

next
generation
barrier
measurements

HIBAR SENS

Contact & Company

get in contact with us

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about SEMPA SYSTEMS

Sempa Systems GmbH (part of the Meptagon Group) has been founded in 2001 in Dresden/Germany as a partner for ultra-pure facility installations. The company designs, manufactures and installs gas and chemical supply solutions for demanding industries and offers various innovative products to high tech industries.

c/o Sempa Systems GmbH

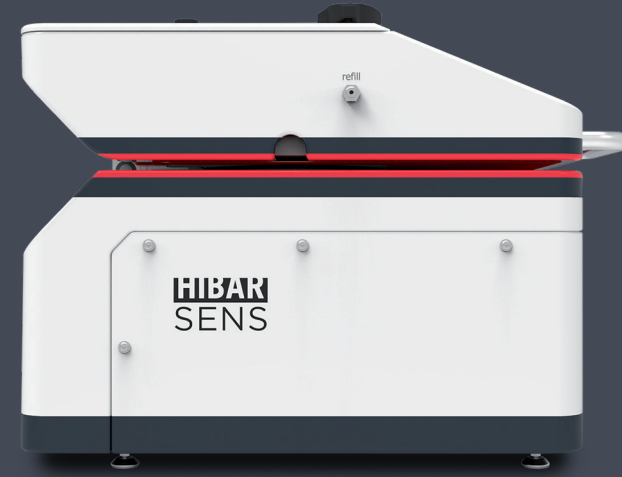
Grenzstraße 13
01109 Dresden
Germany

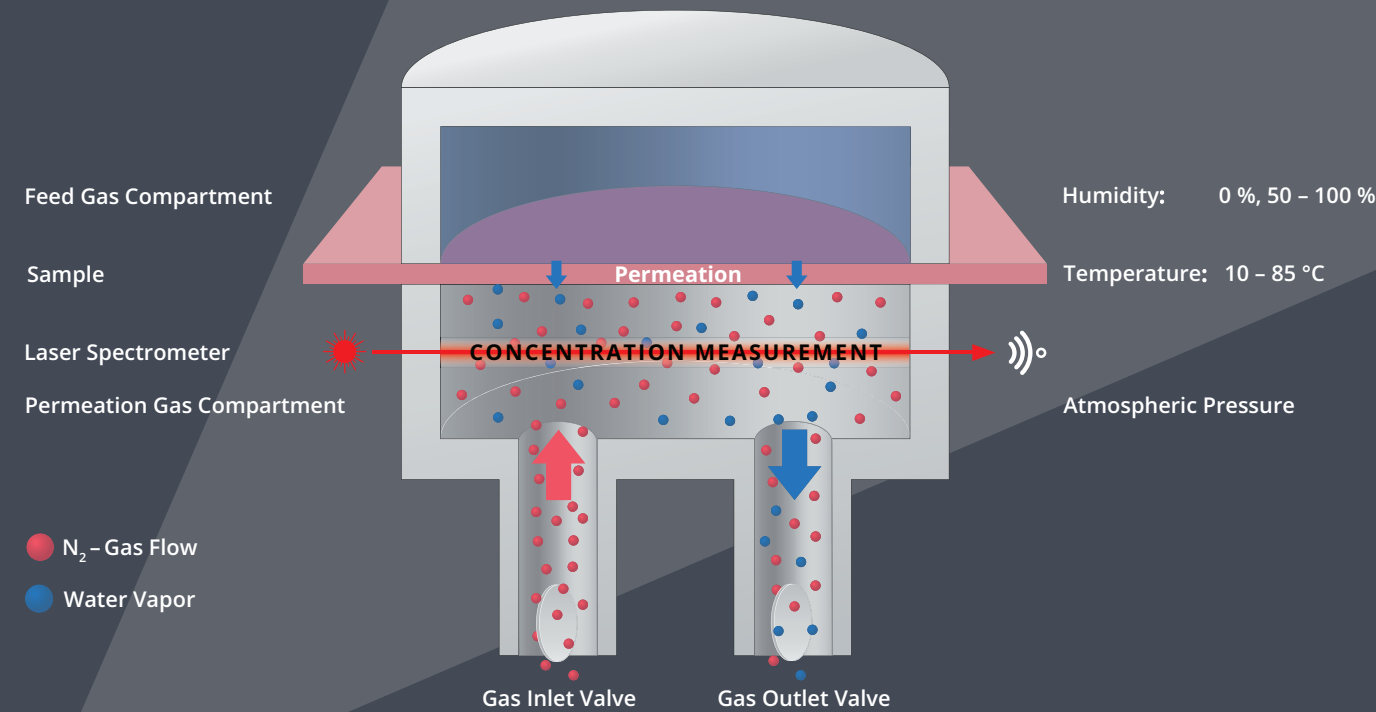
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next generation barrier measurements





WVTR Measuring Principle

HiBarSens® is based on the outstanding performance of a laser diode spectroscopic trace gas analysis.

