

Welcome

IN TOUCH WITH PLASTICS



Active Oxygen Scavenging – Keep the Quality

ALBIS Philosophy.

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All-inclusive solutions for the plastics processing industry.

Distribution

and trading of
thermoplastics
and elastomers

Compounding

of engineering plastics and
Masterbatches –
tailor-made products
for individual requirements

Technical advice

Project management
and product
development of the
highest standard

Customer focus and consulting expertise.

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Global presence

- Europe, Africa
- Asia Pacific
- North America

Regional support

- Qualified sales staff
- On-site technical advice
- Efficient logistics

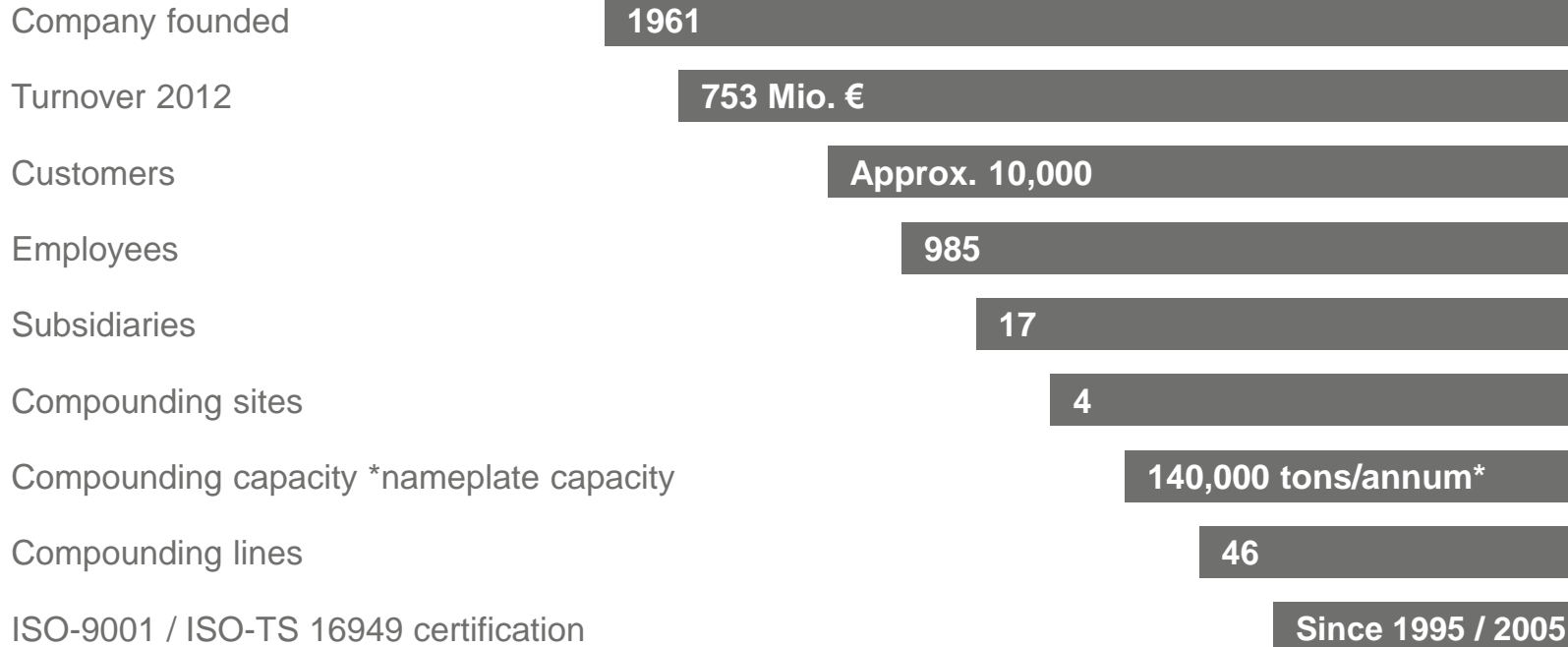
Central expertise

- TSAD centre
- Product development centre
- Laboratory and analytics
- Product management and marketing



Facts and figures worldwide.

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Regulation (EC) No 450/2009 definition

...“active materials and articles” means materials and articles that are intended to extend the shelf-life or to maintain or improve the condition of packaged food; they are designed to deliberately incorporate components that would release or absorb substances into or from the packaged food or the environment surrounding the food...

Source: <http://ec.europa.eu>

Note: Barrier materials like EVOH are not “active materials” per this definition.

