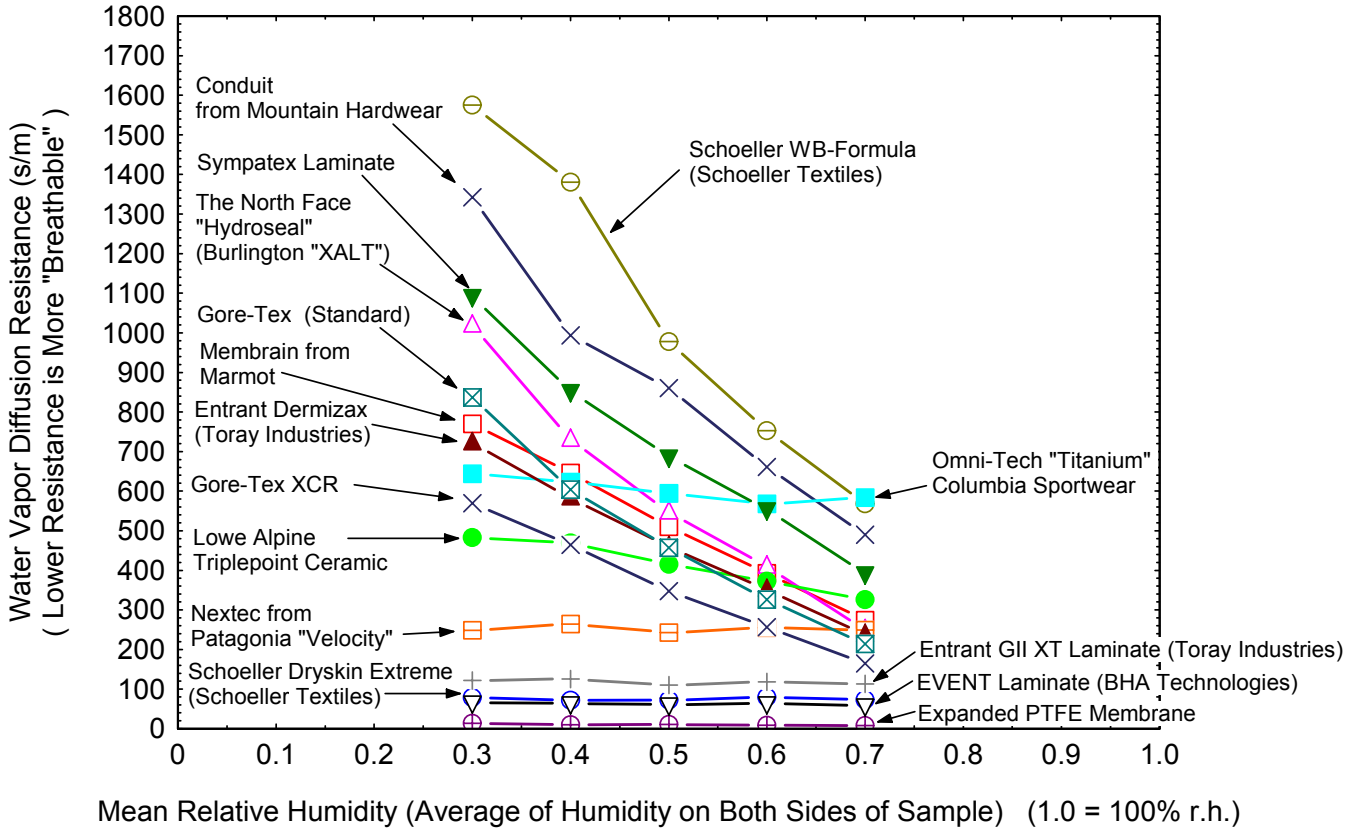
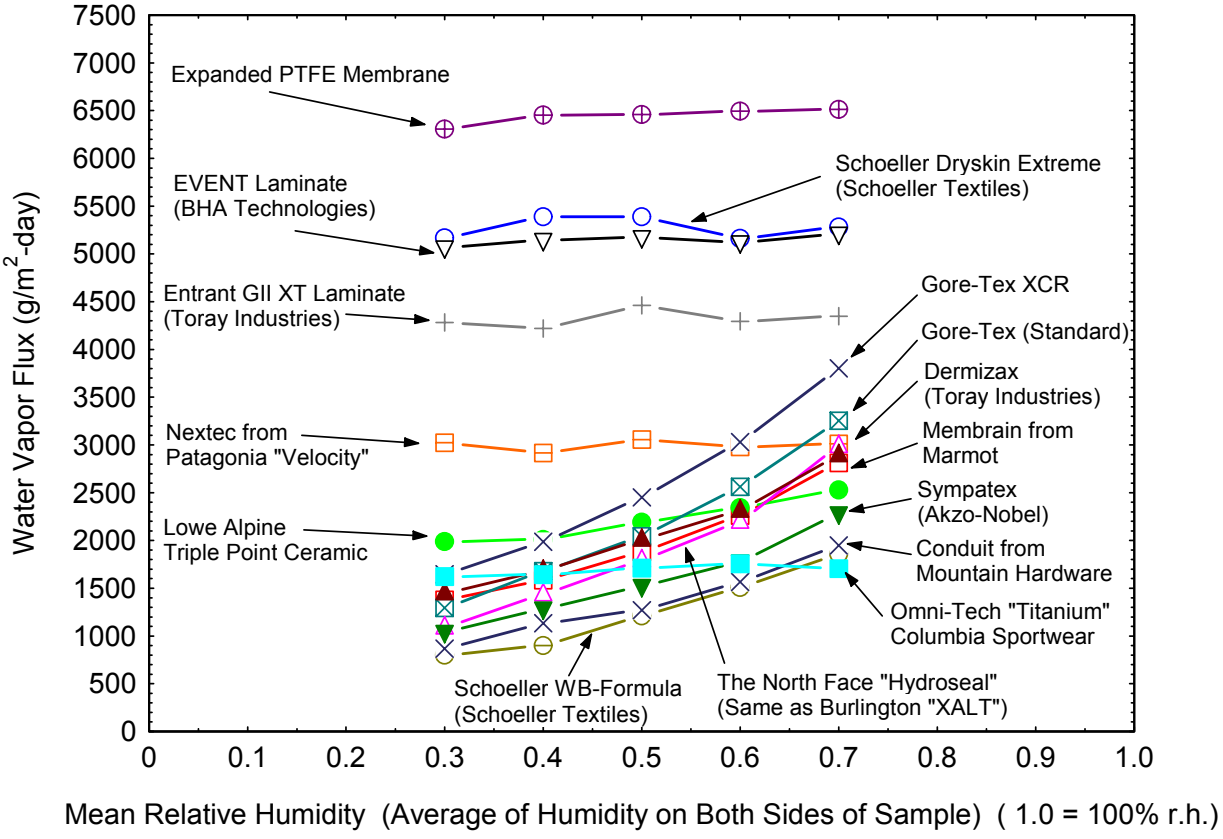
“Breathability” Comparison of Commercial Outerwear Shell Layers





