

Future Trends in Permeation Measurement



FUTURE

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a MOCON company

This paper deals with:

1. Traditional permeation measurement needs
2. New permeation measurement needs arising from trends to more sustainable, eco-friendly and ultra high barrier materials
3. How will these advanced needs drive future developments in permeation measurement ?

1. Traditional permeation measurement needs

- a) Safety related requirements - Regulatory compliance
- a) Quality related requirements
- b) General business related requirements
- a) Cost reduction requirements

Without proper testing barriers products will fail

1. Traditional permeation measurement needs

a) Safety related requirements - Regulatory compliance

- Food Safety and product shelf life are inextricably linked. Food has to remain safe during the indicated self life.
- The barrier properties of a package have an important role in the safety and self life of a product.
- The oxygen permeability of a package, for example, will directly affect the oxidation of oxygen sensitive nutrients such as vitamins, proteins and fatty acids.



1. Traditional permeation measurement needs

b) Quality related requirements

- Manufacturers need to know how their packages react to permeation
- Brand owners need to understand their package performance.
- Demonstrate compliance to requested barrier properties.



1. Traditional permeation measurement needs

c) General business related requirements

- Expanding into new markets.
- Maintain and ensure product quality.
- Shelf life extension measures



1. Traditional permeation measurement needs

d) Cost reduction requirements

- Economic pressure to deliver less expensive and lighter weight material with favorable barrier properties.
- Need to reduce facility's carbon footprint and energy consumption.



2. New permeation measurement trends

- a) Key industries with permeation concerns
- b) Trends to more sustainable and eco-friendly barrier materials
- c) Trends to ultra high barrier materials
- d) Trends to fewer operators running more equipment at most companies.

2. New permeation measurement trends

a) Key industries with permeation concern

- Food and beverage packaging
- Health care, medical device packaging
- Personal care
- Paints and coatings
- Electronics devices
- Electronics and semiconductors
- Many more applications

2. New permeation measurement trends

b) Trends to more sustainable and eco-friendly barrier materials

- The permeation is affected in a complex way by a number of parameters within the material, like the flexibility of the polymer chains, morphology including orientation effects, crystallinity and interaction between the permeant molecules and the polymer, and interaction with an eventual filler.



Extensive permeation testing is required

2. New permeation measurement trends

c) Trends to ultra high barrier materials



The Past



The Present



2. New permeation measurement trends

c) Trends to ultra high barrier materials

Barrier retention over product lifetime!

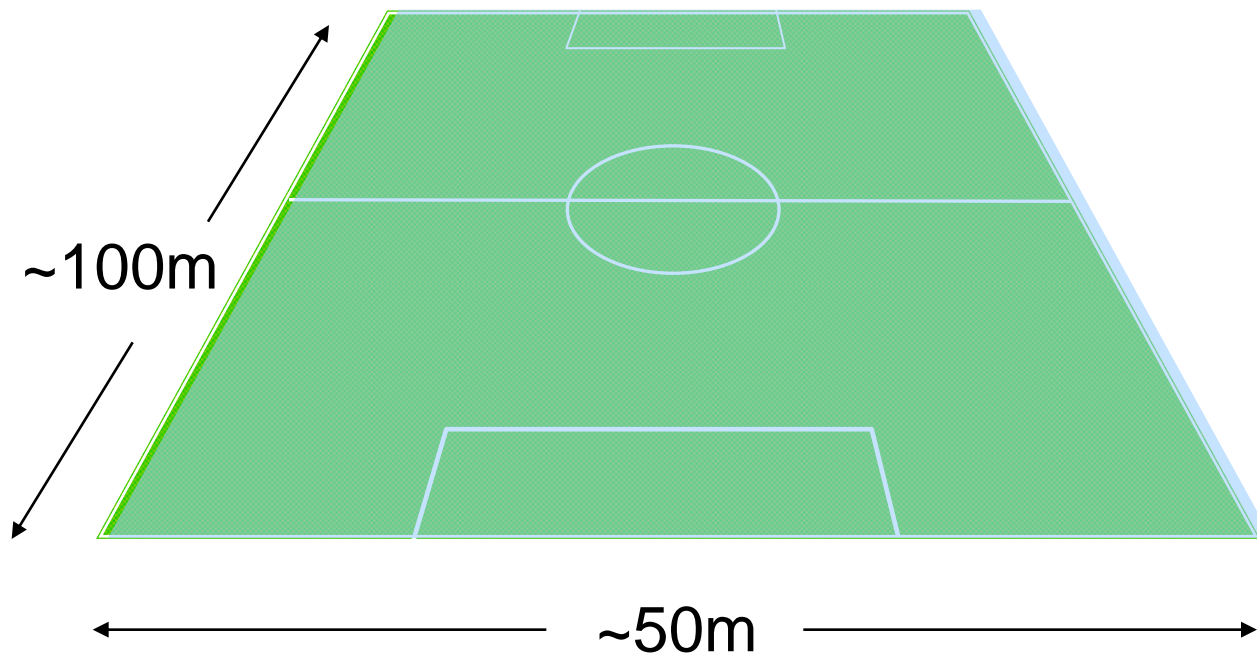
	Water vapour barrier g/m ² /day ⁻¹
Polymer films	1-100
Food packaging	0.1-10
Electro-Chromics	0.001-0.05
Flexible PV	0.00001-0.001
Flexible OLEDs	0.0000001-0.00001

