HiBarSens at a glance

- Isostatic setup – carrier gas method:
  - no sample preparation required
  - consideration the sample homogeneity by evaluation a large sample area
- Laser spectroscopic gas sensor (LDS):
  - sensitivity in the ppb range
  - dynamic range of 4 magnitudes
  - highest selectivity, the signal is not interfered by other gases
  - ensure long-term stability
  - minimal maintenance
  - no sensor drift or damage caused by saturation or overdrying
  - sensor position close to the barrier sample results in shortest permeate transport to the sensor
  - small potential adsorption surface
  - measurement under typical application conditions (pressure, temperature, moisture)
- Active sample sealing
  - suppress any interferences by the ambient humidity
  - careful sample mounting
  - user friendly handling

HiBarSens Specification

Permeate:	H_2O
Measurement range:	WVTR 10^{-6} - 10 g m^{-2} d^{-1}
Sensor:	Tunable diode laser absorption spectrometer (TDLAS)
Temperature range:	10 °C - 50 °C ± 0.05 °C
Rel. humidity range:	60 % - 95 % ± 2 %, 100 %
Sample size (total):	Ø 200 mm
Active sample area:	134 cm^2
Sample thickness:	20 µm - 5 mm
Dimension:	550 x 350 x 380 mm^3
Weight:	35 kg
Power supply:	230 V 50 Hz

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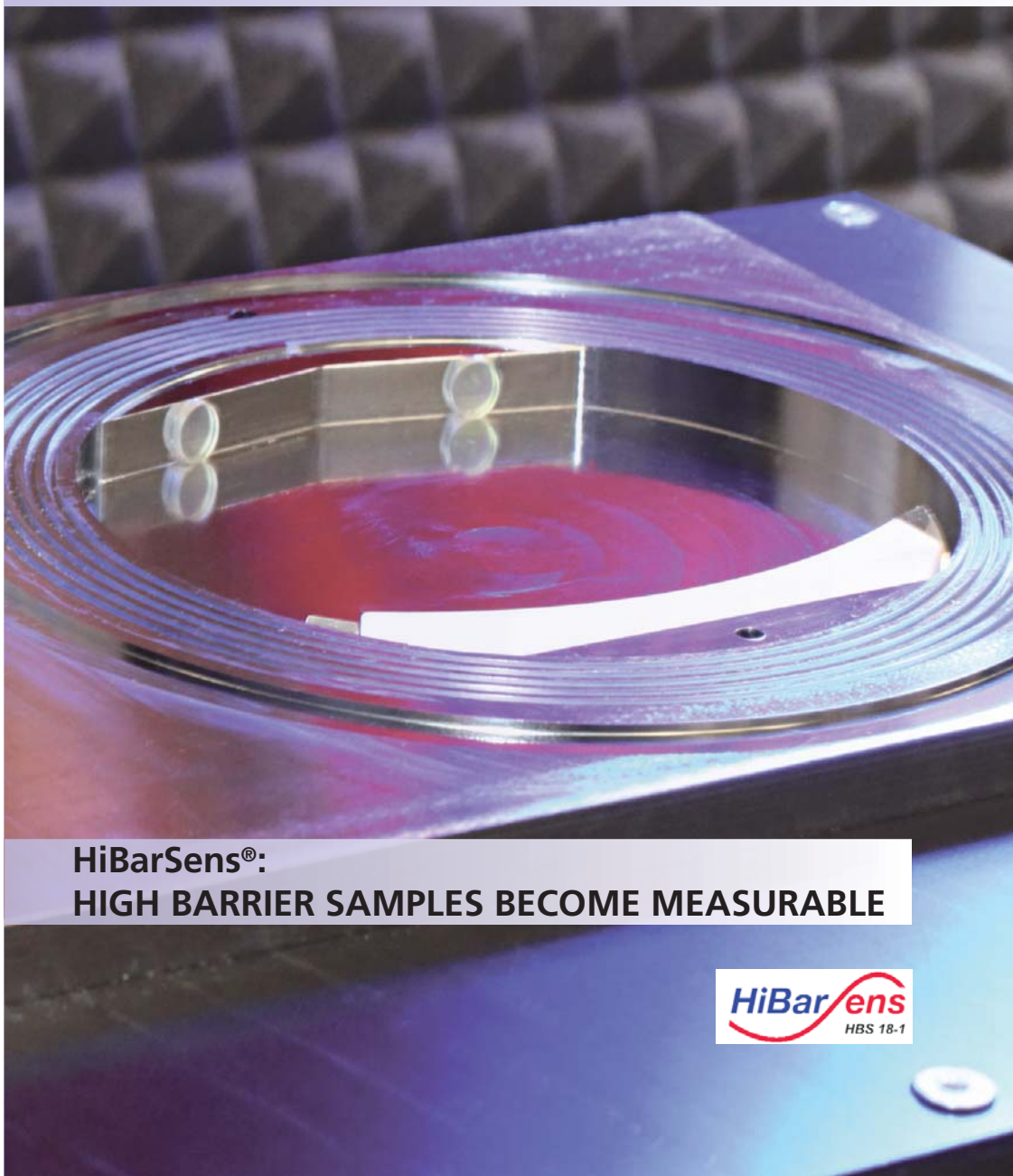


