Laboratory Scale Investigations of Gas Permeation Membranes

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Institute of Polymer Research ■ Membranes – Materials and Processes ■ http://polymerresearch.hzg.de

Single Gas Measurements Using Pressure Increase and Time-Lag Methods

Pressure increase

- One machine for the determination of permeability, diffusion and solubility coefficients
- Fully automatic data acquisition with multiple gases
- Determination of activation energies and permeability coefficients for single gases by measuring simple pressure increases (Figure 2)
- Possibility to measure the permeance of vapours of components which are in liquid phase at ambient conditions (Figure3)
- Pressure and temperature dependencies of gas transport properties

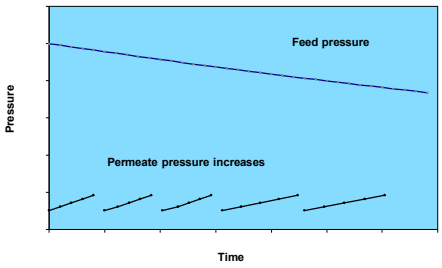

Figure 1: Principle of pressure increase measurement

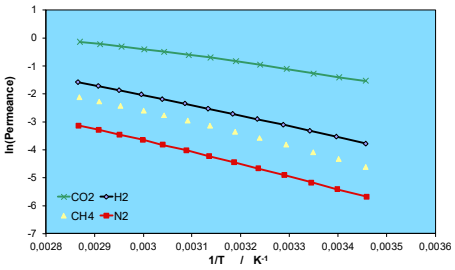

Figure 2: Arrhenius plot for PolyActive membrane

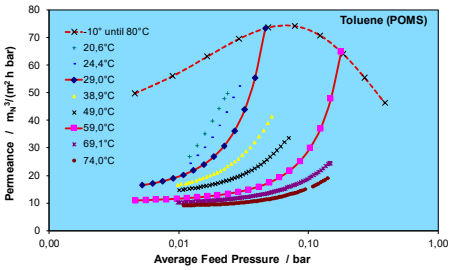

Figure 3: Permeance of Toluene in POMS

Time-Lag

- The diffusion of fast permeating gases can be measured in the range of 5 °C up to 120 °C (Figure 4)
- Precise measurement with fast response (Figure 5)
- Very short time-lags can be measured less than 0.1 s (Figure 6)

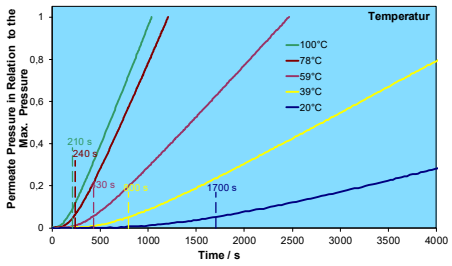

Figure 4: Time-Lags at different temperatures

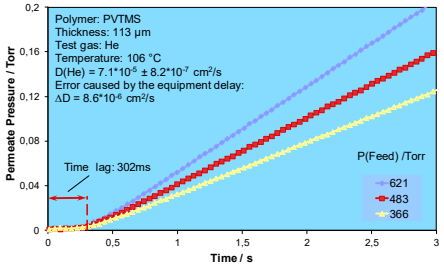

Figure 5: Time-Lag measurements of Helium

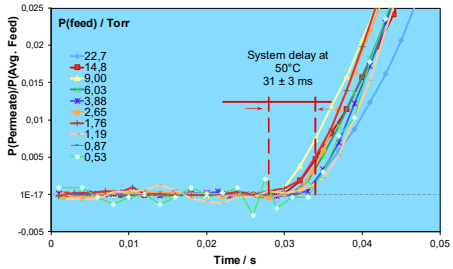

Figure 6: System response time

Unit for Mixed Gas Measurements

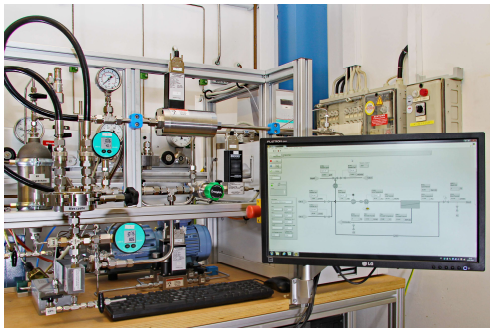

Figure 7: Mixed gas unit

- Assessment of the influence of multicomponent mixtures on gas transport properties of membranes
- Measurement at constant pressures up to 50 bar
- Fully automated: evaluation of long term performance

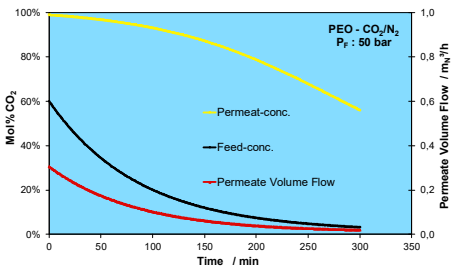

Figure 8: Measuring 30 - 1bar partial pressure of CO_2

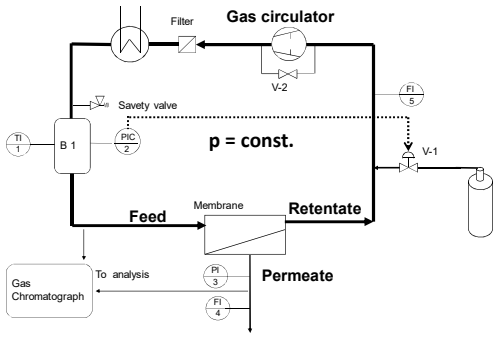

Figure 9: Simplified flowsheet of mixed gas unit

- Permeate leaves the system and has to be compensated by refilling of the feed side
- Measurements in a wide partial pressure ranges
- Example: CO_2 in N_2 (Figure 8)

Helmholtz-Zentrum Geesthacht • Max-Planck-Straße 1 • 21502 Geesthacht / Germany • Phone +49 (0)4152 87-0 • Fax +49 (0)4152 87-1403 • contact@hzg.de • www.hzg.de
Contact: Dipl.-Ing. Torsten Brinkmann Ph.D. • Phone +49 (0)4152 87-2400 • Fax +49 (0)4152 87-4 2400 • torsten.brinkmann@hzg.de