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2. New permeation measurement trends

c) Trends to ultra high barrier materials

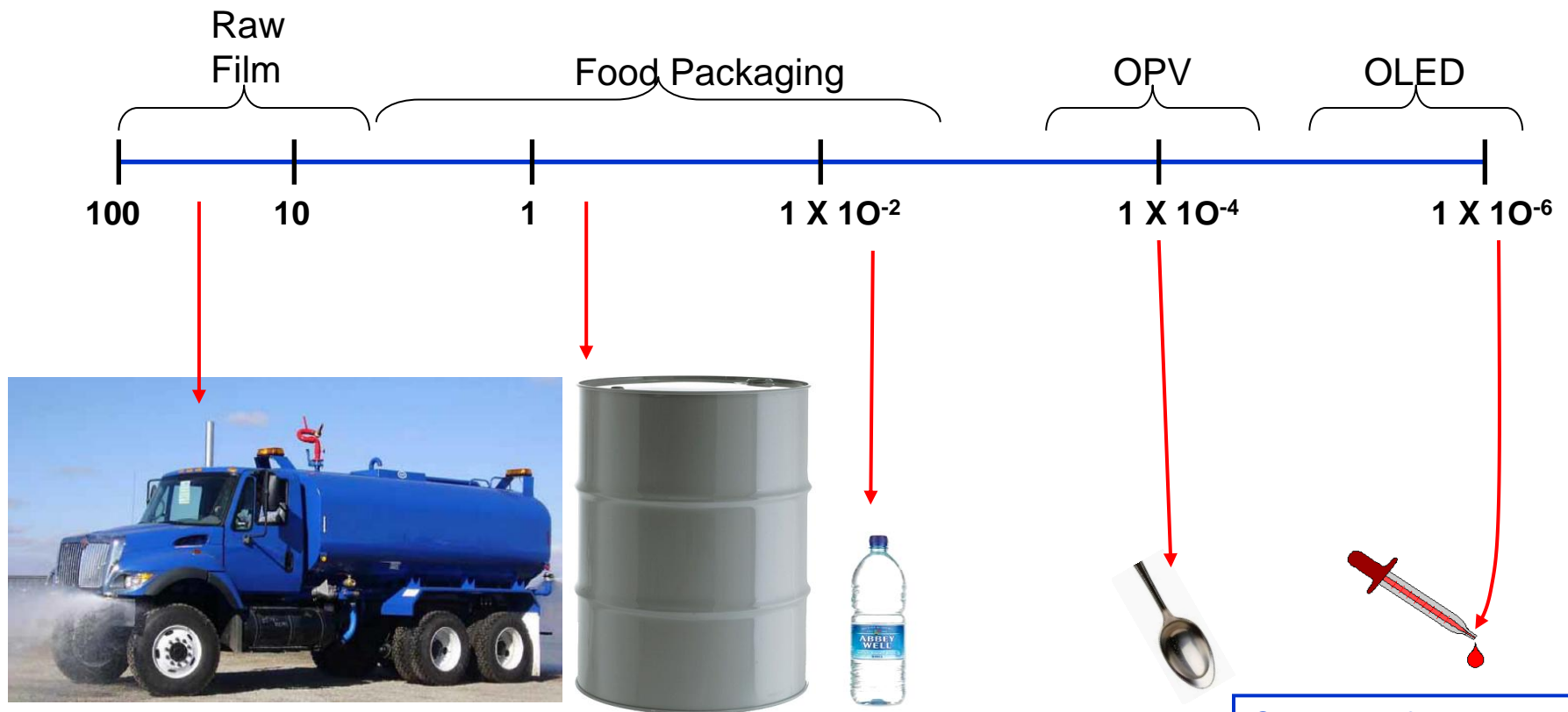
- Imagine a polymer sheet the size of a football pitch: How much water would pass through this over a MONTH at various barrier performance levels?



