



meetingPACK
2017

3rd
EDITION



**Mejore el rendimiento de su película
flexible esterilizable**

**Improve the performance of your
retort flexible film**

**Christopher Passe (UBE)
Pedro Zomeño (AINIA)**

Improve the performance of your
RETORT FLEXIBLE packaging



MeetingPACK
Valencia, 30/05/2017



UBE – Company introduction

Food degradation process

Food preservation process

O₂ Barrier vs moisture

New retort packaging concept

Evaluation methodology & Data

Which UBE NYLON for retort?

Conclusions

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UBE INDUSTRIES LTD / Macro data

- Founded : June 1st, 1897
Consolidated in 1942
- Capital : ¥ 58,4 billion
€ 478 million
- Net Sales : ¥ 641,7 billion
€ 5 255 million
- Employees : 10 764
- R&D Expenses : ¥ 13,6 billion
€ 111 million
- R&D members : 842 (8%)

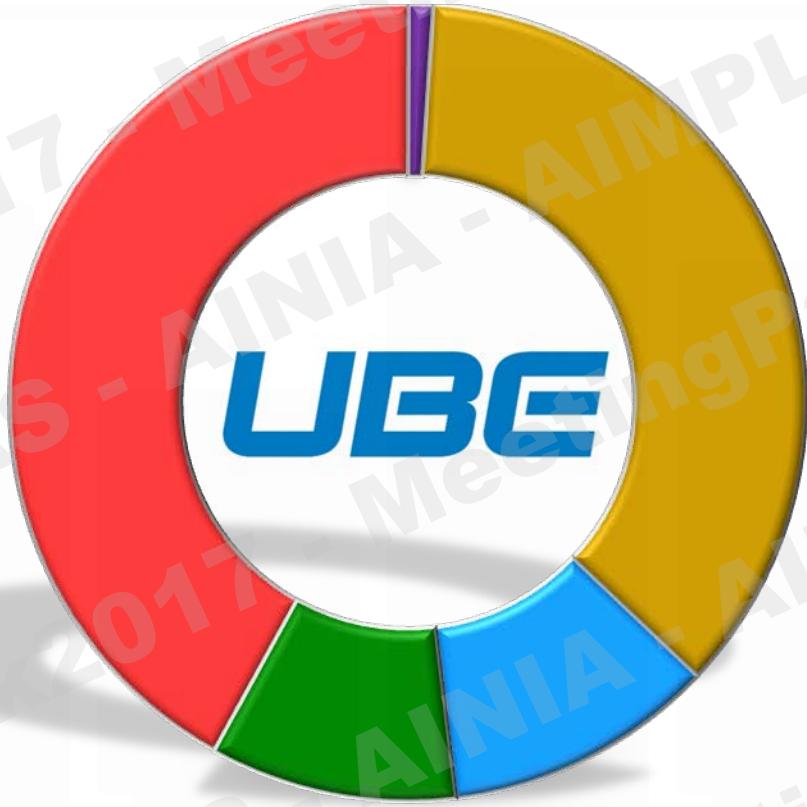
As of March 31st, 2016

Ube city 宇部市



Sukesaku
Watanabe

UBE INDUSTRIES LTD / Activities



Chemicals

42%



Cement & Construction

36%



Machinery

11%



Energy & Environment

10%



Pharmaceutical

1%



Net Sales as of March 31st, 2016

UBE Polyamide Production Sites



Capacities : > 200 000 mT / year (in 2018)
Knowhow : > 50 years

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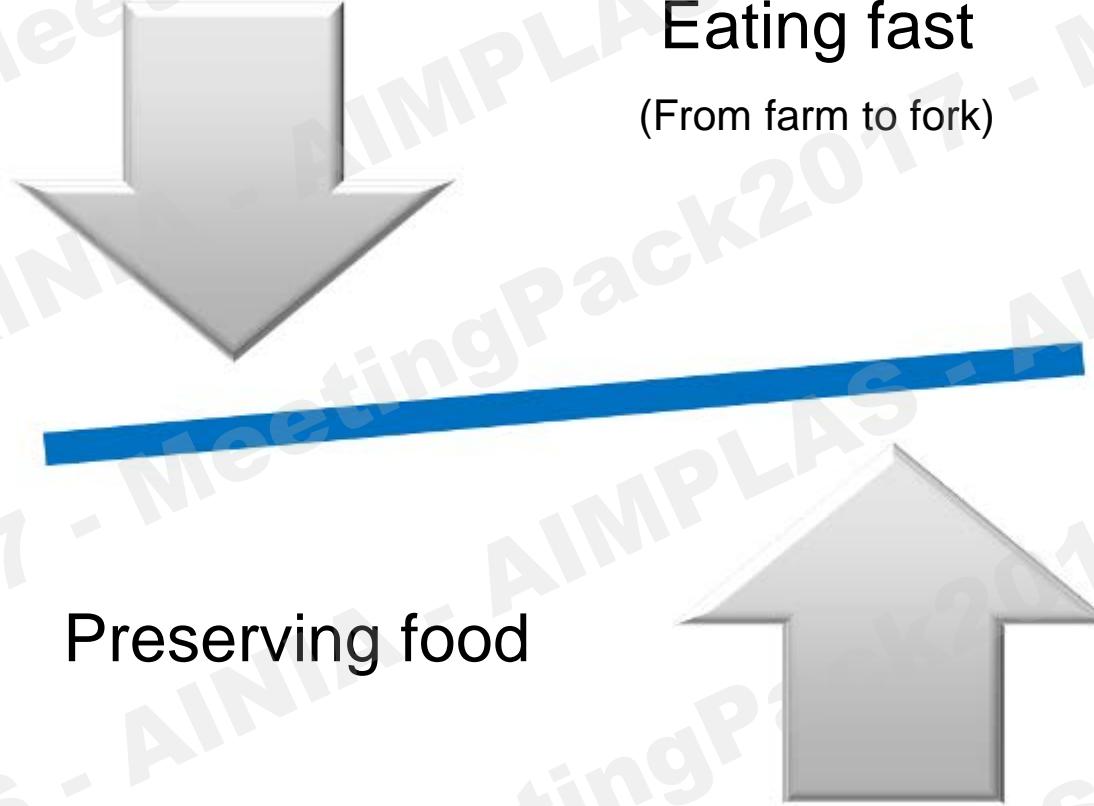
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How to secure **SAFE** food supply?