Active Packaging - Examples

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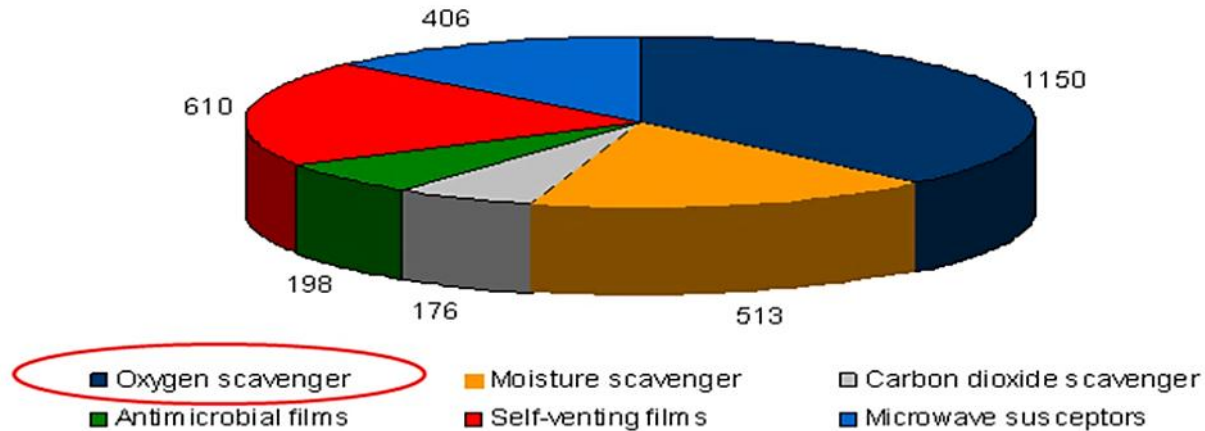
- Oxygen Scavenger
 - Reduction of Oxygen in packaging to increase shelf life
- Humidity Control
 - Adjustment of defined humidity levels inside a packaging
 - Absorption and desorption of moisture
- Carbon Dioxide Control
 - Absorption of CO₂
- Microwave Susceptors
 - Transformation of micro waves into IR – browning
- Self venting films
- Antimicrobial packaging
 - Reduction of microbe growth on packaging surface



Active Packaging Market

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The active packaging market value by technology in 2014 (\$ million)



Source: Pira International 2009

Oxygen Scavenging

Different Technologies Available

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- Scavenging by **oxidation of Iron**
 - Iron incorporation into extruded or molded plastic packaging material
 - Use of iron filled sachets in single packaging units
 - Activation by humidity
- Scavenging by **oxidation of polymers**
 - Use of polymers with double bonds which can oxidize
 - Activation by radical initiation (UV, Peroxides)
- Scavenging by **oxidation of Sodium Sulfite**
 - Use of Sodium Sulfite in sealants of bottle caps and crown corks
 - Activation by humidity



Active Packaging Market

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The oxygen scavenger market by application (\$ million)

Oxygen scavengers: end-use markets, 2004–14 (\$ million)					
	2004	2009	CAGR (%) 2004–09	2014	CAGR (%) 2009–14
Beer	46	230	38.1	383	10.8
Other drinks	14	60	34.7	93	9.1
RTD beverages	6	14	20.3	25	11.7
Fresh and processed meat	204	274	6.1	299	1.8
Ready meals	42	68	10.4	89	5.6
Bakery products	98	134	6.3	161	3.8
Snack foods	61	81	5.7	99	4.0
Total	471	862	12.9	1,150	5.9

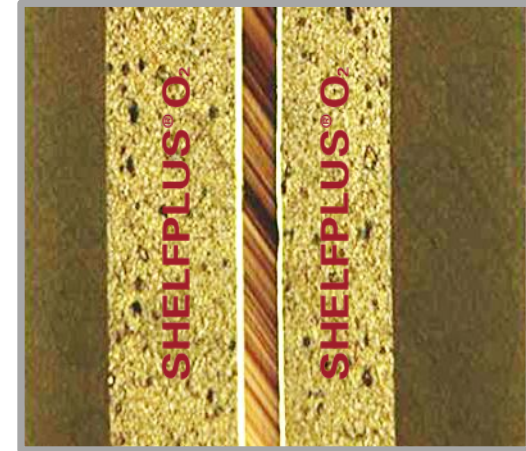
Reference: Pira International 2009

➡ Active packaging driven by growth in convenience food.