The optical measuring principle enables a reliable trace detection of permeated water vapor through thin films down to the ppb range. The measurement is free of sensor drift or sensor hysteresis.

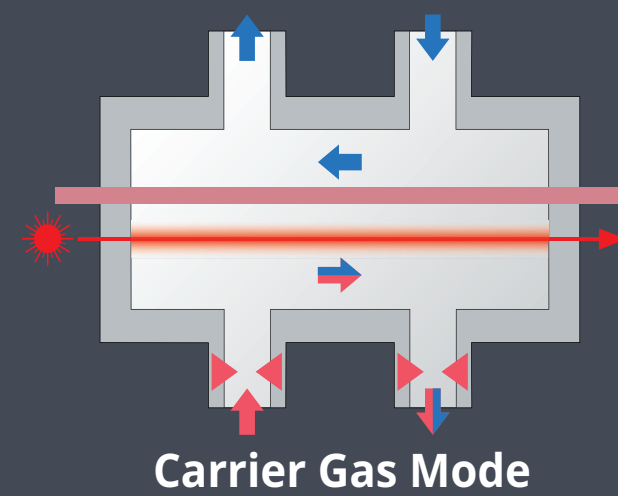
HiBarSens® measures water vapor directly below the sample utilizing a rugged optical sensor. This opens up unique measurement concepts that allow flexible measurements of permeation properties with lowest WVTR detection limits.

Measurement Modes

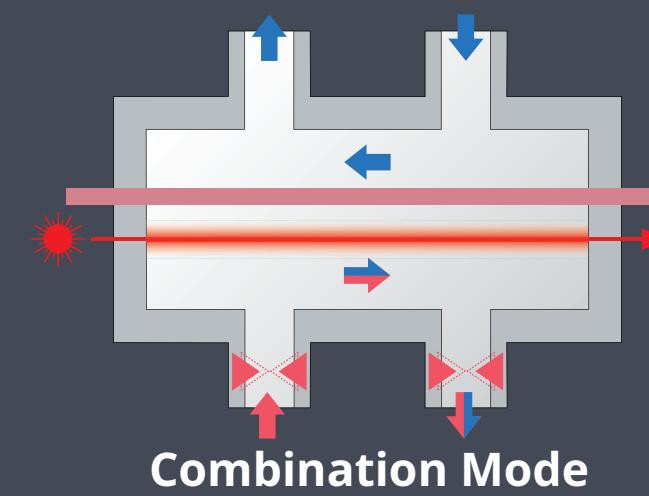
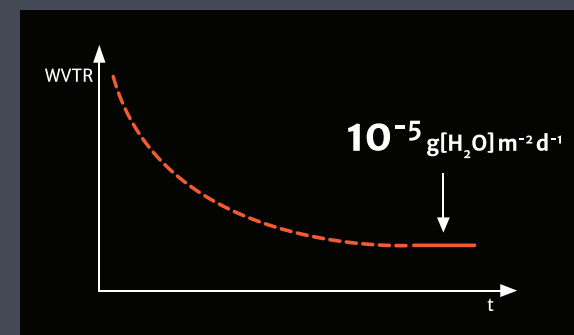
HiBarSens® features three measurement modes. Any of them fulfil the mandatory steady-state measurement condition.

In addition to the conventional **Carrier Gas Mode**, which uses a carrier gas flow through the permeation cell, high performance modes can be easily applied, especially for ultra-high barrier films ($<<10^{-4} \text{ g m}^{-2} \text{ d}^{-1}$).

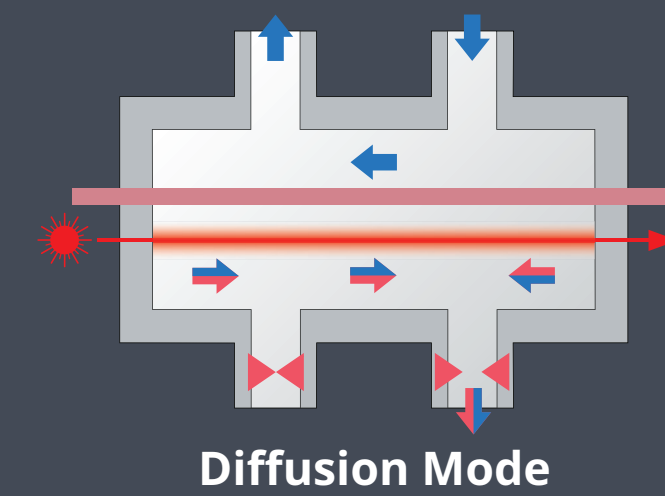
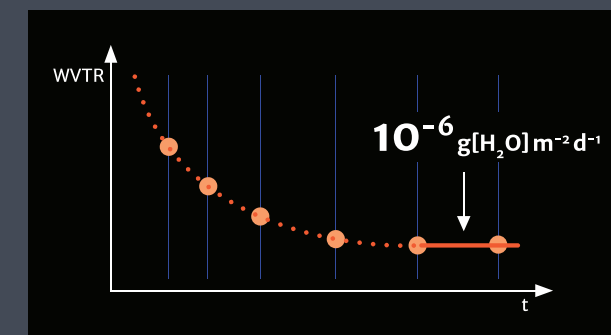
In **Diffusion Mode**, permeate transport is driven by diffusion only. In **Combination Mode**, a permeate accumulation phase alternates with a carrier gas phase.