With diverse effects on the product and the consumer

- **Beneficial:** They act on foods to produce desirable characteristics: aromas, textures, microbiological stability, ...
- **Alterants:** They spoil food by producing undesirable characteristics: bad appearance, bad smell, bad taste, swelling,
- **Pathogens:** They are capable of affecting the individual who ingests them, causing illnesses: vomiting, diarrhea, fever, ...

Able to multiply quickly ... until reaching very large populations

Time	Nº microorganisms
0	1
2 h	16
4 h	256
6 h	4.096
9 h	262.144
12 h	16.777.216
16 h	4.295.000.000
18 h	68.719.000.000

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Which Preservation Process should we select?

**Shelf-life****Degradation Reasons:**

- Microbiological
- Physical-chemical
- Nutritional

Product

Cooked

Salt/sugar

pH

Process

Thermal Process

High Pressures Process

Electric Pulses Process

Packaging

MAP

Vacuum

Storage

Refrigeration

Room Temperature

Which Preservation Process should we select?



Shelf-life

Degradation Reasons:

- Microbiological
- Physical-chemical
- Nutritional

Product

Process

Packaging

Storage

Fresh food

No treatment

No packaging

Room Temperature

Preservation Processes



“Fast microbiological growth” > Short shelf-life

Which Preservation Process should we select?

**Shelf-life****Degradation Reasons:**

- Microbiological
- Physical-chemical
- Nutritional

Product

Cooked

Salt/sugar

pH

Process

Thermal Process

High Pressures Process

Electric Pulses Process

Packaging

MAP

Vacuum

Storage

Refrigeration

Room Temperature

Which Preservation Process should we select?



Shelf-life

Degradation Reasons:

- Microbiological
- Physical-chemical
- Nutritional

Product

Process

Packaging

Storage

Cooked meal

Thermal Process:

Barrier packaging

Room Temperature

Sterilization

Preservation Processes



“No microbiological growth” > “long” shelf-life
(no refrigeration needed)

The beginning

1810. The Frenchman Nicholas Appert invented and developed a commercial process for the manufacture of food packaged in glass.



Comparison of thermo-resistance of some pathogenic microorganisms

C.Botulinum Type	Heating Medium	Heating Temperature (°C)	D value (min)	Reference
Proteolytic B	Phosphate Buffer	121	0.2	Gaze and Brown 1988
Proteolytic B	-	112.8	0.89-1.18	Scott and Bernard 1982
E	Clam Liquor	82.2	0.2	Licciardello 1983
E	Aqueous Suspension	80	0.33-1.25	Roberts and Ingram 1965

Concept of pasteurization and sterilization

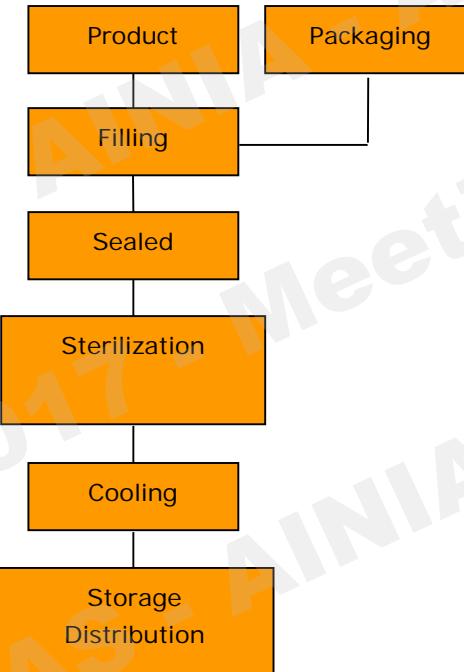
General Criteria

Sterilization. Obtain reductions of **$1/10^{12}$** ($1/1.000.000.000.000$) of ***Clostridium botulinum*** proteolytic type and achieve "commercial sterility".

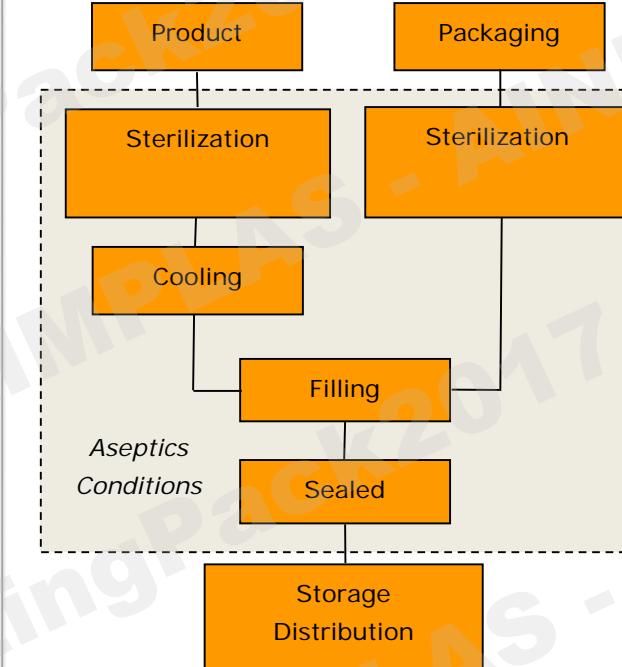
Pasteurization. Obtain reductions "inferior" to **$1/10^{12}$** of ***Clostridium botulinum*** proteolytic type and achieve "stability".