Iron Oxygen Scavenger SHELFPLUS O₂

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- Masterbatch for the packaging industry
- Oxygen (O₂) absorber - Iron (Fe) based technology
- Food contact compliance [FDA & EU]
- Humidity needed for activation
- Resin can be used in multilayer-extrusion and co-injection molding processes
- Enabling “active packaging” solutions

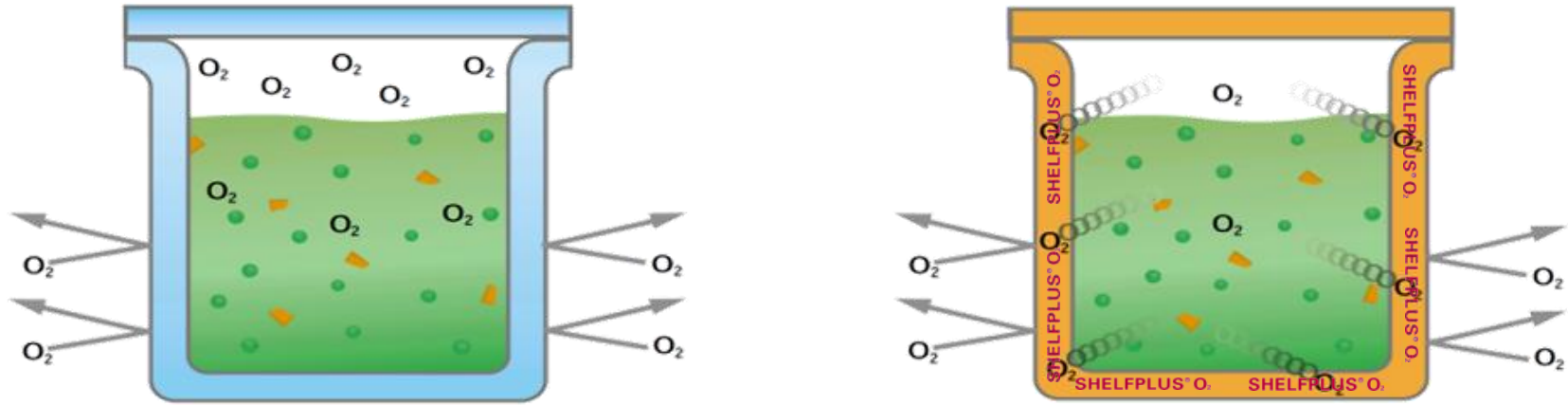


7 layer – EVOH barrier structure

➔ **SHELFPLUS O₂ enables plastic barrier packaging competing with glass and tin.**

Passive Barrier vs. Active O₂ Scavenging

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➔ O₂ Scavenger also absorbs residual O₂.

Keep the Quality

Food protection by Oxygen Absorption

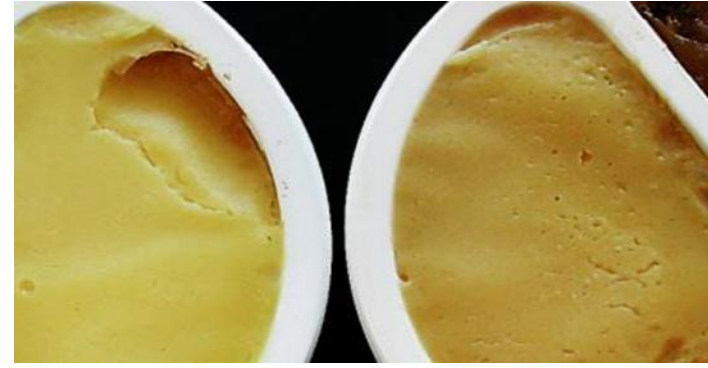
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Sauerkraut / mashed potato – after 70 days @ 25° C
Multi layer barrier tray with EVOH [retort]



