# Introducing the Environment Cell

## Faster Speed. Greater Accuracy. Easier to Use.

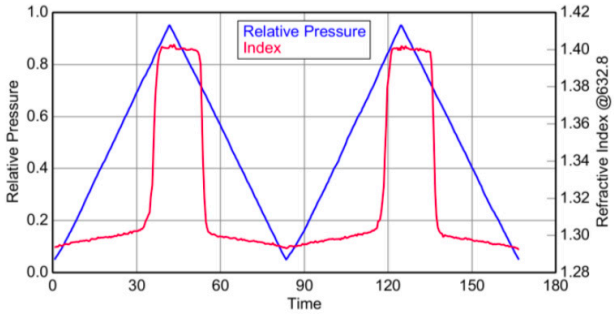

The Environment Cell is an optional accessory for the M-2000 and RC2 featuring a patented vapor-delivery system to create relative pressure environments using a wide variety of solvents. The Environment Cell operates under standard atmospheric conditions enabling quick setup and teardown of experiments.

The included stage is designed to easily attach to the M-2000 and RC2 horizontal bases. Combining the capabilities of spectroscopic ellipsometry with the Environment Cell enables detection of thickness and refractive index as a function of solvent relative pressure. The integrated software calculates the adsorbed solvent volume as well as pore size distribution for mesoporous samples.

# FEATURES

### Patented Technology

The Environment Cell features a patented algorithm to accurately control the relative pressure of the sample environment [1]. This predictive algorithm relates relative pressure to the temperature of the sample environment and flow rates of solvent and carrier gas to enable precision feedback control of the relative pressure of nearly any solvent-gas mixture.

