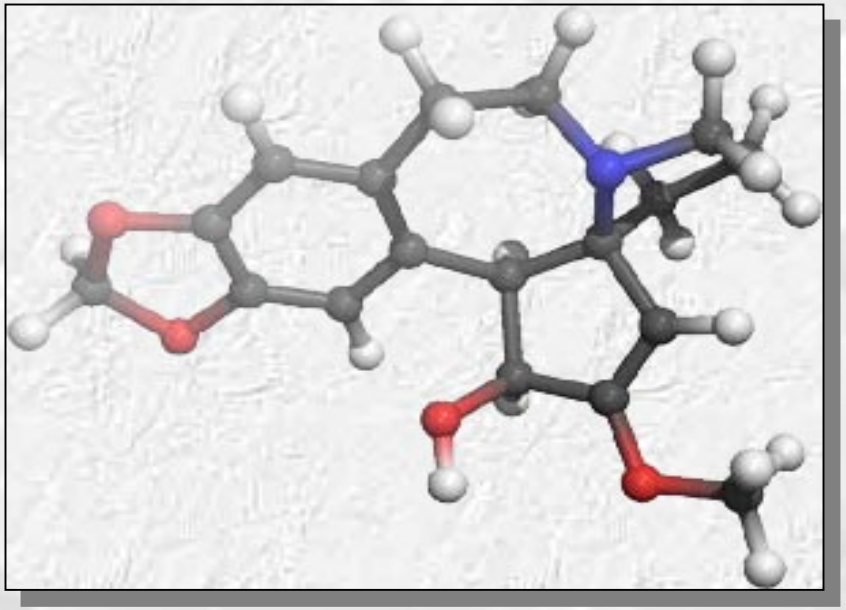
EQUINLAB
Equipos para la Industria y Laboratorio

novasina
The Art of Precision Measurement

Theory of
Water Activity (a_w)



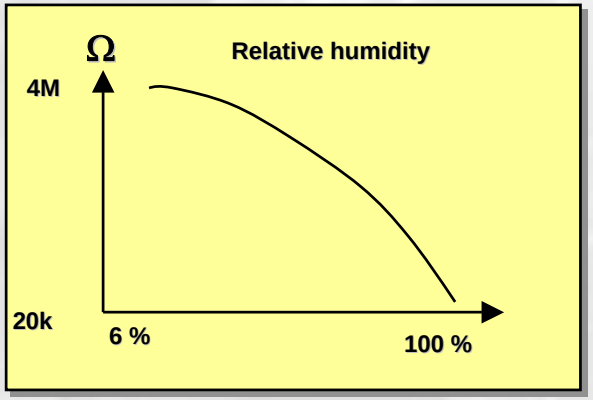
How to measure aw and rh in air ?

Humidity measurement cell

by NOVASINA

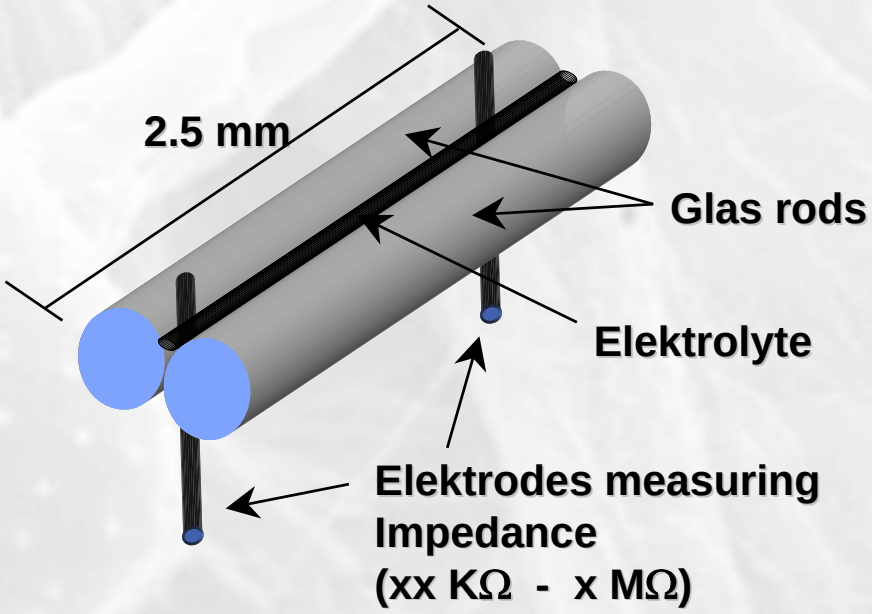
Principle

- ☑ Electrolyte absorbs and evaporates humidity according to its surrounding
- ☑ Absorption of humidity leads to increasing volume and to substantially decreasing impedance
- ☑ Small changes are easily measurable



