MICHELMAN®

Design for High Barrier Recyclable Packaging Structures

Thierry Van Migem

Sales Director EMEA

Krist Vanderstiggel

Sales Print & Pack

Who Is Michelman?

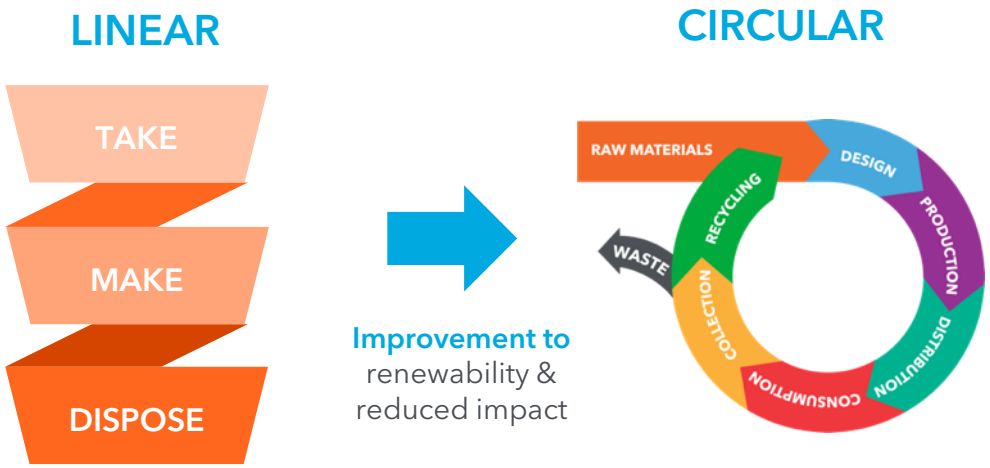
- **Global, 75 years of experience**
- Values-based & purpose-driven
- **Customer focused**
- Focused on the long term
- Family owned, professionally managed

Innovating a Sustainable Future

GOLD | Top 5%
ecovadis
Sustainability Rating
MAY 2024

Four Main Areas of Focus for Our Solutions:

- Replacing Substances of Concern (SoCs)
- Reducing Volatile Organic Compounds (VOCs)
- Light weighting
- **The Circular Economy**



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Michelman Capabilities

70 Technology-Based Associates

- **Five Global R&D Centers of Excellence**
  - USA, Luxembourg, China, India, Singapore
  - Industry experts for new technology and new product development
- **Core Expertise**
  - Emulsification and formulations such as primers, OPVs, barrier coatings, and heat seal coatings for printing and packaging
  - **Collaborative innovation** allows for customized solutions
  - World-class experts that design and optimize solutions using water-based technology, involving prototyping
  - Strong global team in applications/engineering

Regulatory Affairs in Every Region

oneBARRIER FibreCycle

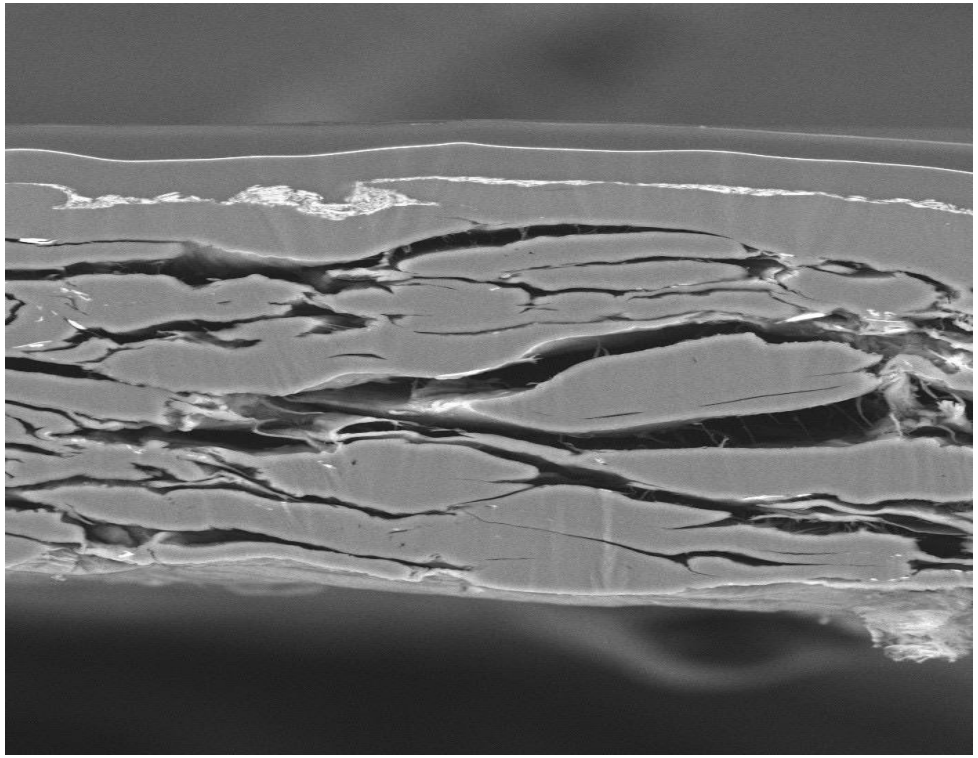
Co-creating a recyclable high barrier fiber-based flexible packaging solution

BOBST UPMSPECIALTY PAPERS UPM MICHELMAN

Paper → Primer-coating → Vacuum coating → Top-coating → Surface printing

Primer and Coatings Selection: Critical Aspects to Consider to Meet High Barrier Paper Requirements

- Selection of the paper
- Pinhole-free surface
- Interlayer adhesion
- Synergy with subsequent barrier coating
- Barrier properties
- Flexibility
- Recyclability
- Food contact compliance