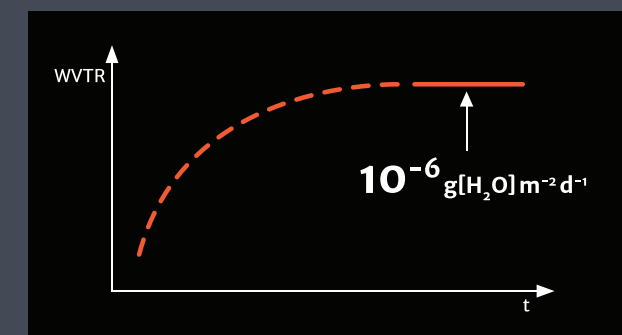
Carrier Gas Mode



Combination Mode



Diffusion Mode



Introduction

HiBarSens® stands for ultra reliable measurement of permeation properties of barrier films. It is used for quality control of barrier film production processes as well as in research and development.

Due to its flexibility and yet simplicity, HiBarSens® is your perfect choice to determine sample and application specific barrier properties such as the water vapor transmission rate (WVTR) or the water vapor breakthrough behavior (Lag time) under very different measurement conditions. HiBarSens® is the first system which is able to measure up to 85 °C and so enabling the important WVTR damp heat measurement condition.

Furthermore HiBarSens® also offers the unique possibility to derive an oxygen transmission rate (OTR).

Your Advantage

- Highest flexibility for measurement parameters
T: 10 - 85 °C
RH: 50 - 95 % RH, 100 % RH
atmospheric pressure
- Unsurpassed limit of detection: LOD ~ $10^{-6} \text{ g[H}_2\text{O] m}^{-2} \text{ d}^{-1}$
- Huge dynamic range: WVTR: $10 - 10^{-6} \text{ g[H}_2\text{O] m}^{-2} \text{ d}^{-1}$
- Addresses various permeation properties such as WVTR, breakthrough time, side ingress behavior
- Variable sample size from R2R large scale ($\varnothing 195 \text{ mm}$) to R&D scale ($\varnothing 4''$)

- WVTR blank value is always close to 0 (ActiveSeal concept)
- Easy to use, simple handling, no sample preparation
- Significant measurement acceleration due to high temperature measurements
- Optional external sample pre-conditioning
- Extremely robust, long-term stable, low-maintenance optical sensor (laser absorption spectrometry)
- **OTR** limit of detection: $10^{-3} \text{ cm}^3 \text{ m}^{-2} \text{ d}^{-1} \text{ bar}^{-1}$
Available in HiBarSens® EXPERT

HiBarSens®- Family of devices

Permeation measurements are required in different industries as well as in research environment. Every application has different requirements to the testing equipment, like sensitivity, selectivity, permeate or measurement duration. The HiBarSens® family of measurement systems is designed to perfectly meet the needs of any application.

HiBarSens® BASIC

Derives WVTR down to $>8 \times 10^{-5} \text{ g m}^{-2} \text{ d}^{-1}$ and is targeting food packaging, pharma and basic flexible electronic applications. HiBarSens® BASIC offers **Carrier Gas** measurement mode and is able to measure at temperatures up to 50 °C with flexible relative humidity range between 0-90 % as well as 100 %.

HiBarSens® PRO

Ultra-barriers down to $10^{-6} \text{ g m}^{-2} \text{ d}^{-1}$ and beyond are required for high end flexible electronic applications and are investigated in research institutions globally. Using **Diffusion** and **Combination** advanced modes HiBarSens® PRO enables the user to precisely determine the world of ultra-barriers. On top of the BASIC functionality PRO also features high temperature measurements up to 85 °C, which leads to a drastic reduction of measurement duration and also offers the possibility to perform Damp-Heat (DH) Testing (85 °C and 85 % r.H.) of ultra-barriers for photovoltaic applications.