SHELFPLUS® O₂ without oxygen scavenger

Source: Fraunhofer Institute - IVV, Germany



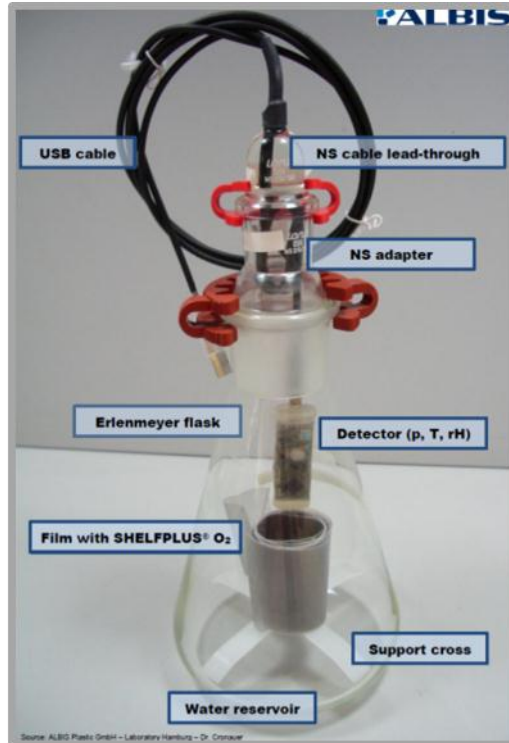
SHELFPLUS® O₂ without oxygen scavenger

➔ **SHELFPLUS O₂ helps avoiding food discoloration.**

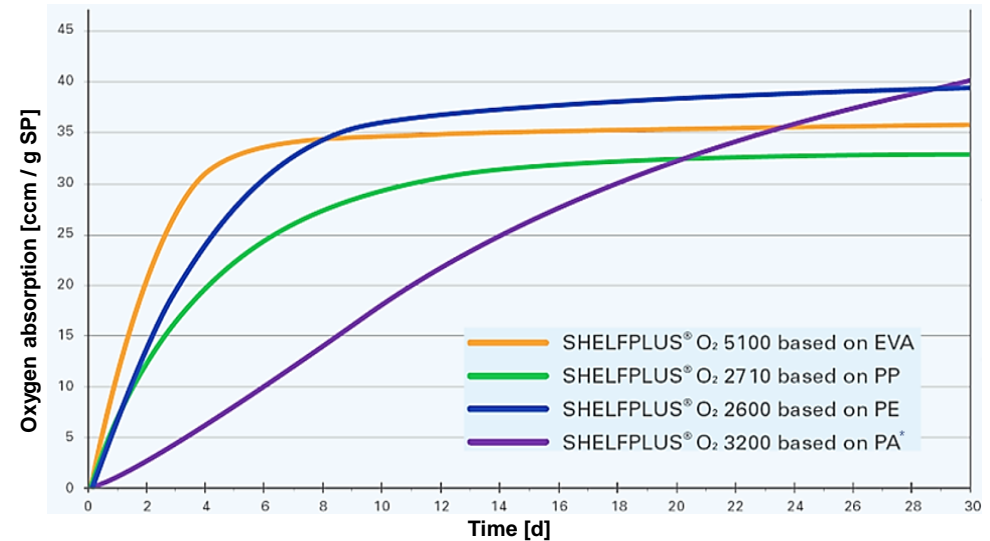
Measurement of O₂ Absorption

An Example

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O₂ absorption measurement system – by ALBIS



* development grade

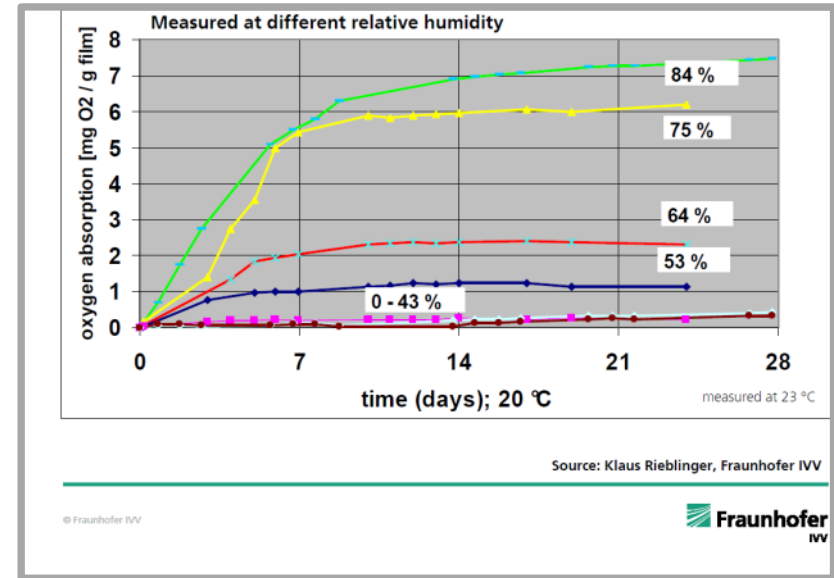
Iron based Oxygen Scavenging Activation by humidity is crucial !