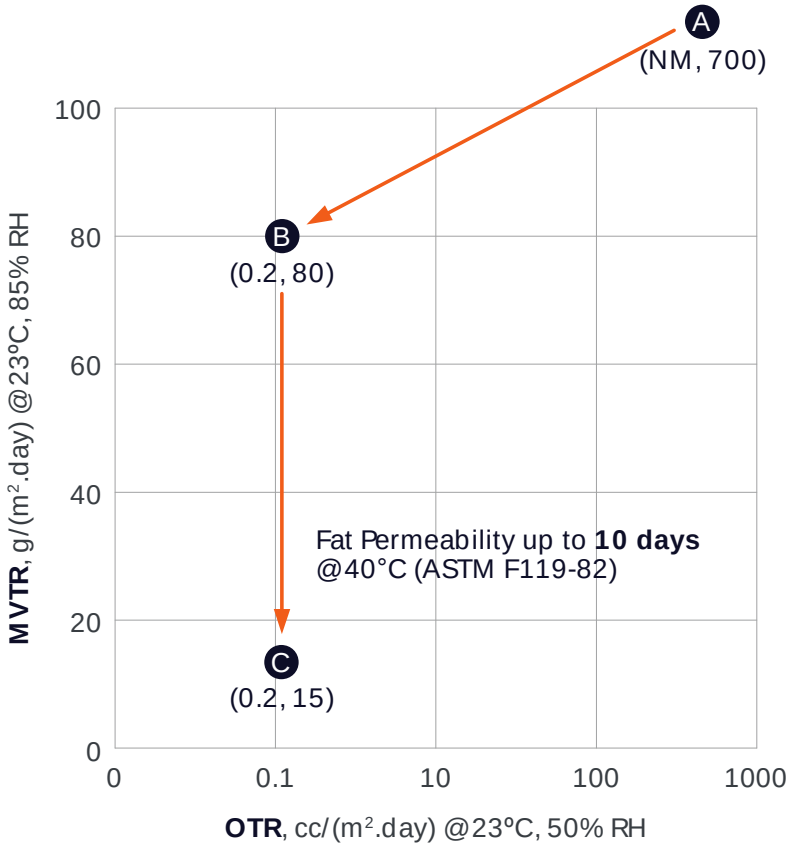
*SEM image provided by UPM

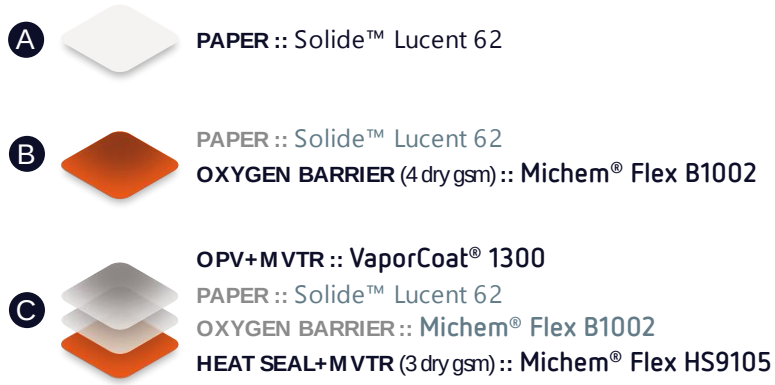
Building a System for High Barrier Heat Seal Paper

High Oxygen and Moisture Vapor Barrier combined with Heat Seal Performance can be achieved by selecting the right paper and tailoring the functional coatings.

At an applied coat weight between 3 to 4 gsm dry, the following barrier enhancements have been measured on UPM ***Solide™ Lucent* 62 gsm**:

- Low temperature Heat Sealable over a wide sealing window
- Oxygen Barrier below 0,5 cc/m2.day (23°C,50%RH)
- MVTR values below 15 g/(m2.day) (23°C, 85%RH)
- Fat Permeability up to 10 days
- Mineral Oil Barrier
- Cobb values below 0.1g/m2
- COF adjustable system