Thermal Process Options

Retort Process



Aseptic Process



Ready to eat meals



Vegetables



Fish



Pet food



Retort food market

Ready to eat meals

VOLUME (t)

	2014	2015	2016
Meat	28.314	28.133	27.724
Vegetable	13.800	14.362	16.794
Beans	13.470	14.255	15.745
Pasta	6.777	8.415	9.232
Fish	1.453	1.600	2.079
Total	63.814	66.765	71.574

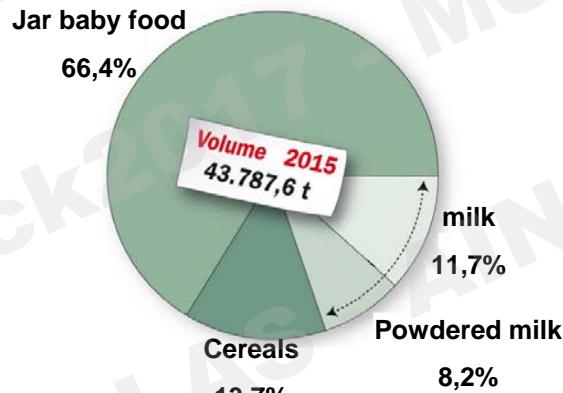
Source: Alimarket



Ready to eat meals



Baby food



Source: Alimarket



Canned vegetables

VOLUME (t)

	2016
Tomato	79.944
Corn	29.150
Asparagus	26.606
Pepper	18.496
Mushroom	16.538
Green beans	15.858
Peas	12.903
Artichoke	9.247
Others	30.993
Total	239.735

Source: Alimarket



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New demands from consumer markets are driving high-barrier film consumption to grow annually by 4.6%

13 January 2017

Print Email

New demands from consumer markets are driving high-barrier film consumption to grow annually by 4.6%

Global high-barrier packaging film consumption was projected at 1.86 million tonnes in 2016 and is forecast to grow during 2016–2021 at an annual rate of 4.6% to 2.33 million tonnes, according to Smithers Pira.

Requirements for packaging and packaging materials

- Resist treatment temperatures
- Do not undergo undesirable changes (color, appearance, transparency)
- Heat-resistant seal system during heat treatment
- Do not have migrations
- Facilitate thermal transfer
- **Barrier properties** appropriate to the estimated **Shelf-life** of the food

Packaging requirements

Before

t=0

After

t > 6 months



Degradation Reasons:

- Microbiological
- Physical-chemical
- Nutritional

Packaging requirements



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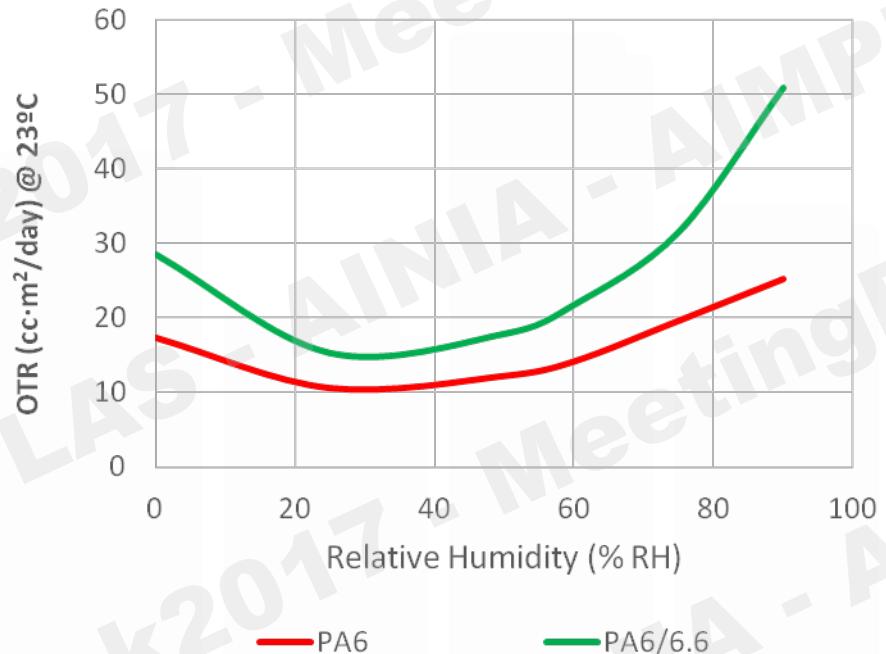
New retort packaging concept

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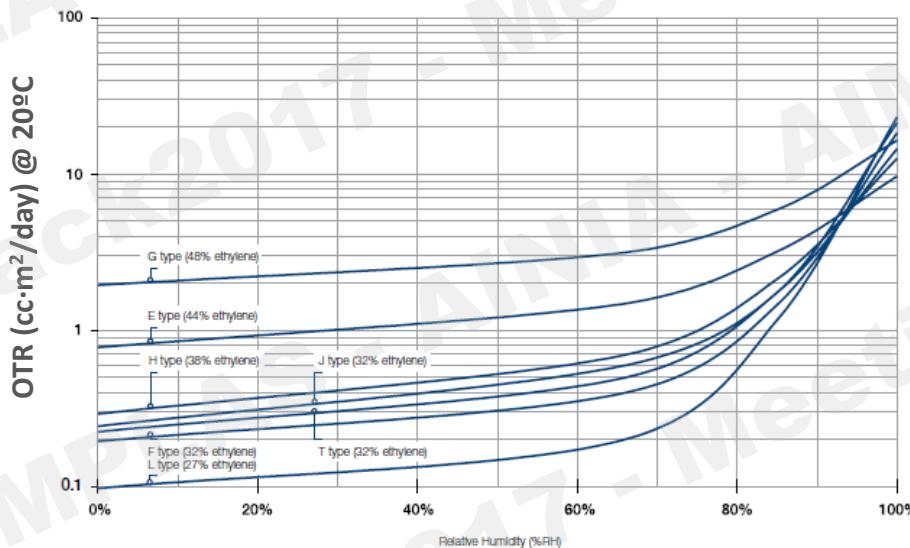
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PA