Water Vapor Diffusion Test - Dynamic Moisture Permeation Cell

Air at two different relative humidities flows over the two sides of the test sample. By measuring the water vapor concentration at the exits of the cell, it is possible to measure how much water vapor crosses the sample. Results may be shown in terms of water vapor flux (grams/square meter/day) or resistance to the diffusion of water vapor (units of s/m). The resistance units make comparing results obtained at different environmental conditions much easier. The lower the diffusion resistance, the more water vapor gets through the material. The reason for doing the testing this way is that some materials like Gore-Tex, Sympatex, etc., have much better water vapor transport properties when they are in a humid environment than when they are in a dry environment, relatively speaking. Other materials, such as most textiles or microporous membranes, have a nearly constant water vapor diffusion resistance regardless of the environmental conditions

Test Conditions – Water Vapor Diffusion

Temperature = 30 ^{o}C

Gas Flow Rate = 2000 cm^{3}/minute.

Note: relative humidity of 100% is 1.0, so 0.50 is 50% r.h., etc.

Setpoint #	Humidity on Top of Sample	Humidity on Bottom of Sample	Mean Relative Humidity	Humidity Gradient
1	0.55	0.05	0.30	0.50
2	0.65	0.15	0.40	0.50
3	0.75	0.25	0.50	0.50
4	0.85	0.35	0.60	0.50
5	0.95	0.45	0.70	0.50

Further details on the test method are available in the following references:

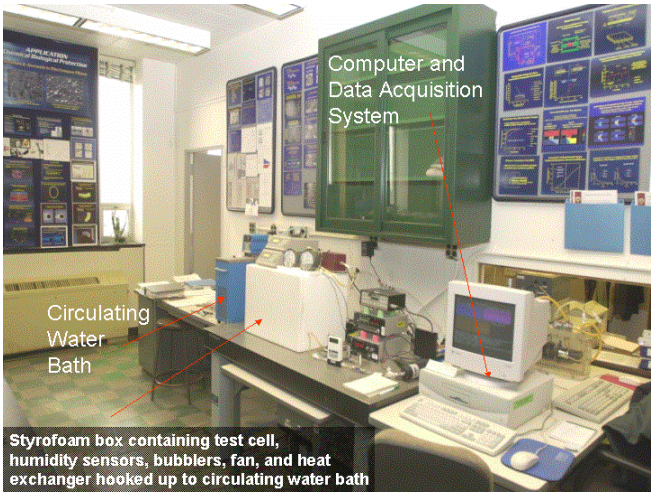
Gibson, P.W., "Effect of Temperature on Water Vapor Transport Through Polymer Membrane Laminates," *Journal of Polymer Testing* **19** (6), 2000.