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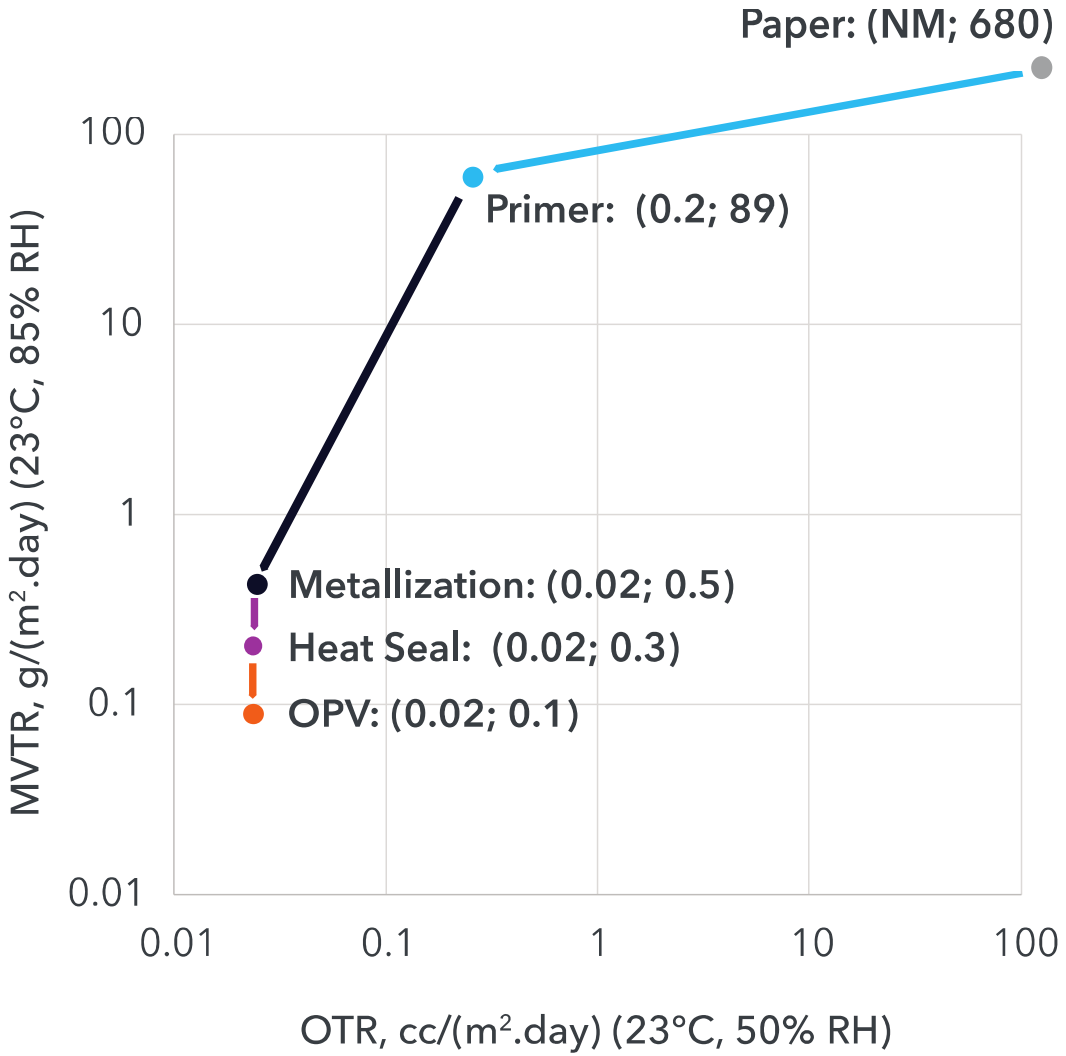
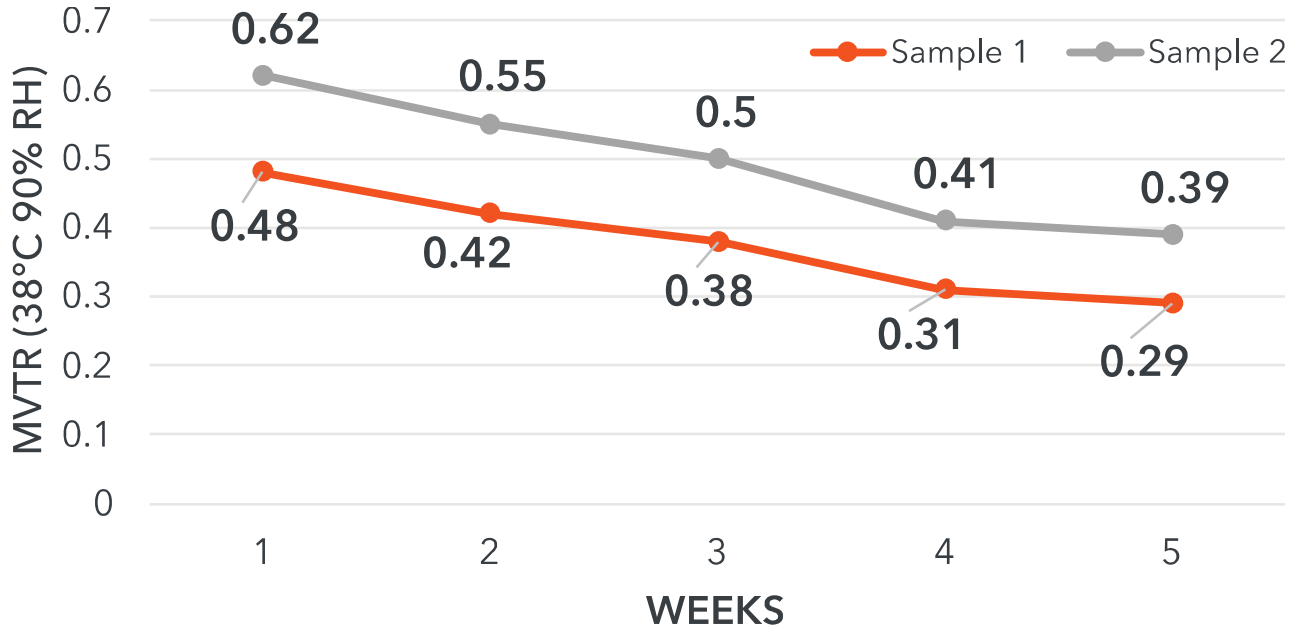
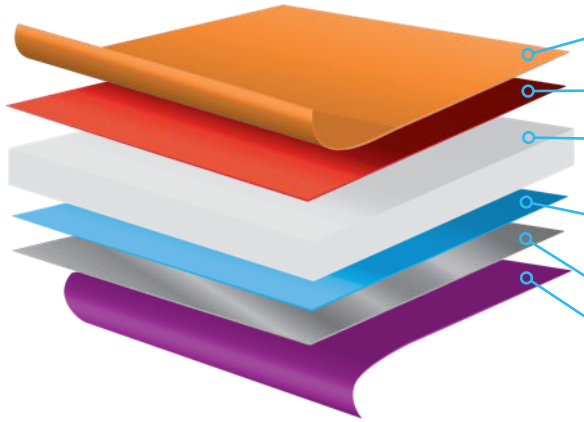
Performance of the oneBARRIER FibreCycle Solution, 94% Recyclable







OPV VaporCoat® 1300 is overprinted to protect the surface and enhance MVTR under tropical conditions.

Ink

Substrate UPM Solide Lucent™, a responsibly sourced and recyclable | paper, is an excellent foundation for achieving optimum barrier properties.

Primer Michem® Flex B1002 (181062PX), is a metallization primer that also provides oxygen, aroma, and mineral oil barriers, oil & grease resistance, and print receptivity.

Metallization via BOBST AluBond® vacuum deposition.

Heat Seal The Michem® Flex HS family enables airtight sealing for a range of seal initiation temperatures.