HiBarSens® EXPERT

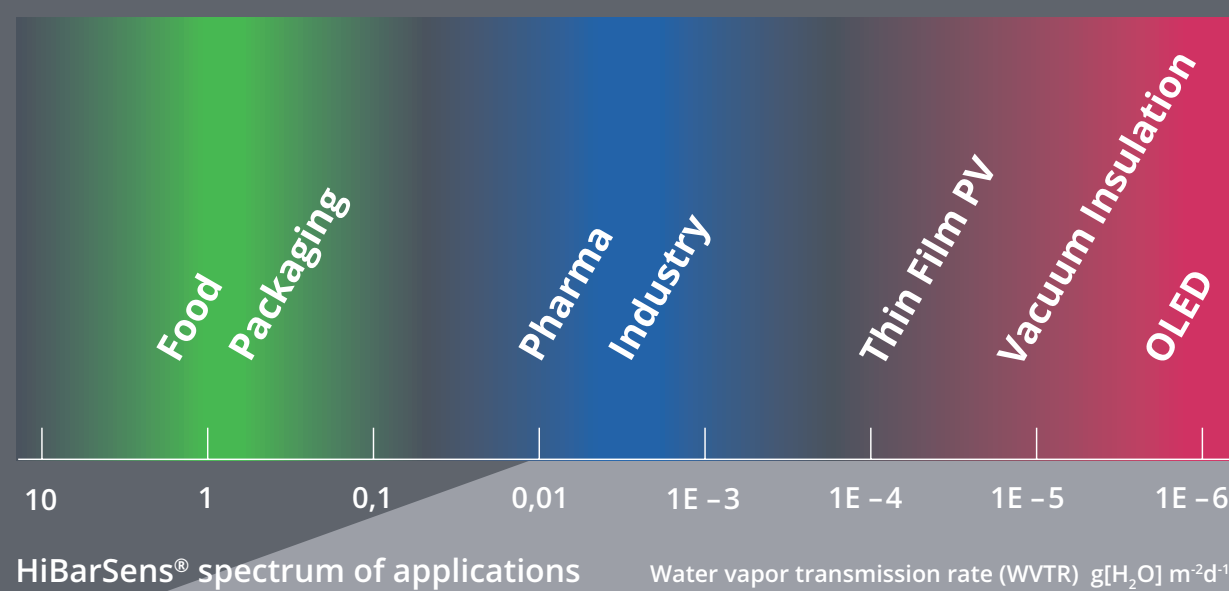
Besides water vapor, oxygen is also a permeate of very high interest. HiBarSens® EXPERT offers for the first time the unique possibility to determine the permeation of water vapor (WVTR) and oxygen (OTR) very easily in only one device at the same time. This concept ensures the most comprehensive evaluation of the barrier properties of foils under absolutely identical measurement conditions.

Applications

Beyond mechanical protection, packaging material for food and pharmaceuticals have another important function: They have to protect the products against atmospheric gases. Especially water vapor and oxygen are critical to the long-term quality of these products.

Novel flexible optoelectronic devices such as OLED's and organic solar cells require barrier properties which are in the range of (WVTR) ~ $10^{-6} \text{ g[H}_2\text{O] m}^{-2} \text{ d}^{-1}$.

HiBarSens® is meeting the requirements from industry and research to measure the dedicated permeation properties (WVTR, breakthrough time) reliably.



HiBarSens® spectrum of applications Water vapor transmission rate (WVTR) $\text{g[H}_2\text{O] m}^{-2} \text{ d}^{-1}$

HiBAR SENS	HiBarSens Basis	HiBarSens Professional	HiBarSens Expert
Operating range WVTR $\text{g m}^{-2} \text{ d}^{-1}$	$10 - 8 \times 10^{-5}$	$10 - 1 \times 10^{-6}$	$10 - 1 \times 10^{-4} (10^{-6})^*$
OTR $\text{cm}^3 \text{ m}^{-2} \text{ d}^{-1} \text{ bar}^{-1}$	-	-	$10^2 - 10^3$
max. Temperature °C	50	85	50 (85)*
Measurement Modes			
Carrier Gas	✓	✓	✓
Combination		✓	✓
Diffusion		✓	✓
HiBarSens® grows with your demand BASIC models can be easily upgraded if clients require higher sensitivity or the high temperature measurement option.			* optional

HiBarSens® PreConCell

Measuring ultra barriers within hours

The time consuming part of the WVTR measurement is to establish a stable water vapor concentration gradient within the barrier film sample. Precious equipment uptime is used meeting this important prerequisite.

Sempa has a preconditioning concept which enables HiBarSens® users to establish the extremely time consuming gradient in a separate PreCon-Cell setup. This results in a significantly higher utilization of the HiBarSens® device. PreConCell enables measurements of ultra barriers within several hours rather than weeks.