
- Windows[®] based software interface
- Highest precision Coulox[®] Oxygen Sensor



Modular Design

Only MOCON systems comply
with the following standards:

- ASTM D-3985 films
- ASTM F-1927 films
- DIN 53380 films
- JIS K-7126 films
- ASTM F-1307 packages
- ISO CD 15105-2

Made in USA

mocon[®]
Over 35 Years of
Permeation Experience

M

Master Base Control Systems to Fit Your Application and Budget... Plus additional Satellite Modules Allow You to Design and E-X-P-A-N-D Your Own System.

Consider the OX-TRAN 2/21's flexibility in your application. Choose from five Master Base Control Systems and five Satellite Application Modules, each providing different test capabilities. Combine a Master Base Control System with as many as nine Satellite Application Modules for a maximum of 20 test cells per system. The Coulox oxygen sensor is contained in each module for high accuracy and maximum throughput.

I

Includes Computer with Printer and WinPerm™ Permeability Software



- Sophisticated Windows® based software control with a high speed computer & printer
- Up to 10 modules (20 test cells) can be incorporated, each containing a high performance oxygen sensor for maximum throughput
- No sensor calibration required
- Computer-determined equilibrium and barometric pressure compensation
- Double-cell film testing mode for increased sensitivity
- RS-232-C output

O

Optional Package Environmental Chamber (PEC)

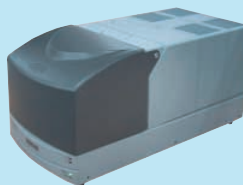


- Package testing under select environments
- Compatible with any Master or Satellite L, H, S, or T module

ADD ONE...

Master Base Control Systems (each contains...)

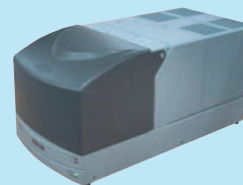
ML



- Dual film test cell module
- Blue Sensor for ultra sensitivity
- Precise control of relative humidity
- Temperature Control 10 C to 40 C
- Computer and printer

OR

MH



- Dual film test cell module
- Red Sensor for high sensitivity
- Precise control of relative humidity
- Temperature Control 10 C to 40 C
- Computer and printer

OR

MS

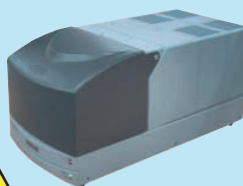


- Dual film test cell module
- Red Sensor for high sensitivity
- Temperature Control 10 C to 40 C
- Computer and printer

AND FROM THE CHOICES BELOW, UP TO 9 SATELLITE MODULES CAN BE ADDED— NOW OR LATER...

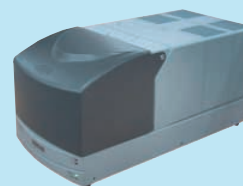
Satellite Application Modules (each contains...)

SL



- Dual film test cell module
- Blue Sensor for ultra sensitivity
- Precise control of relative humidity
- Temperature Control 10 C to 40 C

SH



- Dual film test cell module
- Red Sensor for high sensitivity
- Precise control of relative humidity
- Temperature Control 10 C to 40 C

