

Best material size for permeation testing

Question:

I have some film samples for WVTR testing. I understand the MOCON cell area is 50cm². What film dimensions work best, and how small could we make the films for masking before the WVTR reading is affected? We don't expect the barrier level to surpass 0.35 g/(m² • day).

Recommendation:

Recommendation from Joel Fischer MOCON's lab manager in our corporate office in Minneapolis, Minnesota.

When we analyze materials, we do prefer to mount a "full size" sample. This would be a 4" x 4" (10.16cm x 10.16cm) square sample that mounts into our diffusion cell. When sealed into the cell, the actual test area / film exposure area is 50cm².

For WVTR testing, when analyzing a 50cm² sample, the low-end sensitivity of the instrument is 0.005 g/(m² • day).

Via a "masking" process, we can analyze smaller samples. As you've already noted, this will affect the low-end sensitivity, because a smaller test area allows for less water to reach our sensor.

The most common area that we mask samples to is 5cm². This is roughly the size of a US quarter coin. The material needs to be slightly larger than the exposure area and I'd recommend a 2" x 2" (5.08cm x 5.08cm) square piece. When masked to the smaller 5cm² size the low-end of the instrument is now 0.05 g/(m² • day). For a material near 0.35 g/(m² • day), this is a large % of the measured value.

When possible, we only mask materials in two situations:

1. The material is a very high transmitter and the larger 50cm² sample size lets too much flux through to the detector and over-ranges the instrument, and
2. When larger samples can not be produced.

The two downsides to masking are:

1. For low transmitters, we lose sensitivity and gain a higher +/- variability in the results.
2. Many "lab made" films or "small scale" runs can have a lot of variability (especially coatings / materials made in a petri dish). The materials could have thickness variability and differences between curing and crystallinity. So... innately, analyzing small areas yields large differences. Whereas a larger exposure area can better "average" the material differences and the corresponding water vapor transmission rate.

My recommendation is to produce the largest samples possible, which will allow us to mask them to the largest possible exposure area.

If you're looking for a very good generic source of innate transmission rate / permeability data, we recommend a book that is published by the Plastics Design Library.

http://www.ebook3000.com/Permeability-Properties-of-Plastics--and-Elastomers--A-Guide-to-Packaging-and-Barrier-Materials-by-Liesl-K--Massey_127495.html