EVOH

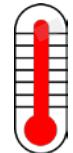


Source : EVAL brochure

High moisture content of the barrier layer = Lower Oxygen barrier

Moisture absorption in autoclave

In autoclave during retort process



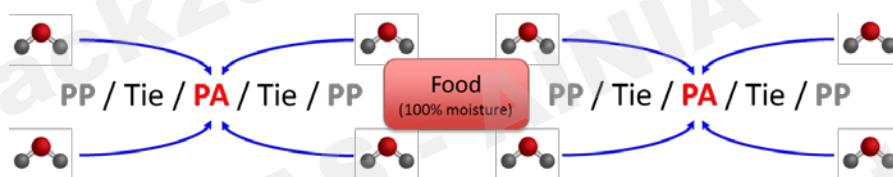
$T \geq 121^\circ\text{C}$



P : High

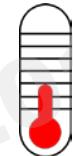


$t \geq 30 \text{ min}$



Moisture absorption of the barrier layers

On the shelf after retort process



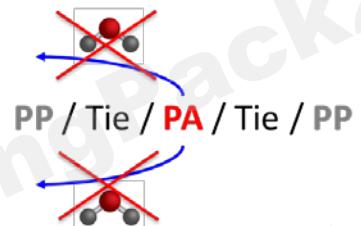
$T = \text{Room temp.}$



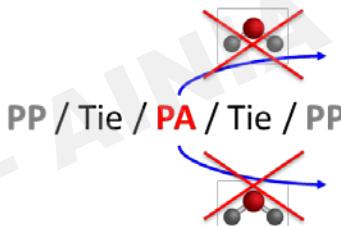
P : atm.



$t : \text{long storage}$



Slow moisture release (drying)



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**Why not placing the barrier materials
in outer layer?**

	Symmetrical structures Conventional	Asymmetrical structures
Medium barrier	PP / Tie / PA / Tie / PP	Out In PA / Tie / PP / PP / PP
High barrier	PP / Tie / EVOH / Tie / PP PP / Tie / PA / EVOH / PA / Tie / PP	Out In PA / EVOH / PA / Tie / PP

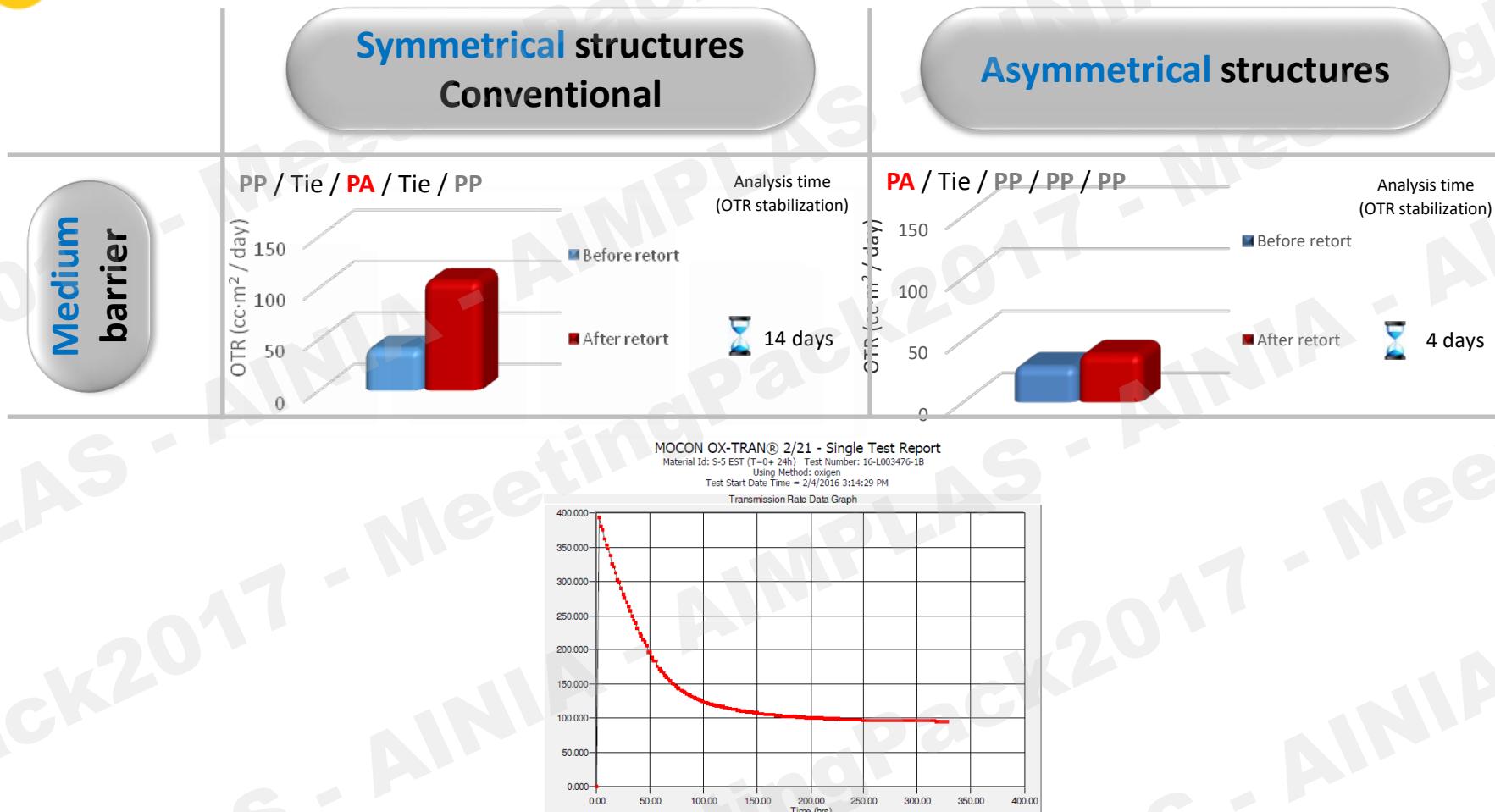
For the study :

