



Powering the Future

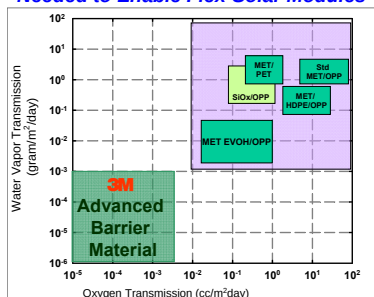
3M Renewable Energy Division

Pulsed Valve Mass Spectrometry Film Permeation Tool

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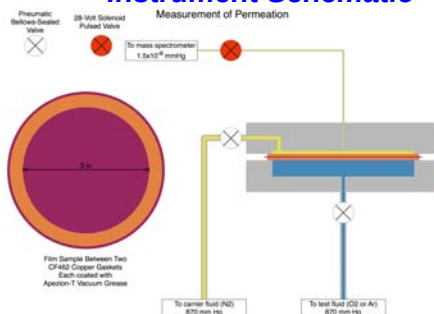
Ultra-low Flexible Barriers Needed to Enable Flex-Solar Modules



New detection methods required for
permeation performance verification

Approach: Pulsed valve sample introduction from atmospheric
pressure test cell, permeation detection by mass spectrometry

Instrument Schematic

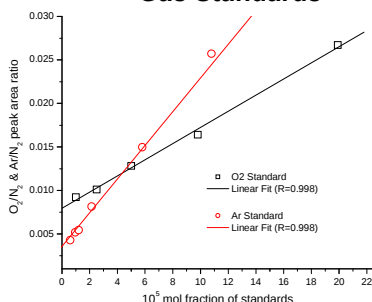


Key Features

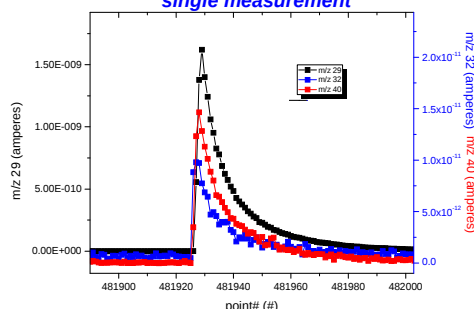
- ➔ Atmospheric pressure test conditions
- ➔ Measurements up to 100°C
- ➔ Multiple species detection
- ➔ Integration of permeation signal → high sensitivity
- ➔ Proprietary method & apparatus

Calibration, Pulsed Signal Response, Certification Film

Calibration Plots for Ar & O₂ Gas Standards

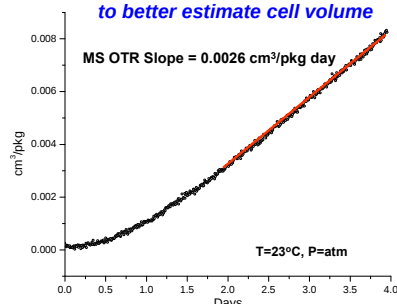


MS Signal/Valve-pulse Multiple permeant detection in a single measurement



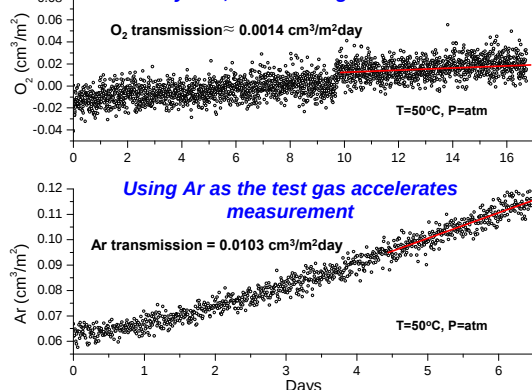
OTR Certification Film Measurement

Certification film (0.0026 cm³/pkgday) used
to better estimate cell volume

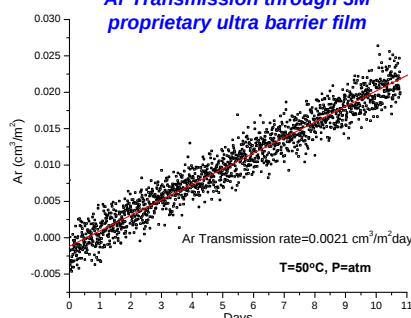


Measurements on 3M Proprietary Barrier Film

O₂ Transmission through this 3M proprietary barrier film
is very low, takes a long time to establish rate



Ar Transmission through 3M
proprietary ultra barrier film



Summary

3M is developing proprietary
barrier films with engineered
performance for solar and
display applications

This mass spec based
permeation tool allows for high
sensitivity, fast determination
of barrier performance

Tool can detect below limits of
other commercial instruments

Development is underway for a
water MS permeation tool