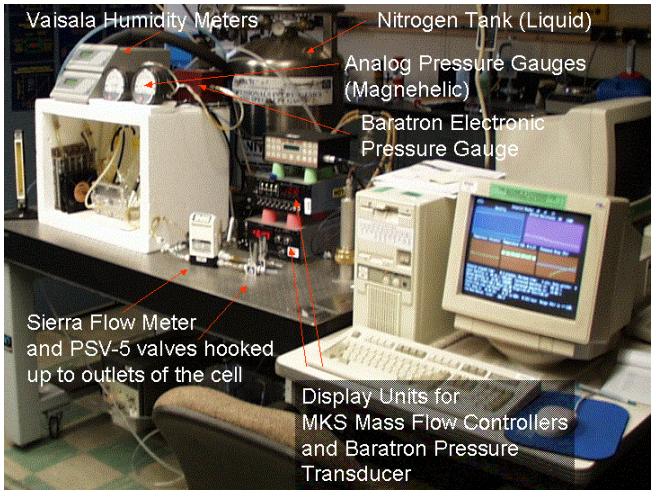
Gibson, P.W., Rivin, D., Kendrick, C., "Convection/Diffusion Test Method for Porous Textiles," *International Journal of Clothing Science and Technology* **12** (2), 2000.

Gibson, P.W., "Water Vapor Transport and Gas Flow Properties of Textiles, Polymer Membranes, and Fabric Laminates," *Journal of Coated Fabrics* **28**, April, 1999.

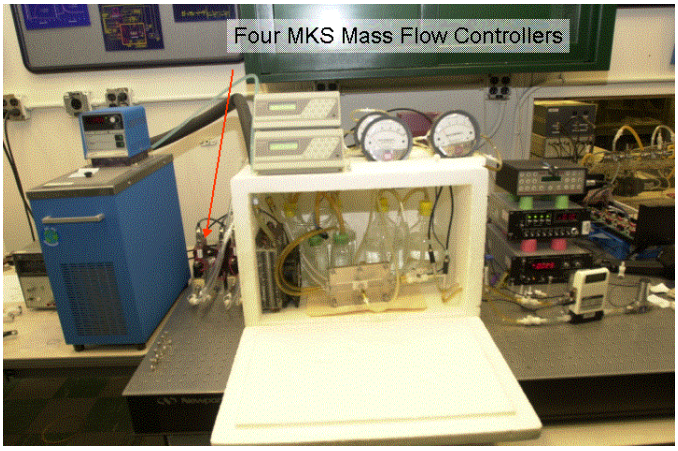
Gibson, P.W., Rivin, D., Berezin, A., Nadezhdinskii, A., "Measurement of Water Vapor Diffusion Through Laminated Fabrics and Membranes Using a Diode Laser Spectroscope," *Polymer-Plastics Technology and Engineering* **38** (2), 1999.

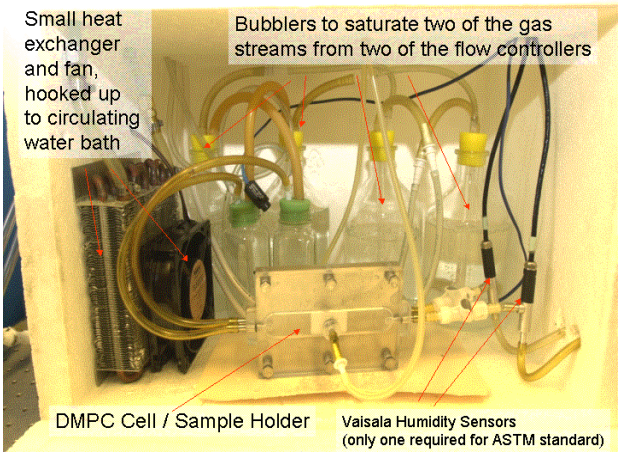
Gibson, P., Kendrick, C., Rivin, D., "Apparatus and method for determining transport properties of porous materials," United States Patent 6,119,506, September 19, 2000.





Dynamic Moisture Permeation Cell (DMPC)





Conditioning Chamber and Sample Holder

Phil Gibson
Materials Science Team
AMSRD-NSC-SS-MS
U.S. Army Soldier Systems Center
Natick, MA 01760-5020
phone: 508-233-4273
fax: 508-233-5521
email: Phil.Gibson@natick.army.mil
http://www.natick.army.mil