Total film thickness : 100µm

PA layer thickness : 30%

EVOH layer thickness : 10%

Oxygen Transmission Rate (by OTR)

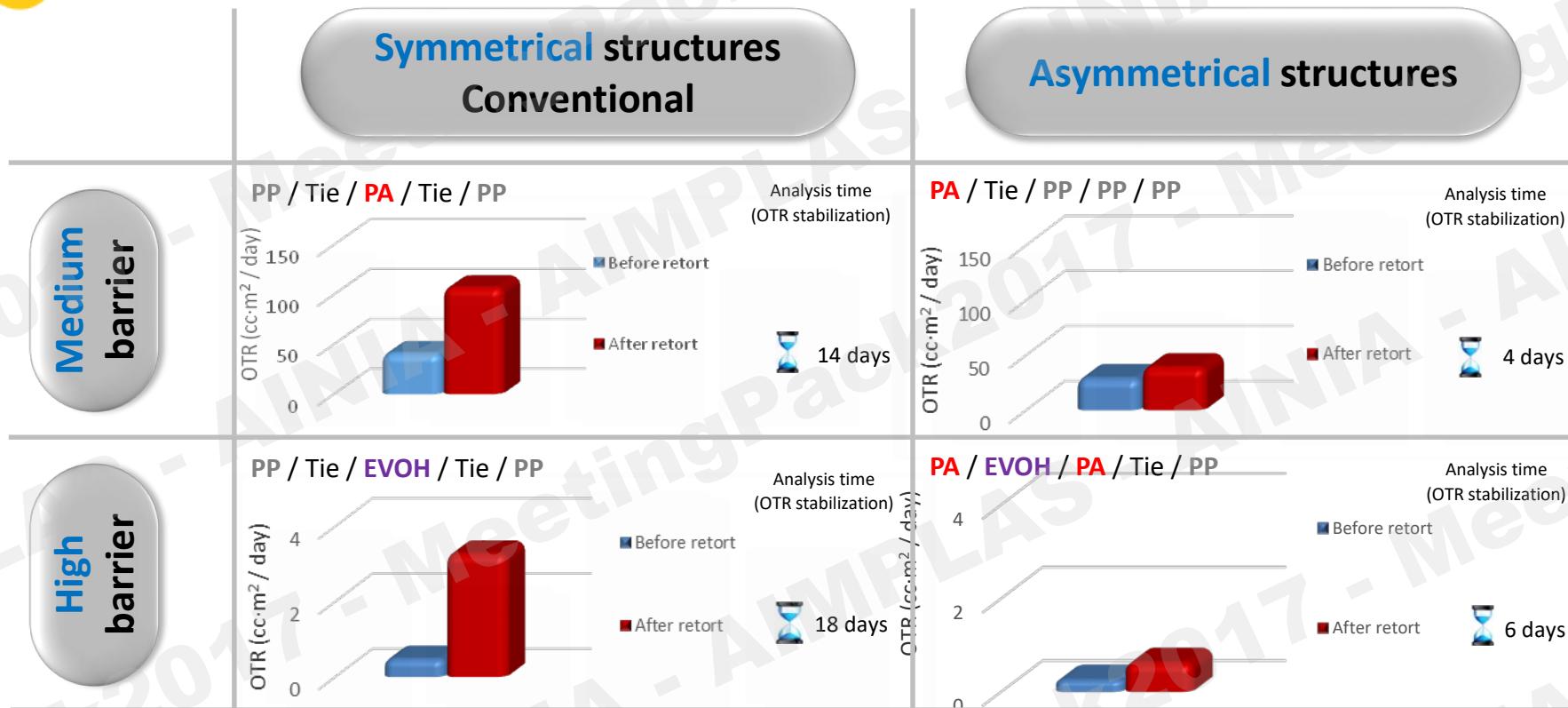


Autoclave conditions : T=125°C, t =30min

Room conditions : T=23°C, RH =50% t=24h

Testing conditions : T=23°C, RH (O₂) =50% - RH (N₂) = 90%

Oxygen Transmission Rate (by OTR)



Autoclave conditions : T=125°C, t =30min

Room conditions : T=23°C, RH =50% t=24h

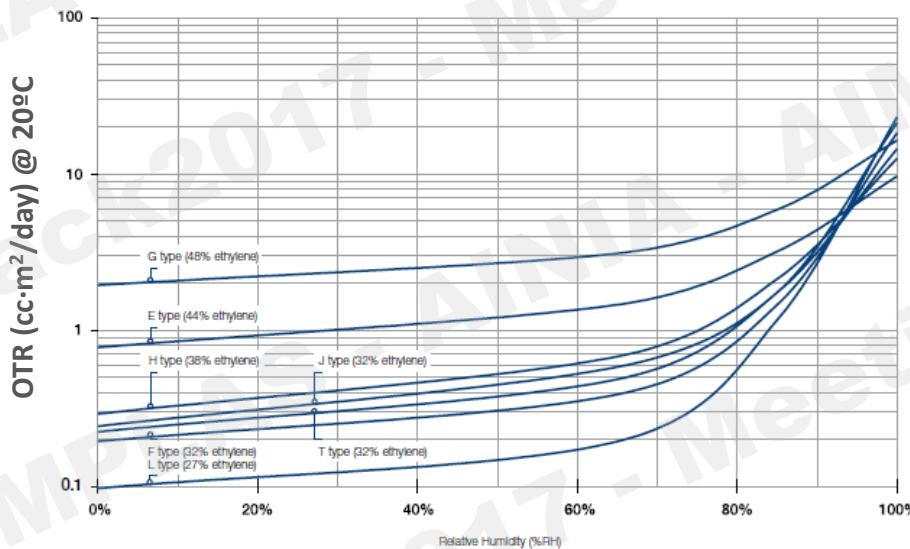
Testing conditions : T=23°C, RH (O₂) =50% - RH (N₂) = 90%