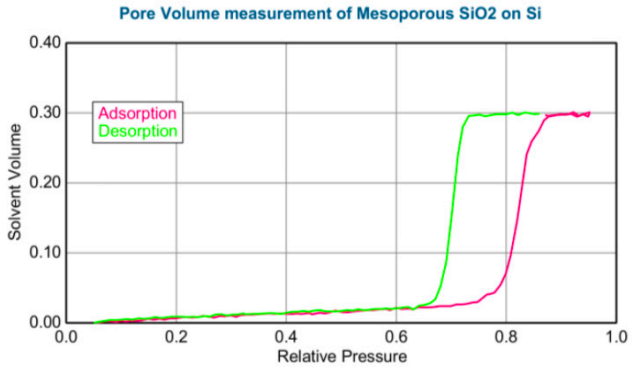


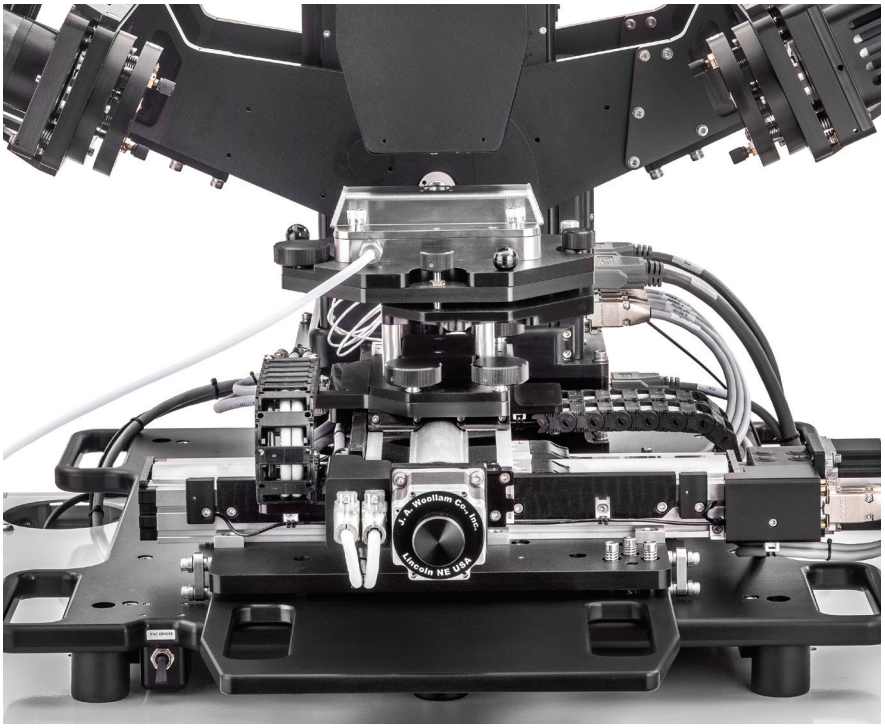

### Versatile

The Environment Cell is compatible with a wide variety of solvents including water, toluene, methanol and more.

### Integrated

The pore size analysis approach commonly used by Baklanov and collaborators [2] is integrated into CompleteEASE. This approach calculates pore volume characteristics by relating refractive index at a single wavelength to pore volume using the Lorentz-Lorenz effective medium theory and is sufficient for isotropic materials. We have also integrated our new, patented approach which takes advantage of all measured wavelengths and uses the Bruggeman effective medium approximation to relate refractive index to solvent volume [3]. Our patented approach is typically used to analyze anisotropic or non-uniform samples. Both pore-size analysis techniques are integrated into the CompleteEASE model library.






### Stage & Windows

The Environment cell is designed to quickly mount to your ellipsometer. The quick-release system allows you to switch from standard measurements to environment-based studies with relative ease.

The Environment Cell uses a sealed lid with optical windows to enable measurements using unfriendly solvents in a leak-free manner. Data acquisition occurs through optical windows at 70° angle of incidence. Window birefringence effects are corrected using a patented window calibration procedure. This procedure is used any time the windows are removed and re-attached for any reason.

## COMPONENT SPECIFICATION SUMMARY

- The cell is designed for use with a wide variety of solvents. All wetted surfaces (other than the windows) in contact with the solvent are stainless steel or Teflon (PTFE).
- Relative pressure: range | resolution
  Water: 0.05 - 1.0 by 0.005
  Toluene, Methanol: 0.005 - 1.0 by 0.0025
- Sample area: 25 x 100 mm
- Enclosure with sealed lid provides optical windows for measurements at fixed 70° angle of incidence and enables use of unfriendly solvents such as toluene.
- Includes solvent storage tank, precision mass-flow controllers, atomizing nozzle and Bronkhorst control module
- Software control of relative pressure to coordinate measurements with relative pressure profiles

## FACILITY REQUIREMENTS

- Pressurized, dry carrier gas supply (typically nitrogen) capable of delivering up to 600 liters of gas per measurement.
- Pressurized gas supply should be regulated between 125 - 150 psi
- Output of gas supply should be configured to mate with 1/8-inch ID PTFE tubing.

[1] Van Derslice, Jeremy A., Christopher A. Goeden, and Martin M. Liphardt. System and Method for Investigating Change in Optical Properties of a Porous Effective Substrate Surface as a Function of a Sequence of Solvent Partial Pressures at Atmospheric Pressure. US Patent US9,546,943 B1, filed March 18, 2016, and issued January 17, 2017.

[2] Baklanov, M. R., *et al.* "Determination of pore size distribution in thin films by ellipsometric porosimetry." Journal of Vacuum Science & Technology B: Microelectronics and Nanometer Structures Processing, Measurement, and Phenomena 18.3 (2000): 1385-1391.

[3] Schoeche, Stefan, Van Derslice, Jeremy A., Hale, Jeff S., Herzinger, Craig M., Method to Analyze Spectroscopic Ellipsometry or Intensity Data of Porous Samples Utilizing the Anisotropic Bruggeman-Effective Medium Theory. US Patent US10,175,160 B1, filed April 20, 2018, and issued January 8, 2019.