HiBarSens®: HIGH BARRIER SAMPLES BECOME MEASURABLE

HiBarSens HBS 18-1

THE HiBarSens® INSTRUMENT MEASURES ULTRA-BARRIER PROPERTIES:

The demands on a permeation tester are challenging

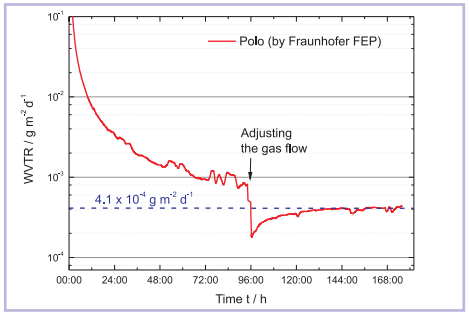
Beyond the mechanical protection, packaging materials for food and pharmaceuticals have another important function: They have to protect the products against atmospheric gases. Especially water vapor and oxygen are crucial features concerning the quality and durability of these products. Flexible materials with barrier properties are applied to suppress the gas permeation (the gas transport through a solid object).

Compared to applications like usual packaging the encapsulation of organic electronics (like OLED-displays, organic solar cells) or vacuum insulation panels have much higher demands to the barrier. They need to resist temperature cycles from -40°C to +80°C, mechanical stress and UV radiation over a lifetime up to 20 or even 50 years. Based on these lifetime requirements water vapor transmission rates (WVTR) less than 10^{-5} g [H_2O] m^{-2} d^{-1} are required for high barrier systems especially for OLEDs. In spite of these demands the today's commercially available permeation testers reach detection limits of only 5 x 10^{-4} g [H_2O] m^{-2} d^{-1}. Only highly sophisticated laboratory setups combined with time consuming sample preparations are currently able to measure such ultra low WVTR levels. There is a high demand to an easy to use, reliable table top permeation tester with a much higher sensitivity than the current state of the art.

HiBarSens® opens the easy access to ultra barrier properties

A new permeation measurement system, using a laser diode spectroscopic sensor, has been developed by the Fraunhofer IWS together with the company SEMPA Systems GmbH. The aim was to quantify the water vapor transmission rate of ultra barrier materials down to WTVR < 10^{-4} g m^{-2} d^{-1} in a simple but reliable manner. The laser spectroscopic trace gas analysis is the key technology of this novel measuring device HiBarSens®. Apart from the possibility to detect reliably trace gases (ppb level), the sensor technology is characterized by the absence of any drift or hysteresis effects and it does not need a periodic regeneration. Furthermore, there is no risk for any sensor degradation by high levels of water vapor like for high sensitive coulometric probes.The detection principle is the measuring of the attenuation of the laser light intensity caused by the excitation of the permeated water molecules. This attenuation is proportional to the moisture concentration.

HIGHLY SENSITIVE AND RELIABLE



Following the concept of the commonly permeation cells - based on the isostatic setup - the permeation cell of the HiBarSens® system is divided into two compartments by the barrier sample. One compartment, the "feed side", contains a defined high humidity level. The other compartment is purged by a dry inert gas that transports the permeated water vapor to an (external) sensor. The major difference of the HiBarSens® setup is the sensor position directly below the barrier in the "dry" compartment. Since no additional moisture transport to the sensor is needed, a small total surface area can be realized consequently. Thus the critical adsorption and desorption effects at low moisture levels can be reduced significantly. The dry inert gas continuously flows through the measuring compartment of the permeation cell and the resulting steady-state water vapor concentration is measured.

At any time the optimum balance of compartment purge and detection sensitivity can be adjusted by the variation the purge gas flow.

A further key feature of the HiBarSens® design is the active sample sealing technology that prevents leakages and unwanted permeation through the sample edges. The leak rate of the (dry) measuring compartment of the permeation cell is comparable with metal seal performance or even better. In this manner no blank value contributing a high level of uncertainty needs to be subtracted and a previous determination of the moisture background level is not mandatory needed for the calculation of the WVTR. If the steady-state condition is reached, the readings represent the current water vapor concentration inside the measuring compartment solely caused by the permeation rate of the sample at certain temperature and humidity conditions.

The fully automated PermAlyzer® software controls all relevant parameters and delivers pre-defined one-touch reports. HiBarSens® is a compact ruggedized table top system for the daily use in a laboratory environment.

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