- Films don't recover 100% initial O₂ barrier after retort treatment
- Faster drying = Faster barrier recovery in asymmetrical structures

PA



EVOH



Source : EVAL brochure

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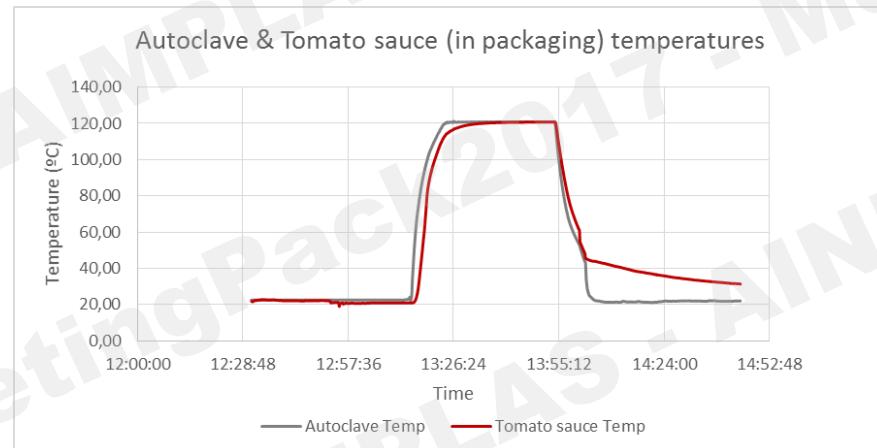
Autoclave treatment:



Autoclave conditions :

121°C

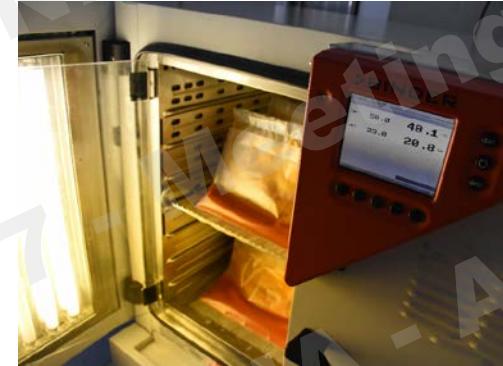
30 min



Evaluation methodology

Storage conditions:

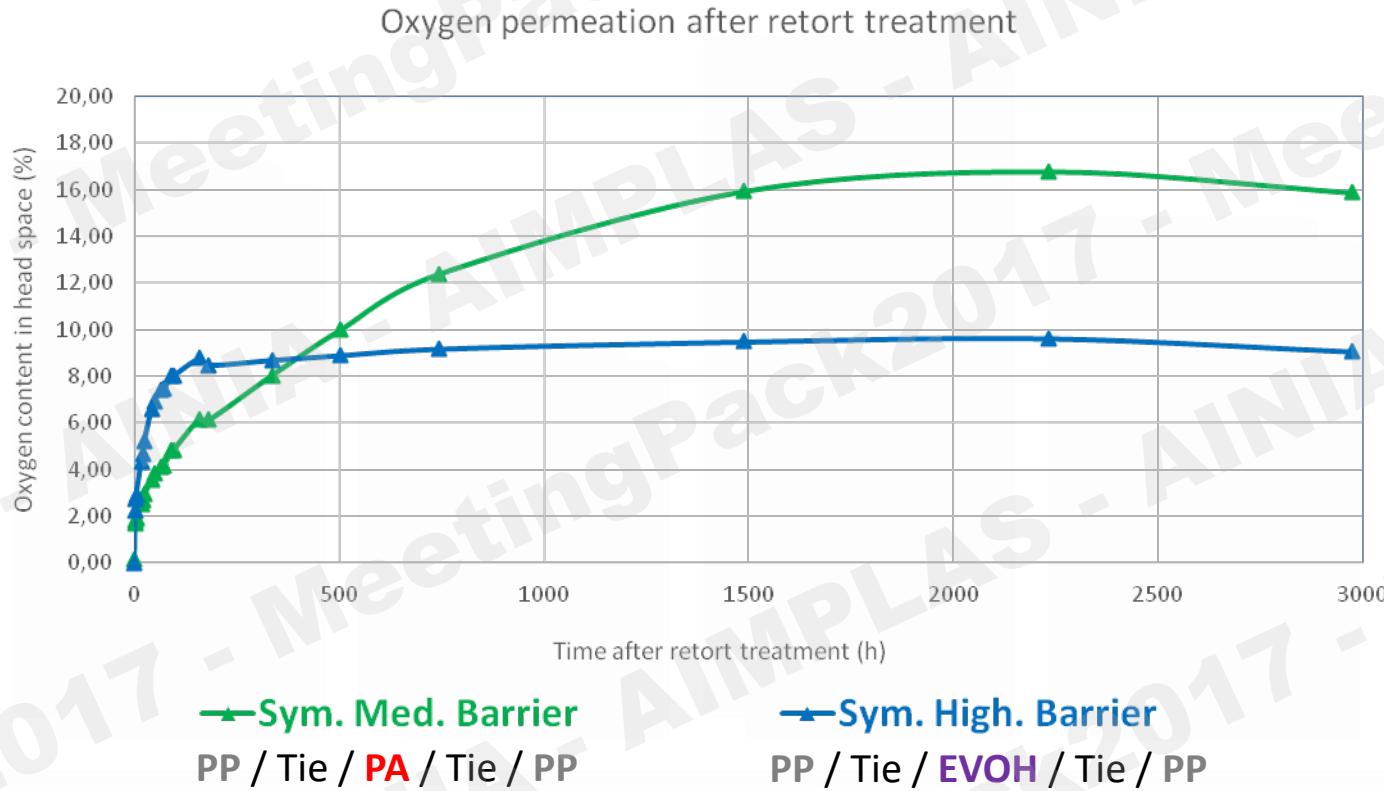
- Temperature : $T = 23^{\circ}\text{C}$,
- Relative humidity : $\text{RH} = 50\%$
- Time : $t = \text{up to 6 months}$



