

Valued clients,

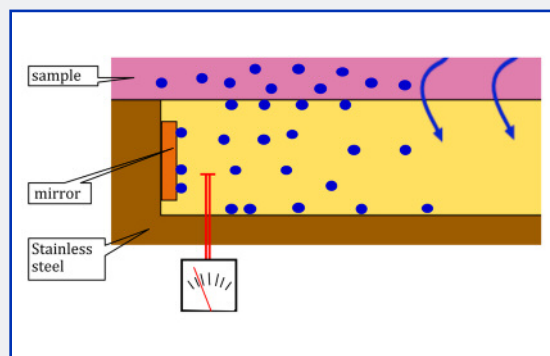
we proudly present the 3rd update on HiBarSens® technology. For research as well as industry it is key to reliably measure water permeation rates down to the 10^{-6} range or even possibly below. In the last issue we introduced a new measurement method (Diffusive Mode) which enables HiBarSens® to enter the desired measurement range. In addition to Diffusive mode we can now also offer another highly sensitive measurement mode which takes the important steady state conditions into account. Combination mode innovatively links an accumulation of water moisture (hence the concentration gets accessible to the sensor) with a purge out phase – the latter is important to fully account for sorption effects.

As those sorption effects are so important we start of this issue with a chapter on measuring under steady state. HiBarSens® is now available with 3 measurement modes giving customers a high degree of flexibility. All modes can be controlled using Permalizer 2 our updated software to run HiBarSens®.

HiBarSens® Technology

Steady State Conditions

In the range of $10^{-4} - 10^{-6} \text{ g/m}^2\text{d}^{-1}$ adsorption/desorption effects do play a dominant role and affect the measurement result greatly if not fully taken into account. Water molecules do have a high sticking coefficient to stainless steel and do also adsorb to the film. However, for any sensor only the gas phase is measurable and adsorbed water vapor to the internal surfaces has to be considered in order to determine the WVTR correctly. One can reduce such effects by applying electro polished surfaces and an optimized relationship between measurement cell volume and internal stainless steel surface. However, for exact measurement steady state conditions need to be reached i.e. adsorption and desorption need to annihilate. In other words the permeated moisture through the sample needs to equal the moisture concentration which is getting transported out of the measurement cell.

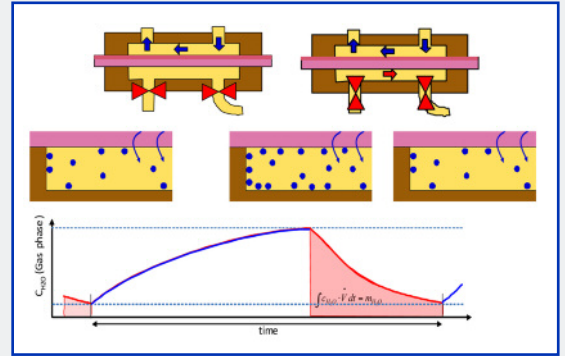


Combination measurement mode

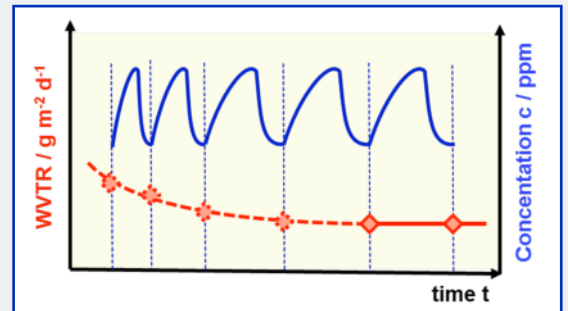
Combination mode, similar to diffusive mode, is designed to measure in the 10^{-6} range. Combination mode combines moisture accumulation with a purge out sequence.

To accumulate moisture in the measurement cell the purge valves are closed. Permeation through the sample now causes an increase of the moisture concentration in the measurement cell but also an increase of adsorption of permeated moisture to the walls inside the measurement cell. This adsorbed moisture is not accessible to the sensor, but need to be taken into account in order to receive the correct WVTR.