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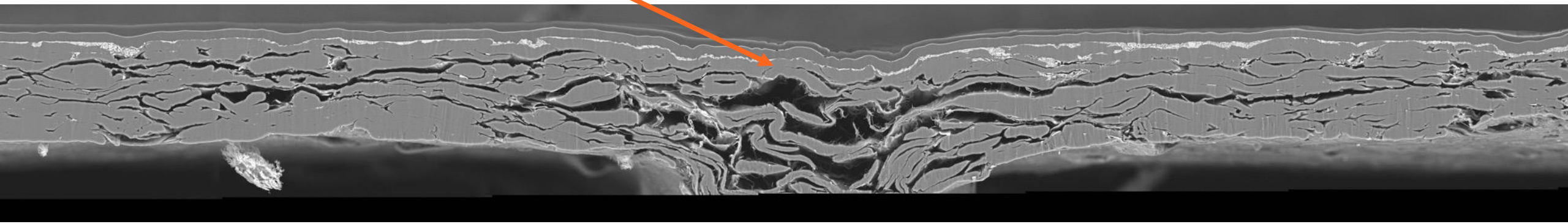
Image SEM Flexibility + Value OTR/MVTR Retention After Creasing

Sample	OTR (23°C 50% RH) cc/m².day		MVTR (38°C/90%RH) g/m².day	
	Flat	Crease	Flat	Crease
Before Conversion	0.01/0.01	0.01/0.01	0.3/0.2	0.2/0.2

Sample	OTR (23°C 50% RH) cc/m².day	MVTR (38°C/90%RH) g/m².day
After Conversion	0.04/0.04	0.3/0.5



*SEM image provided by UPM

Bio-Based Solutions

Next-Generation Sustainability – Bio-Based Coatings

Work is under way on the next generation of environmentally friendly barrier and functional coatings and the substrates with which they can be paired.

Sustainability Benefits

- Bio-based
- Plastic-free (SUPD)
- Home compostable
- Recyclable

Potential Applications

- Retail dry food pouches, bags, and wraps
- Foodservice (ice cream, burger wrap, meat)
- Pet food
- Paper plates
- Shopping bags

Properties Imparted

- MVTR
- Mineral oil barrier
- Water resistance
- Oil and grease resistance
- Heat seal

Additional Features

- Direct food contact compliance
- Crease resistant
- Overcoatable
- Low coefficient of friction

Bio-Based Packaging Structure with 221151PX + 231098PX

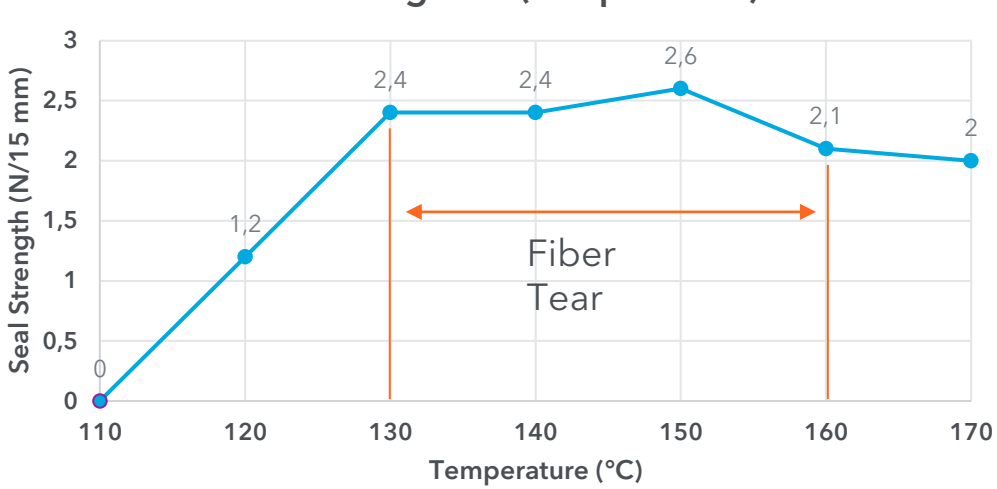
Inside Barrier Coating: 221151PX

- Heat seal
- Oil & grease resistance
- Mineral oil barrier

62 g/m² paper
Recyclable & compostable

Outside Barrier Coating: 231098PX

- MVTR
- Cobb
- Oil & grease resistance



Heat Seal Conditions (3 bar 0.5 sec)
Applied coat weight: 3 dry g/m²

	Coat Weight g/m²	MVTR @ 23°C, 85%RH, g/m²·day	MVTR @ 38°C, 90%RH, g/m²·day	Heat Seal 3 bar 0,5 sec	Cobb 30min g/m²	OGR
Inside						
Heat Seal coating, rough side	3.0	**600**	**950**	110-150°C	55.6	12
Outside						
MVTR & Cobb coating, smooth side	0.9	**38**	**160**		49.0	<7
MVTR & Cobb coating, smooth side	1.7	**20**	**60**			
MVTR & Cobb coating, smooth side	2,2	**5**	**20**		12.0	10
MVTR & Cobb coating, smooth side	4.1	**3**	**11**			

Sustainability Attributes

- Plastic free (SUPD compliant)
- Recyclable (Cepi v2)
- 98% bio-based in dry film*
- Home compostable*

Potential Applications

- Tea bags, chocolate, Cereal bars, soap bars

* Based on information provided by the raw material suppliers

Certifications OK Biobased and SUPD

CERTIFICADO | СЕРТИФИКАТ | شهادة | 证书 | 인증서

OK biobased TÜV AUSTRIA

TÜV AUSTRIA

CERTIFICATE FOR AWARDING AND USE OF THE 'OK BIOBASED' CONFORMITY MARK

TA8072508858

Issued by TÜV AUSTRIA GMBH

Product(s):	
Domain	Biobased Products
Group	Components & Constituents
Family	Ink, Colorant, Adhesive & Additives
Type	Additive
Trade mark	231098PX.E
Description / Particularities	Colour: Light cream liquid
Class (between 1 & 4):	The product is assigned to class **4**, meaning: Biobased Carbon Content of the product ≥ 80 % ★★★★
Licensee:	**MICHELMAN INTERNATIONAL SARL** Rue de l'Industrie 11. 8399 Windhof LUXEMBOURG
Criteria:	• Certification Scheme with reference OK 20 edition C Methodology conform to EN 16640: "Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method"
Validity:	From 14 January 2025 till 14 January 2030

DATA SHEET of Certificate TA8072508858

Validity from 14 January 2025 till 14 January 2030

Biobased Carbon Content
Carbon Fraction

According to EN 16640:

Biobased Carbon Content X_B^{TC} The biobased carbon content of the product is determined at: **98 %**

PTS FIBRE based solutions

Evaluation of SUPD Compliance

Product	**EXPERIMENTAL 221151PX (221151PX.E) and BIOBASED WR MVTR COATING (231098PX.E)**
Company	**Michelman International SARL** **11, rue de l'Industrie** **L-8399 Windhof**

The products **"EXPERIMENTAL 221151PX (221151PX.E) and BIOBASED WR MVTR COATING (231098PX.E)"** manufactured by company „Michelman International SARL" are water based coating applications for paper surfaces.