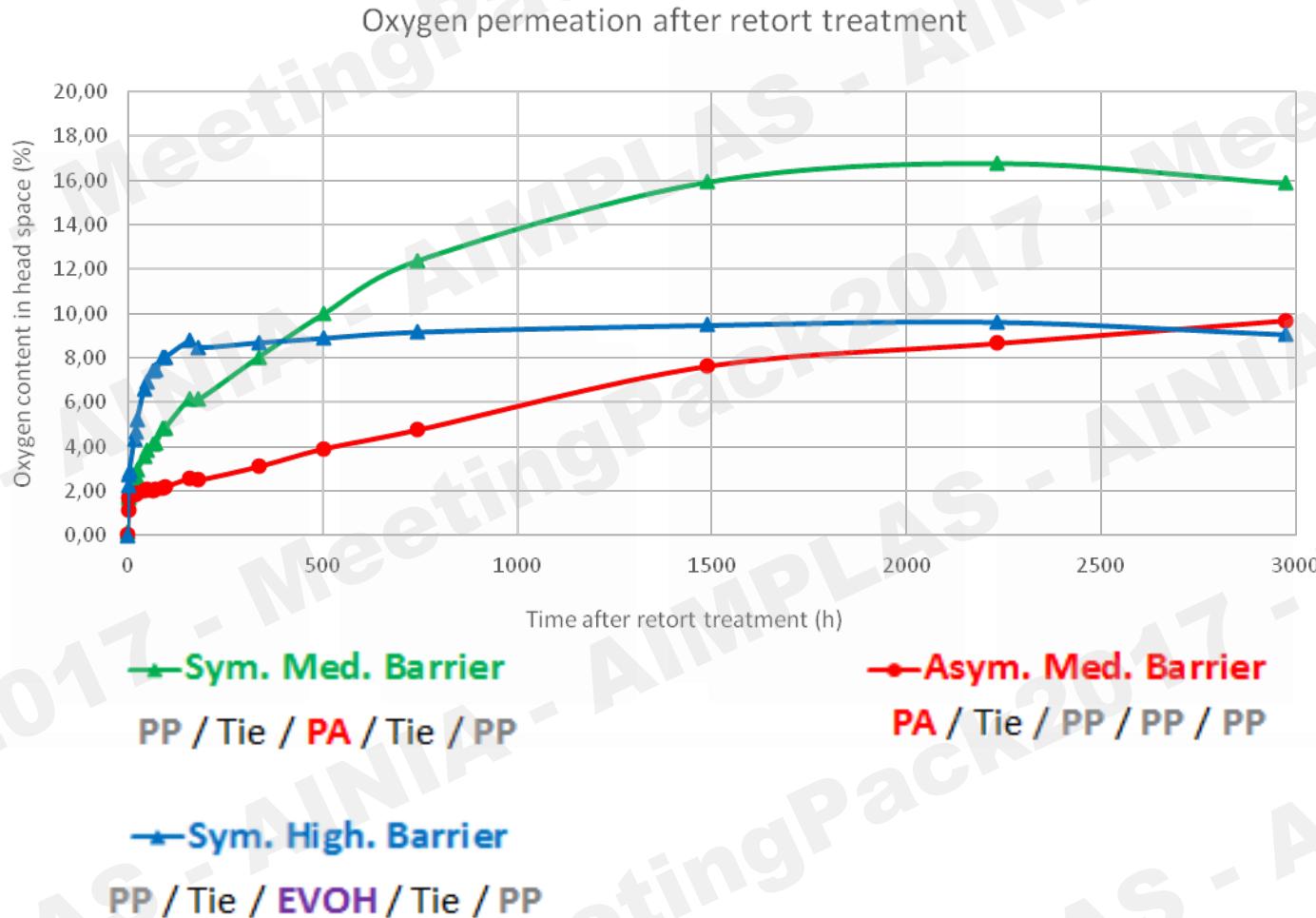
Oxygen permeation measurement (non-invasive):