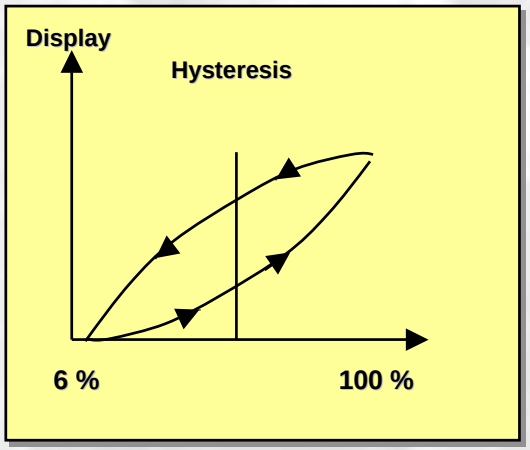
Design

- ☑ Microtechnic design for fast response
- ☑ Good reproducibility in quantities of less then 10’000 pcs per year
- ☑ Optimal containment around the sensor element



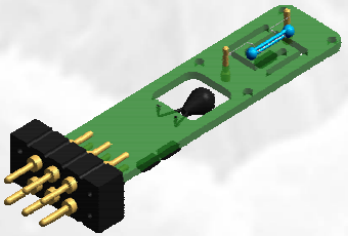
Advantages / High accuracy

Neglect able Hysteresis



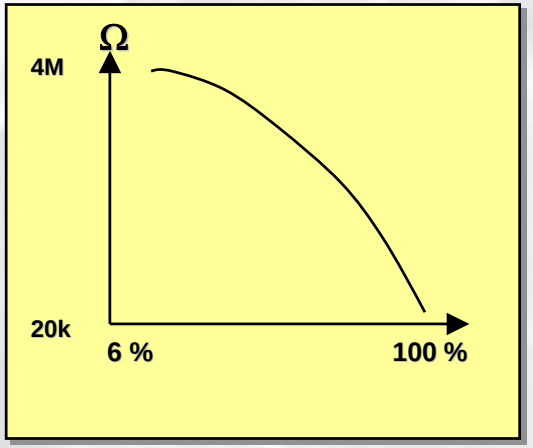
Hysteresis is neglectable. Electrolyte has no absorptive effects

Dew protection



New materials and a heated probe prevents condensation on the sensor

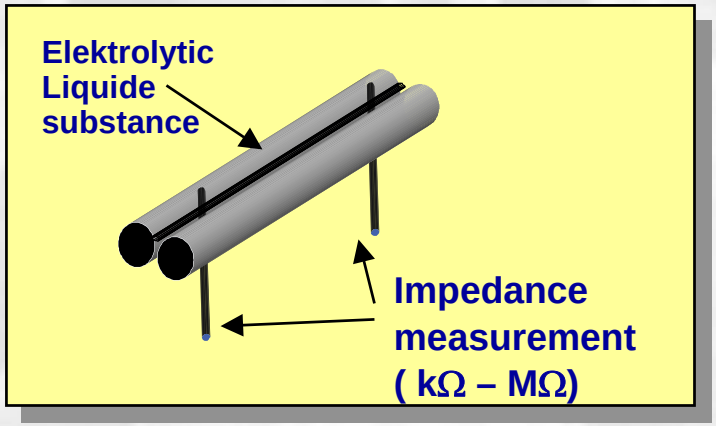
Simple measurement



A small increase in humidity leads to a substantial increase in impedance

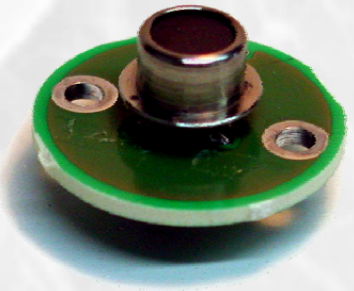
The humidity/aw measurement element

Resistive Electrolyte Cell



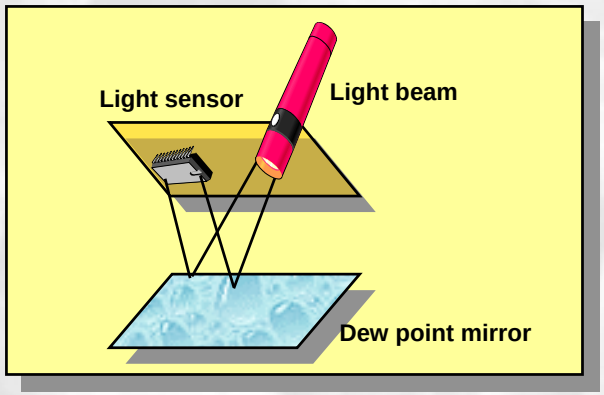
Function :