The product was evaluated with respect to the ingredients, additives and processing aids used as well as the manufacturing process as such. Corresponding PTS test report is report number 51.631.

According to the recipe analyses carried out and considering the requirements of:

DIRECTIVE (EU) 2019/904 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on the reduction of the impact of certain plastic products on the environment

and

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

and

Commission guidelines on single-use plastic products in accordance with Directive (EU) 2019/904 of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment (2021/C 216/01)

the assessed products **"EXPERIMENTAL 221151PX (221151PX.E) and BIOBASED WR MVTR COATING (231098PX.E)"** are **out of the scope of being a single use plastic item according to DIRECTIVE (EU) 2019/904 when used according to specifications as surface coatings for paper.**

4evergreen-Cepi 2 Recyclability

Results_Sample 1

Fibre-based packaging recyclability evaluation protocol Beta release, December 2022

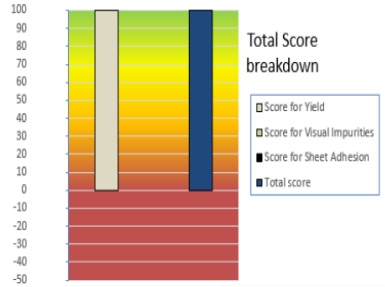
Calculation of Recyclability Scores for Standard Mill

Version 1.0
Date 14/11/2022

4evergreen
perfecting circularity together

Cells in Green should be filled by the user
Cells in Yellow are calculated automatically

Recyclability Results	Acronym	INPUT	Unit	Recyclability Score Standard Mill	Score Range
Coarse Reject	CR	0.0	0 - 100 [%]		
Fine Reject	FR	0.1	0 - 100 [%]		
Yield	Y	*99.9*	0 - 100 [%]	100	*min -100, max 100*
Visual Impurities	VI	1	1 - 4 [Level]	0	*min -30, max 0*
Sheet Adhesion	SA	1	1 - 3 [Level]	0	*min KO, max 0*
				100	/100



Please note that the Beta Version of the Fibre-based packaging recyclability evaluation protocol does not include all test parameters yet. Additional parameters, such as Dissolved and colloidal solids (DCS), Macrostickies area (MSA) and Reject quality (RQ), might be incorporated in future versions of the recyclability evaluation protocol. In that case the score calculation should be adapted accordingly.

Download the protocol template here:
guidelines and protocol - 4evergreen (4evergreenforum.eu)

Yield: 99,9%
Recyclability score: 100

Results_Sample 2

Fibre-based packaging recyclability evaluation protocol Beta release, December 2022

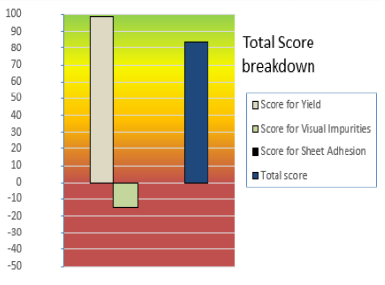
Calculation of Recyclability Scores for Standard Mill

Version 1.0
Date 14/11/2022

4evergreen
perfecting circularity together

Cells in Green should be filled by the user
Cells in Yellow are calculated automatically

Recyclability Results	Acronym	INPUT	Unit	Recyclability Score Standard Mill	Score Range
Coarse Reject	CR	0.0	0 - 100 [%]		
Fine Reject	FR	0.7	0 - 100 [%]		
Yield	Y	*99.3*	0 - 100 [%]	99	*min -100, max 100*
Visual Impurities	VI	3	1 - 4 [Level]	-15	*min -30, max 0*
Sheet Adhesion	SA	1	1 - 3 [Level]	0	*min KO, max 0*
				84	/100



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Download the protocol template here:
guidelines and protocol - 4evergreen (4evergreenforum.eu)

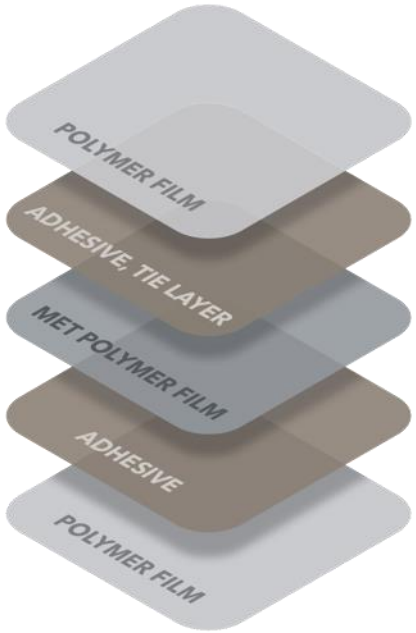
Worst case scenario: 2X coating
Yield: 99,3%
Recyclability score: 84

Mono-Material Film Solutions

Designing for Recyclability with Film

- Brand owners have a need for packaging materials to meet circular economy goals (improved recycling) while still protecting their products cost effectively.
- Food safety and reducing Food Waste remain a key focus areas. Mineral Oil migration concerns increases.
- Shelf appeal is highly valued by Brand Owners and consumers want to be able to see what they are purchasing.
- Reduced complexity and lighter weight packaging.
- Environment friendly water-based solutions, are becoming more desired due to fear of migration into food and VOC restrictions.