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- Activation of SHELFPLUS O₂ based on PP
 - Retort process, autoclaving, pasteurization & hot fill
 - High humidity level >70% of RH
- Activation of SHELFPLUS O₂ based on PE, PA*, EVA
 - Reaction starts at 50% RH
 - Higher humidity level recommended >70% of RH

* development grade

- ➔ **>70% RH recommended for activation!**
- ➔ **Important for application choice !**

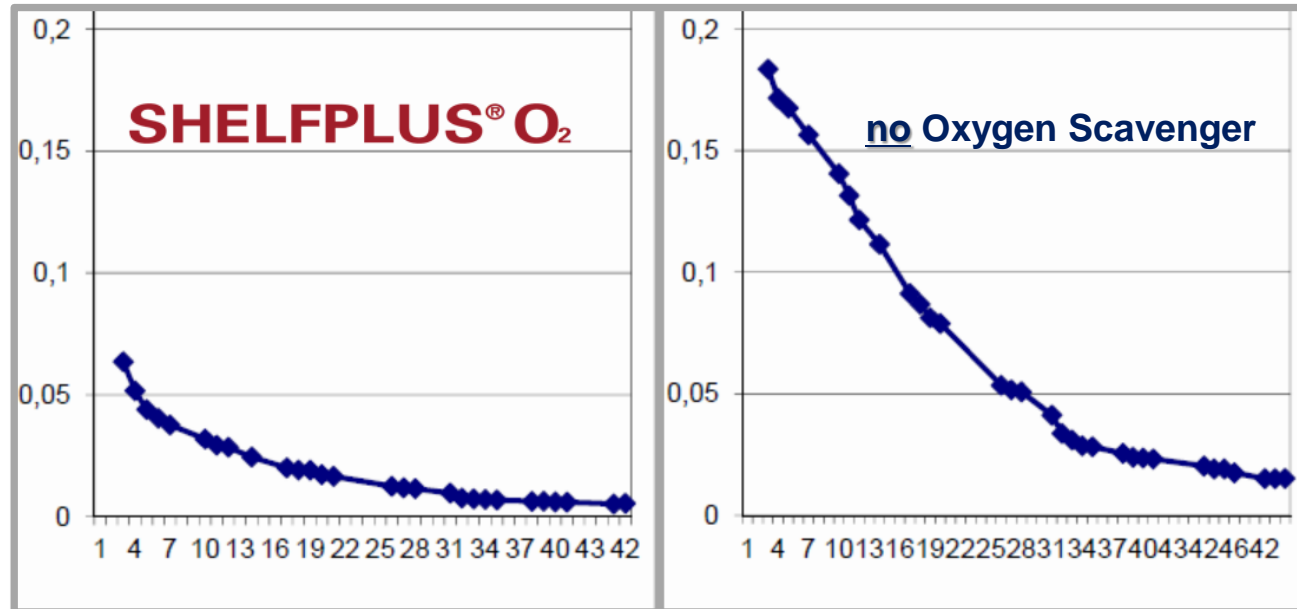


Activation by humidity

Combination of Active and Passive Packaging

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Same 7 layer barrier tray with EVOH (right) vs. tray with SHELFPLUS O₂ loading of 1.5% by weight (left). OTR [ccm/package*24h*0,21bar] measured with 20,9% O₂



➡ O₂ Scavenging eliminates EVOH- „retort shock“.

Benefits and Possibilities using Oxygen Scavengers

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- Longer shelf life of food-stuff
- Less food preservatives needed
- Preserving color
- Preserving taste
- Substitution of scavenger sachets and labels
- Applicable for products that carry humidity
- Improvement of passive barrier properties
- Can be combined with co-extrusion, lamination and IML techniques
- Applicable in rigid and flexible applications



Drivers to use Oxygen Scavengers

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- Share of convenience food is increasing within the industry
- A “fresh” perception is important at POS
- Industry is seeking opportunities to replace glass or tin with plastic
- Request for reclosable & microwavable solutions
- Ban of BPA containing tin coatings effective in France → also for imported cans
- Longer shelf life helps saving cost



Application Examples:

Bag-in-Box beverage protection

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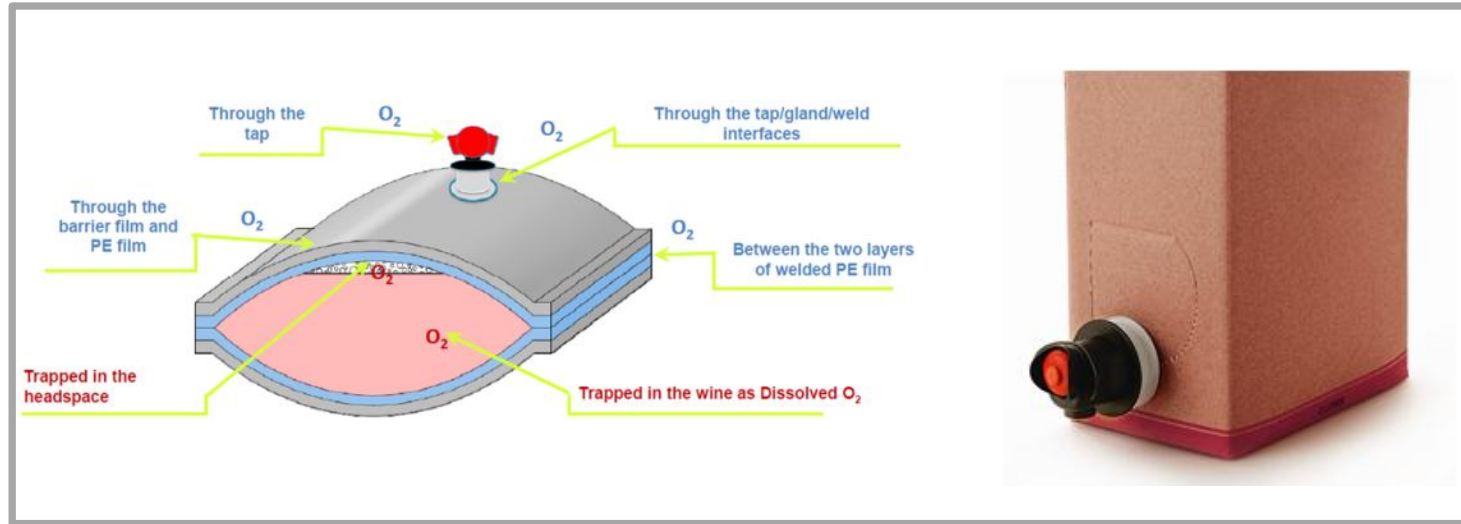


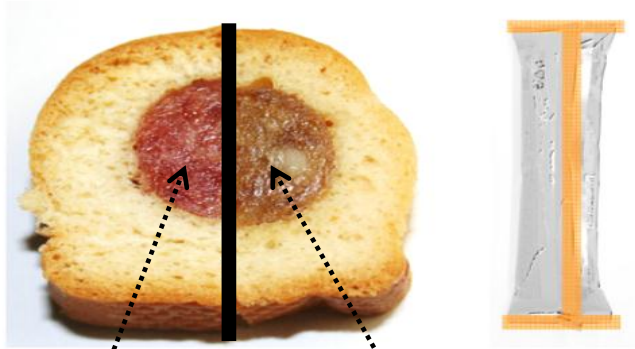
Illustration on the left: „The measurement of total oxygen in filled BIB wine“ by Patrick Shea, Jean-Claude Vidal and Sophie Vialis - 2010

➔ Removing oxygen, longer shelf life and preserving taste.

Applications Examples: Avoiding Discoloration

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Consequence of untight sealing layers



Untight sealing layers: high O_2 -impact
→ seldom occurring; company desires 100 % quality

Protected by
SHELPLUS O_2

Without
 O_2 scavenger



Conclusions

- pinholes of $< 10 \mu m$ are hardly detectable inline
- iron based oxygen scavengers are attractive to compensate pinholes
- humidity of snack activates iron based scavenger
- new method was successfully applied: cells with adjusted oxygen ingress rate
- oxygen impact by pinholes of $10 \mu m$ diameter is reduced
→ improved product quality

Oxygen scavenger film compensates pinhole of $10 \mu m$

© Fraunhofer IVV



Source: Fraunhofer Institute - IVV, Germany

Applications Examples: ...and many more

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Note:

Any information given on the chemical and physical characteristics of our products, including technical advice on applications whether verbally, in writing or by testing the product, is given to the best of our knowledge. However, this information is given without obligation and does not exempt the buyer from carrying out own investigations and tests in order to ascertain the product's specific suitability for the purpose intended. The buyer is solely responsible for the application, utilisation and processing of the products, and must observe the laws and government regulations and the consequential rights of any third party. At all times our Conditions of Sale apply. Our product lists include dangerous goods. The correct marking of such goods is described in the respective data sheets.

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