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2. New permeation measurement trends

c) Trends to ultra high barrier materials



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2. New permeation measurement trends

- d. Trends to fewer operators running more equipment at most companies.



Application support, training and customer service!!

3. How will these concerns drive the future developments in permeation measurement ?

More test cells, more sample throughput

Eco-friendly but complex polymer chains require more testing

Easy-to-use, fast answers

Today we have fewer operators running more equipment at most companies

More accurate, verifiable, traceable results

Need for absolute or intrinsic sensors like COULOX[®] or AQUATRACE[®] sensors

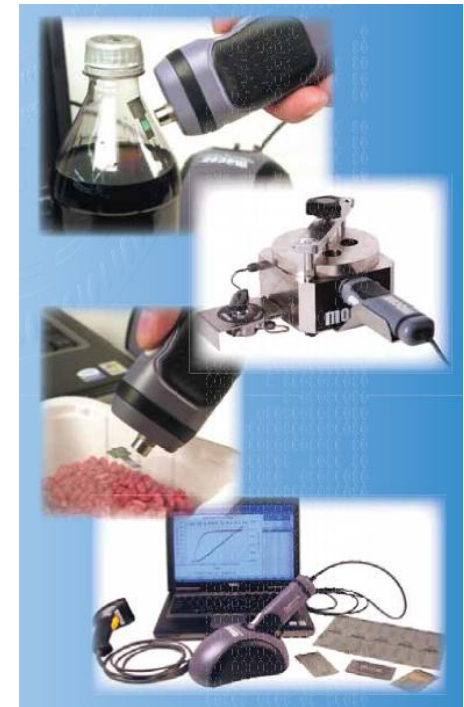
Fast, knowledgeable technical service

Specifically new operators appreciate the support and advice

3. How will these concerns drive the future developments in permeation measurement ?

The OpTech[®]-O₂ Platinum using optical fluorescence technology provides fast answers and is easy to operate.

- Film Testing high transmitters, porous and perforated films
- Continuous O₂ measurement



3. How will these concerns drive the future developments in permeation measurement ?

More test cells, more sample throughput Eco-friendly but complex polymer chains require more testing

- The Model 700 was designed to become an industry workhorse that provides additional testing capabilities



3. How will these concerns drive the future developments in permeation measurement ?

The AQUATRAN[®] is a good example of how new needs in photovoltaics have driven new instrument developments.

- Absolute or intrinsic WV measurement
(measures ALL water vapor)
- Theoretical sensitivity is 2×10^{-6} (g/m²/day)
(or better with future improvements)
- Coulometric technology not affected by
(not affected by temperature, pressure, flow or vibration)
- No calibration required

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