Commercial 3-Ply Laminate

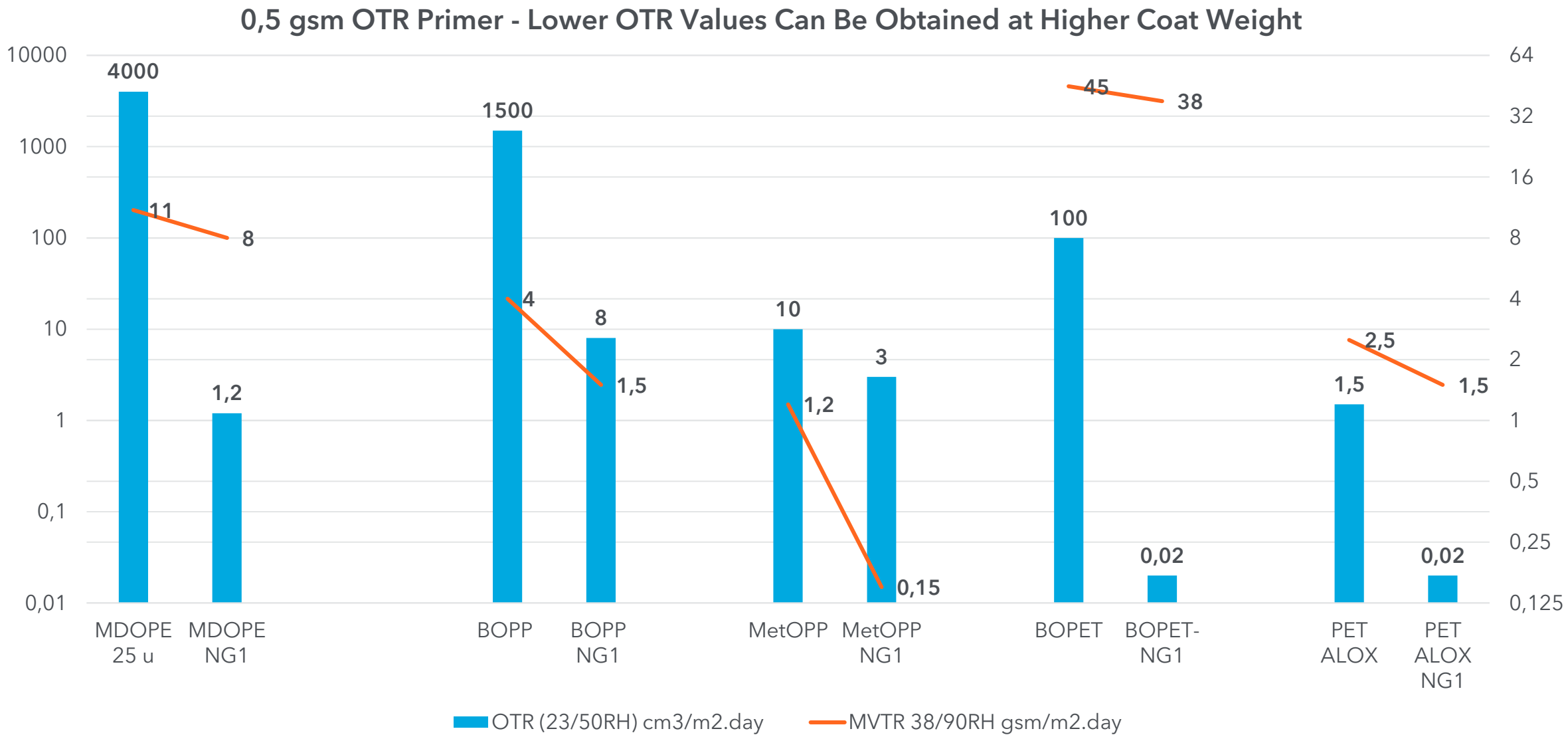


2-Ply Laminate

2-Ply High Barrier Met Laminate

Light Weighting Flexible Model

Michelman BIF on Different Substrates



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Recyclable High-Barrier Metallized Film Pouches

- **Collaboration with BOBST on industrial scale**
- **Oxygen and moisture vapor barriers**
- **Mono-material MDO-PE** (compliant with CEFLEX D4ACE guidelines)
- **Recyclable** (Class AAA certified by Cyclos-HTP)
- **No loss of barrier performance**

CERTIFICATE

Recyclability of Packaging Material

Bobst Manchester Ltd
Pennine Business Park,
Pilsworth Road, Heywood
Lancashire OL10 2TL, United Kingdom

The company receives the certification of recyclability for the following packaging material.