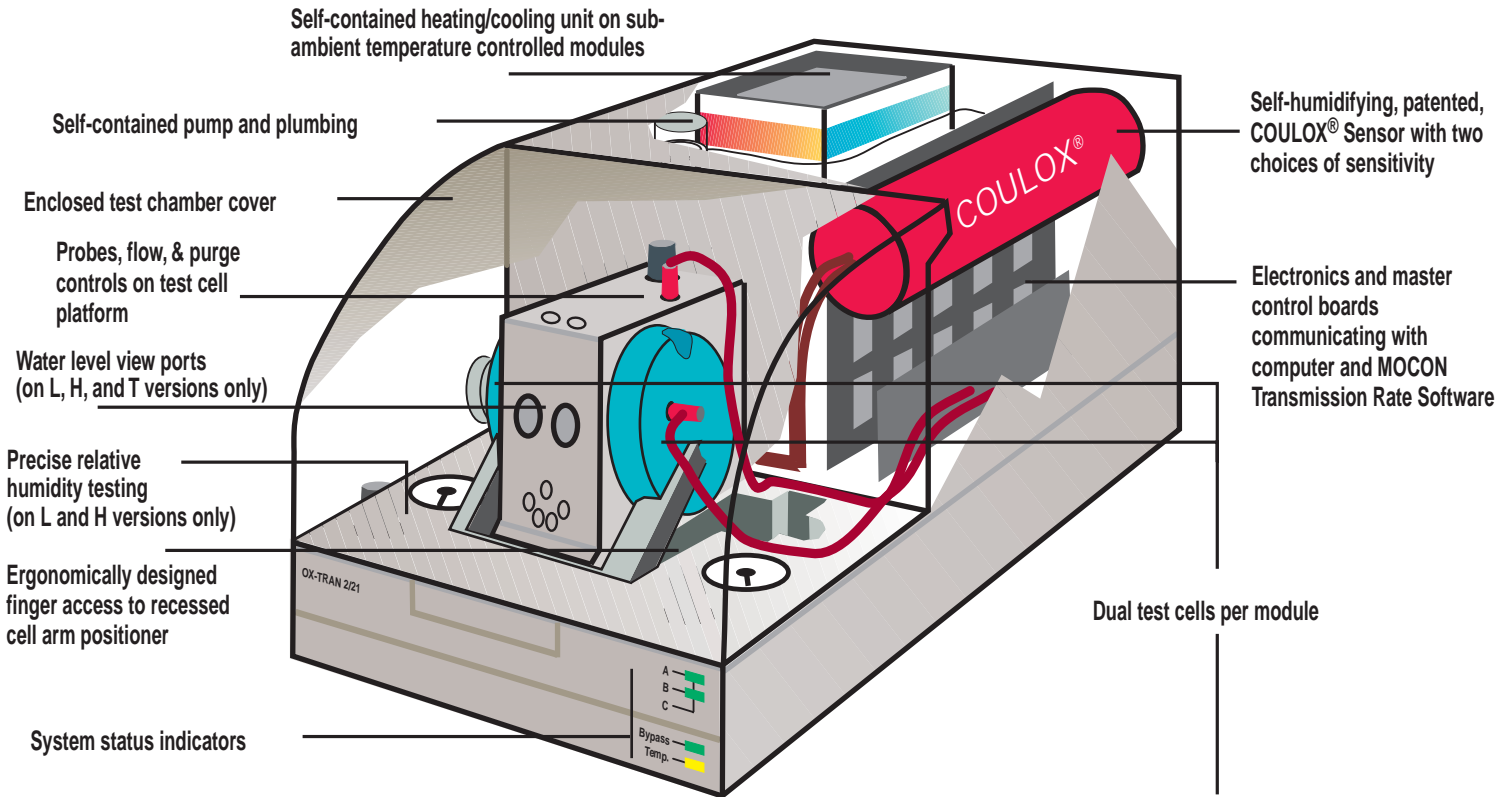
SS



- Dual film test cell module
- Red Sensor for high sensitivity
- Temperature Control 10 C to 40 C

PEC CAN BE INSTALLED ON L, H, S or T MODULES

The OX-TRAN 2/21 Provides Maximum Flexibility in a Modular Design

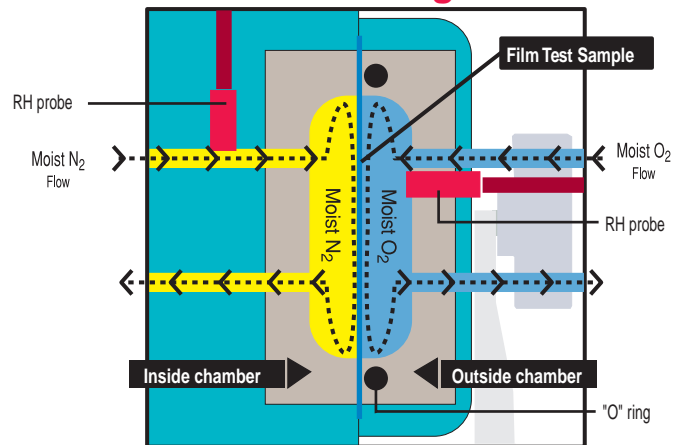


P rinciple of Operation

Setting the worldwide standard for permeation testing, the OX-TRAN 2/21 system uses a patented coulometric sensor (COULOX®) to detect oxygen transmission through both flat materials and packages. This high performance sensor (three models available, each with distinct ranges for higher accuracy) provides parts-per-billion sensitivity even in the presence of water vapor. The Coulox sensor is an intrinsic or absolute sensor that does not require calibration. Calibration films are provided to ensure the entire system is performing to the highest MOCON precision and accuracy standards.

Flat film samples are clamped into the diffusion cell, which is then purged of residual oxygen using an oxygen-free carrier gas. The carrier gas is routed to the sensor until a stable zero has been established. Pure (99.9%) oxygen is then introduced into the outside chamber of the diffusion cell. Molecules of oxygen diffusing through the film to the inside chamber are conveyed to the sensor by the carrier gas.

Side View of Test Cell Diagram



Various system configurations allow you to simultaneously condition and test materials over a wide range of temperature and relative humidity conditions similar to a package's actual storage environment. For example, the film test cell in the OX-TRAN 2/21, ML Module incorporates RH probes on both sides of the film to ensure precise control of the monitored RH levels.