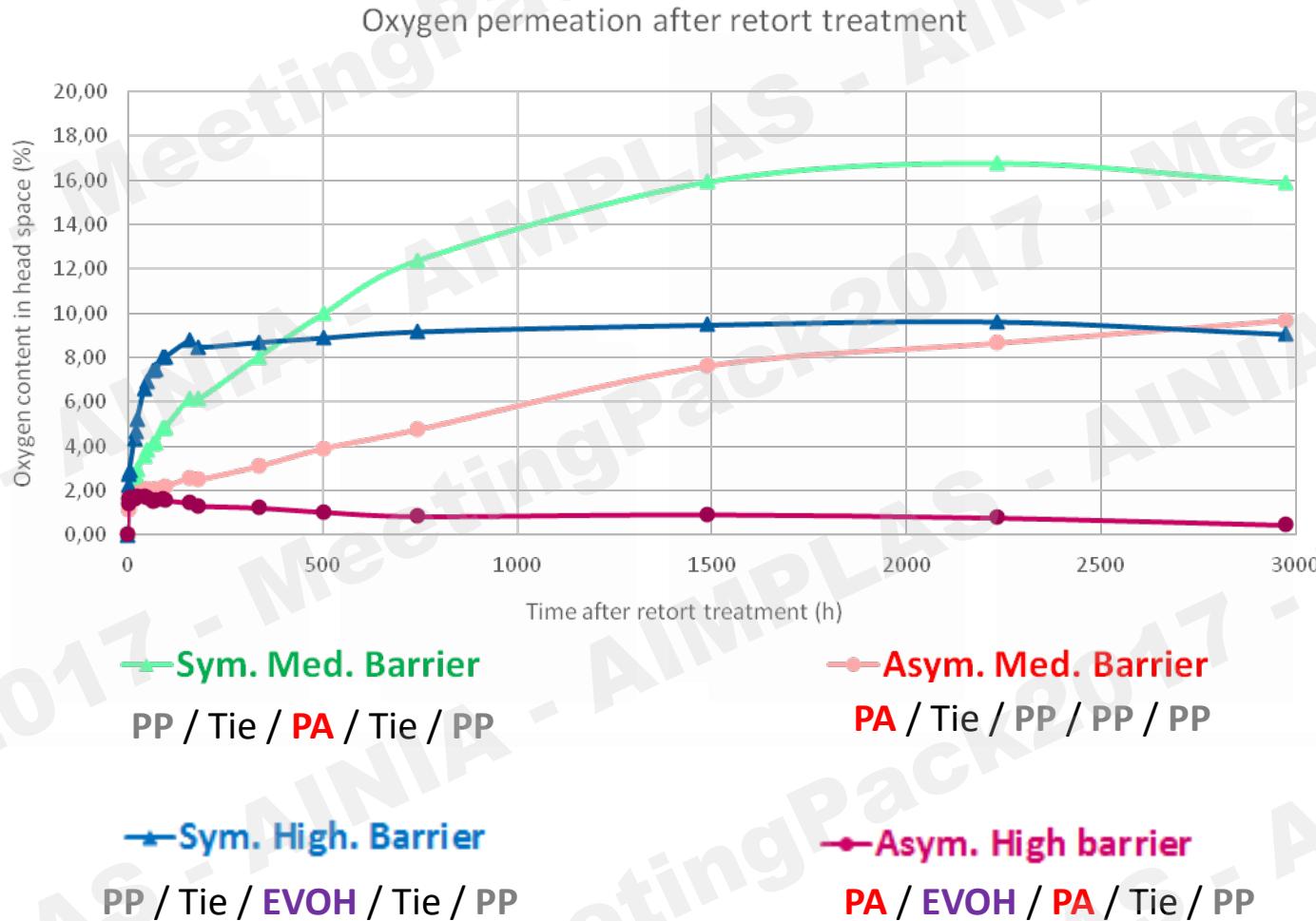
Oxygen Permeation



Oxygen Permeation



Oxygen Permeation



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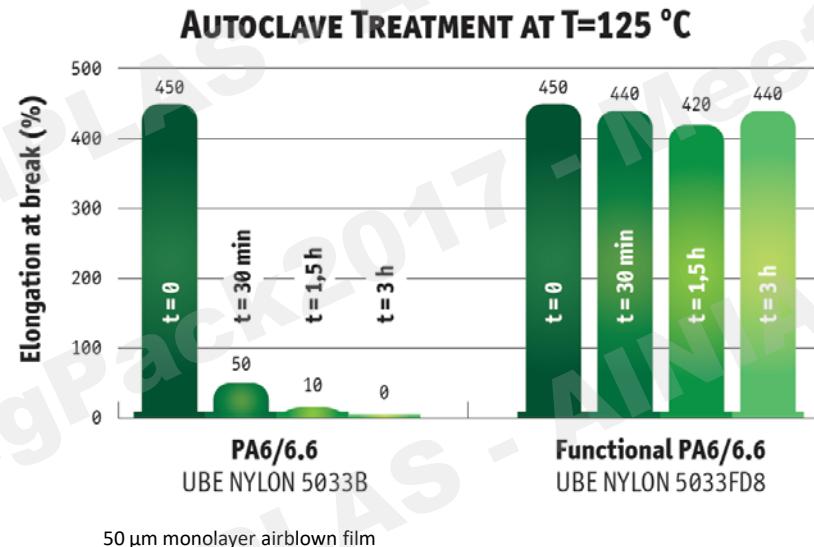
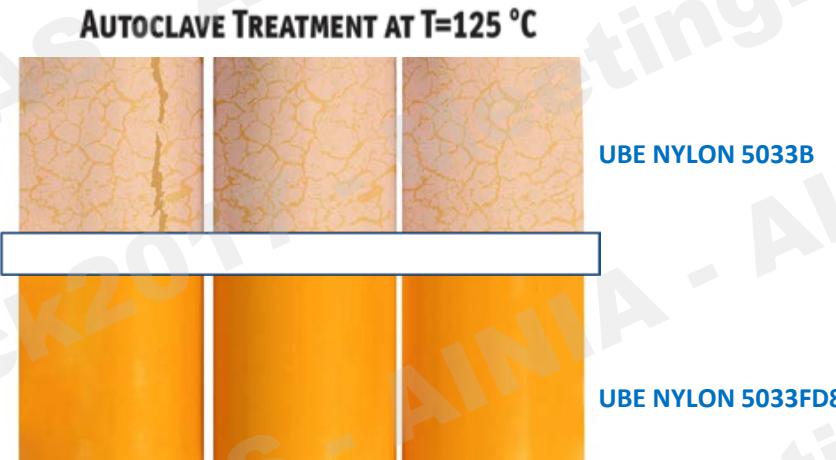
Structure :

PA/Tie/PA/Tie/PP or PA/EVOH/PA/Tie/PP

Outer layer :

HYDROLISIS Resistant - UBE NYLON 5033FD8

Tested up to T=125°C, t=3h



Which UBE NYLON?

Structure :

PA/Tie/**PA**/Tie/PP

or

PA/EVOH/**PA**/Tie/PP

or

PP/Tie/**PA**/Tie/PP

Middle layer :

UBE NYLON 1030B

UBE NYLON 5033B

UBE NYLON 5033FD8

Tested up to T=125°C, t=30min

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- 1) **Medium barrier asymmetrical films (PA/Tie/PP/PP/PP) :**
Good alternative to current high barrier symmetrical films (PP/Tie/EVOH/Tie/PP).
Besides they offer superior mechanical and optical properties.

- 2) **High barrier asymmetrical films (PA/EVOH/PA/Tie/PP) :**
Solution to extend significantly the shelf life of the foodstuffs.
Besides they offer higher mechanical and optical properties.

- 3) **UBE NYLON 5033FD8** (unique material in the market) offers the possibility to place PA in outer layer of retort packaging.

Thank You

very much for your attention