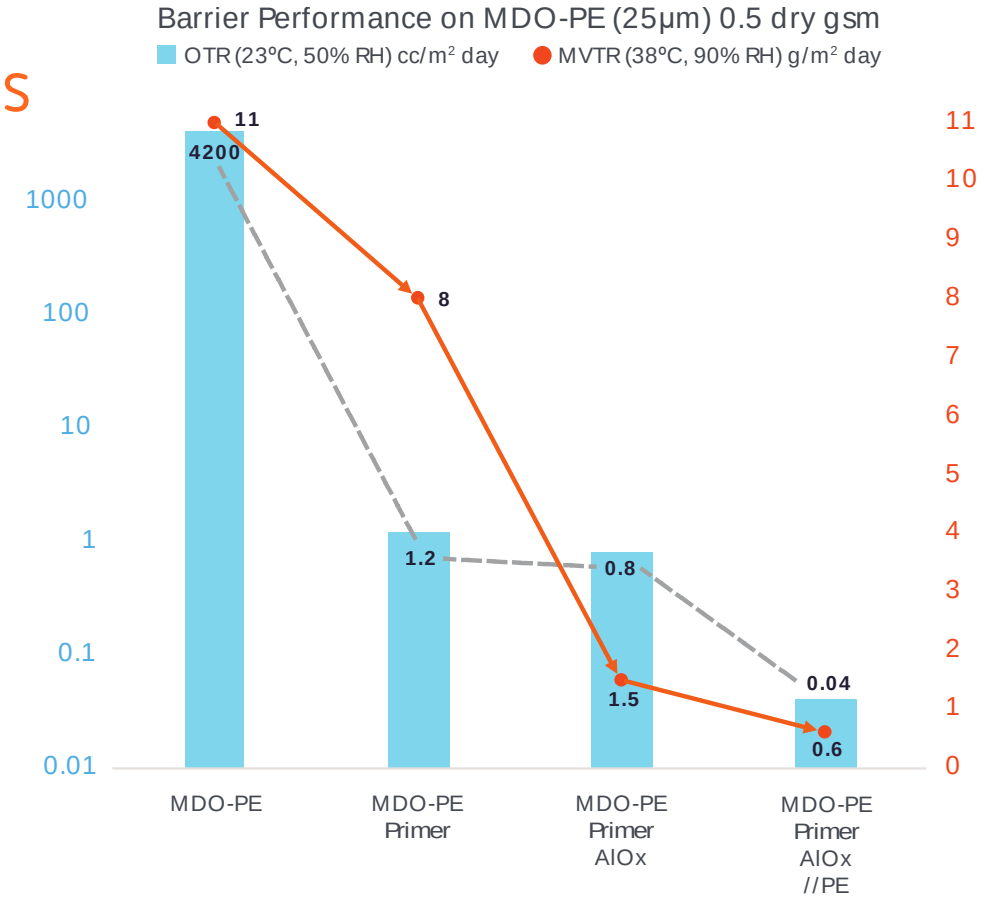
Designation

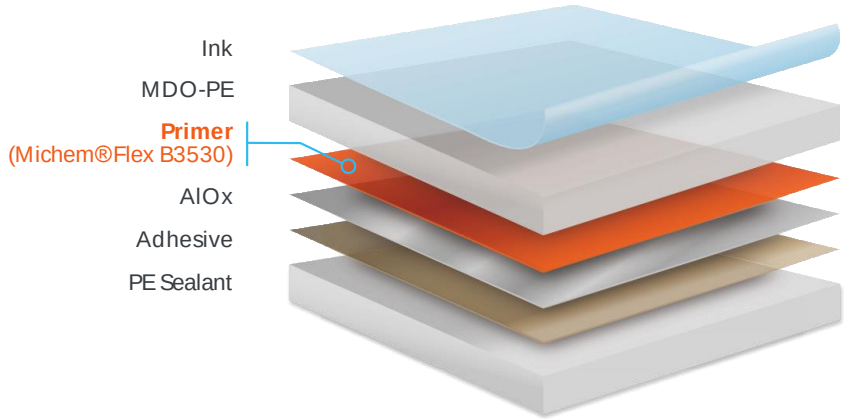
oneBARRIER PrimeCycle AlOx high barrier PE monomaterial

Packaging film; additional printings or labels can affect the recyclability of the final packaging

Test result

Assessment via path	Recyclability
Path 1: Plastic films / LDPE	98 %
Path 7: Mixed Polyolefins / Mixed Plastics (flexible)	