Liquid electrolyte changes resistance when the humidity around is changed



- directly measuring the a_w-value
- virtually hysteresis-free
- accurate to **0.003a_w** (0.3%rh), from below **0.03a_w** up to **1.00a_w**
- excellent repeatability of **0.002a_w** (0.2%rh)
- very easy and simple to change a calibrated measurement element (full accuracy)
- simple to calibrate the aw-system with saturated salt solutions

The dew point measurement method

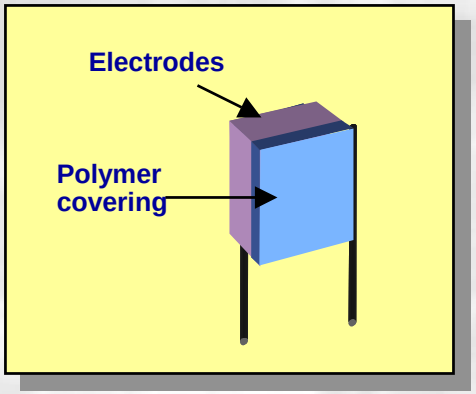


Function :
Optical identification of condensation on mirror temperature

- needs a lot of electronics and control tools
- is not easy to handle and maintain (daily mirror cleaning)
- indirect measurement; gets a result by ***calculating*** the $\mathbf{a_w}$ from both, mirror dew point and sample temperature
- tremendous errors can be caused by volatiles (eg. **alcohols**!) as well as from sample surface colour and structure, which influence the infrared surface temperature measurement
- results are sometimes **calculated too fast**, so repeated measurements are recommended and frequent mirror cleaning is advisable

The humidity/aw measurement element

Capacitive measurement



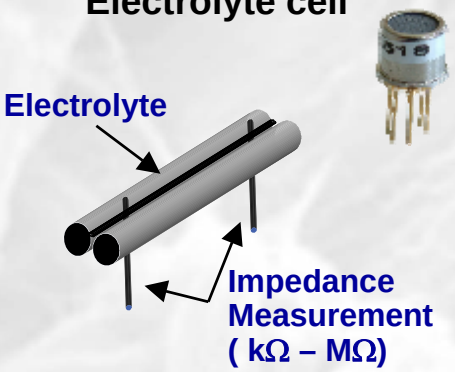
Function :

Polymer expands with increasing humidity, thus changing capacitance

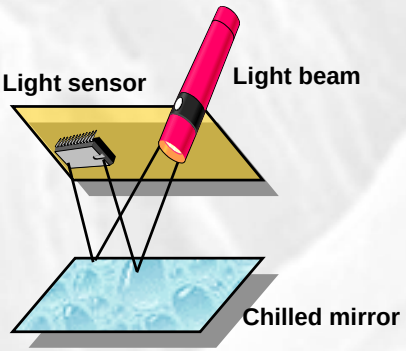
- easy and simple to handle
- quick reading of (+/- 0.04-0.05 a_w)
- directly measuring rh, have a physically given hysteresis of min. 1.5%rh (0.015a_w)
- “second sorption effect” in the high range: they absorb additional water molecules, which leads to a higher reading
- Problematic against chemical contamination

How to measure aw and rh in air ?

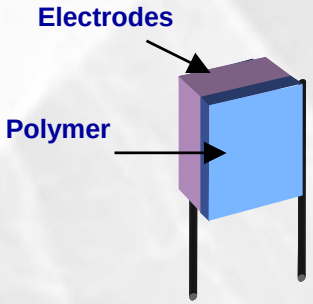
Resistive Electrolyte cell



Dew point mirror



Capacitive measurement



Function	Liquide electrolyte changes resistance when the humidity around is changed	Optical identification of condensation on mirror temperature	Polymer expands with increasing humidity, thus changing capacitance
+	• Precision, reproducibility • Accuracy • No meas. hysteresis	• Precision • Speed	• Robust • Mass production (commodity)
-	• Limited temp. range (-20….+80°C) • Protection against chemical gases	• Costs • Cleaning • Service, maintenance • Interaction of chemical gases	• Hysteresis and irreversible condensation • Less accuracy spec. in high humidity range