Opening of the purge valves does now cause the accumulated moisture to get purged out and importantly adsorbed moisture on the walls does come off again. During both cycles (accumulation and purge out) the moisture concentration gets measured. If during purge out sequence the same initial moisture concentration is reached one is able to derive correctly the WVTR from this experiment. The integral amount of moisture measured during the purge out sequence over the total time of the experiment (accumulation and purge out) together with the known sample area enables to calculate the WVTR, as we again ensure steady state conditions for the measurement.



Differently to the other measurement methods the WVTR calculation is done only at certain points, not continuously. This is important to comply with the steady state requirement.



Permalizer 2 – updated software

With Permalizer 2 we did a full upgrade of the HMI. All important measurements facts and a system sketch are visualized on the main screen. The software controls HiBarSens® entirely - operators are just required to place the sample. The connection is carried out via USB and measurement parameters and modes can be set through the software.

The screenshot shows the Permalizer 2 software interface. Key features are highlighted with callouts:

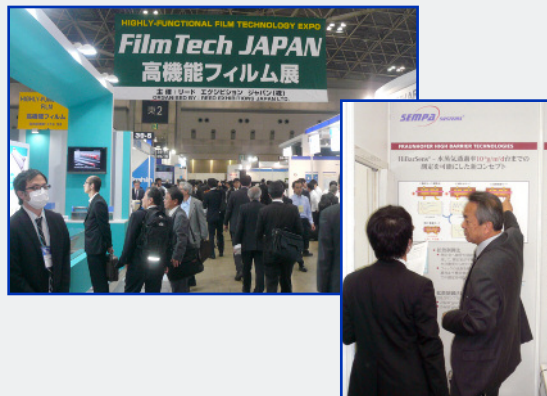
- Data navigation:** A sidebar menu for navigating through the software.
- Click to open relevant windows:** A callout pointing to the 'Control' window.
- Data evaluation tools:** A callout pointing to the 'Evaluation' window.
- Current relevant data:** A callout pointing to the 'Evolution' window, which displays:
 - Temperature: 20.00 °C
 - Humidity: 90.0 % rel.
 - Permeation: 1.39E-3 g/m²d
- Current raw signal of laser:** A callout pointing to a graph showing the raw laser signal.

The main interface also displays a detailed schematic of the carrier gas measurement system, including components like the water vapor generator, sample compartment, and various sensors.

HiBarSens® Technology on display

Highly Functionally Film Exhibition, 10-12th April 2013, Tokyo

For the second consecutive year HiBarSens was on display at Highly Functionally Film at Tokyo Big Sight. This year's focus has been on steady state conditions and the unique feature of combining 3 measurement modes in one system. The fair was well attended by international visitors and has underlined the growing interest in flexible electronics.



Workshop on High Barrier and Opto Electronics Related Technologies 16th April 2013, Tokyo, German Culture Center

Under the expert organization of our partner SurfTech Transnational the second workshop on High Barrier and Opto Electronics Related Technologies was held successfully. A line of selected experts in the field made presentations and subsequent discussion rounds a well worth event for the participants. Compared to the first workshop last year the number of participants increased substantially reaching capacity of the lecture hall.

SVC 2013 TechCon/Exhibit/Education Program, April 22-25, 2013 Rhode Island Convention Center

In parallel to the exhibition booth our scientific cooperation partner gave a paper at the conference: The talk on „Reliable determination of the water vapor transmission rate of ultra-high barrier samples in the 10^{-4} to 10^{-6} g m⁻² d⁻¹ range enabled by tunable diode laser spectroscopy“ was given by Harald Beese and triggered fruitful discussion and interest in steady state conditions and HiBarSens measurement technology.

LOPE-C, June 12-13, 2013, Munich

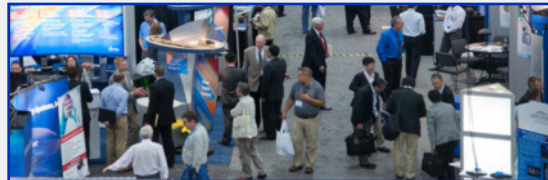
Hibarsens® was again displayed at LOPE-C in Munich. Wulf Grählert of IWS attracted a lot of interest with his presentation on the unique feature of combining 3 measurement modes in one system.



Meet us at the next upcoming events:

Semicon WEST,
July 9-11, 2013, San Francisco

Proflex,
September 24-25 2013, Fraunhofer FEP
Winterbergstraße 28, 01277 Dresden



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For further information please also check out our new web page: www.hibarsens.com