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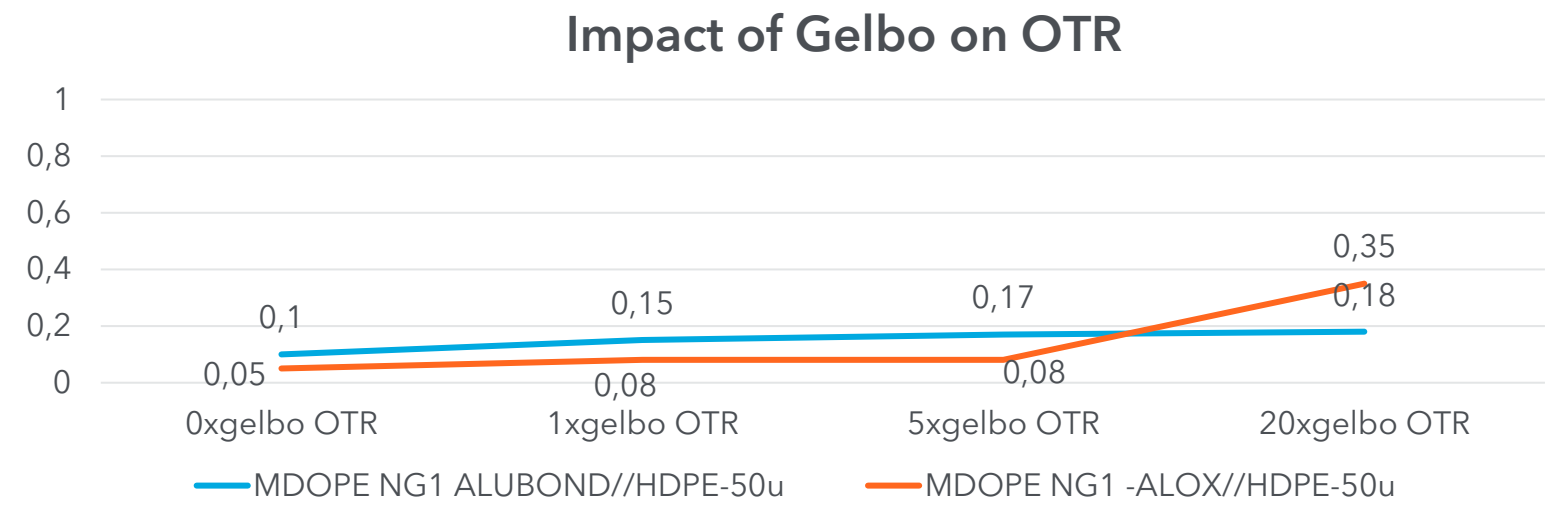
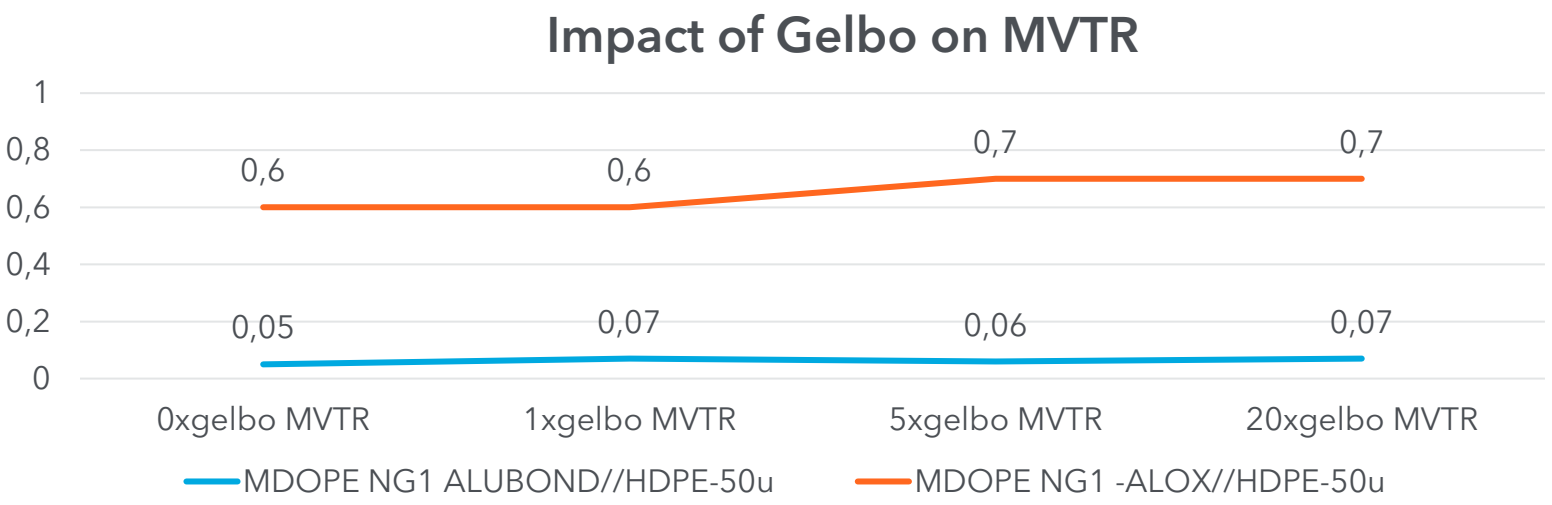
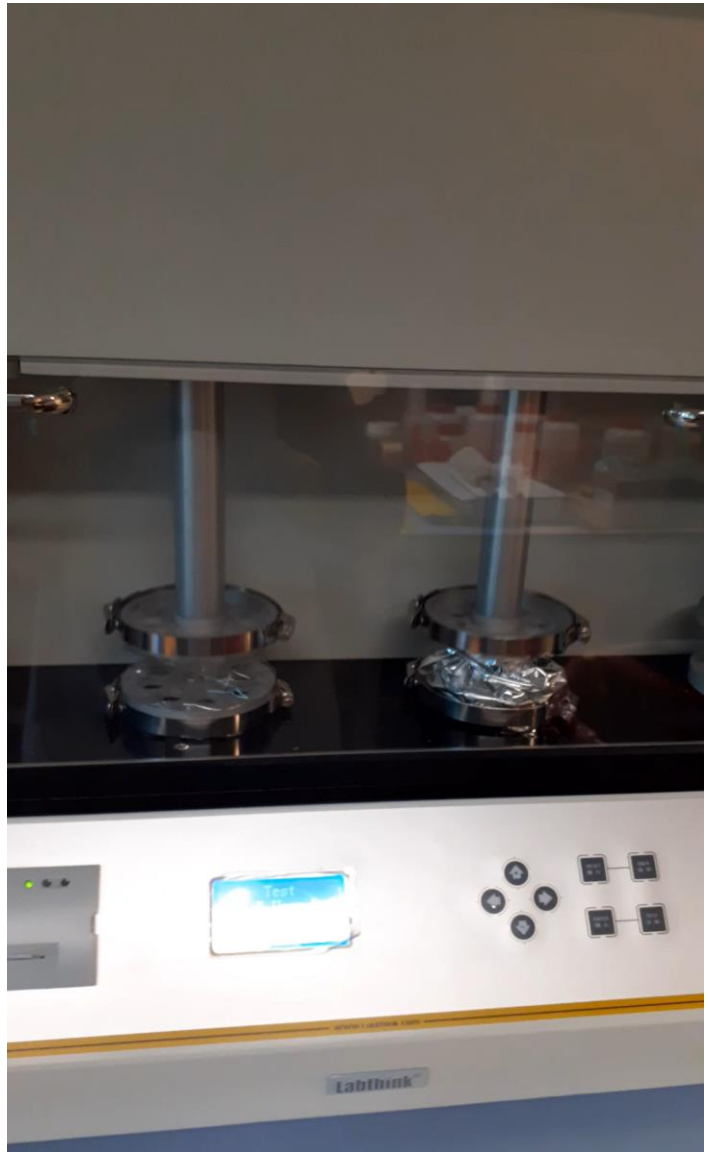
Gelbo ASTMF392 – OTR & MVTR Barrier Impact





Excellent ability to retain barrier throughout the supply chain



Watch Video

The Value of Collaboration

Partnerships and collaborations throughout the value chain are essential to developing these new collective solutions.

Academia ~ Raw material suppliers ~ Substrate producers ~ Equipment Manufacturers ~ Converters ~ Brand owners

Iterating together:

- Leverages the collective expertise of all partners
- Allows us to fail fast and learn quickly by testing more aspects of the solution simultaneously
- Pilot equipment essential to efficient trial iterations
- Provides all partners with a more holistic understanding of the requirements

Combined, these factors increase the probability of success.

Ultimately, collaboration accelerates the pace of innovation for all involved.

The Time Is Now

MICHELMAN®

Thank you!

Any questions?

thierryvanmigem@michelman.com

mchl.mn/inc