TAPPI INTERNATIONAL FLEXIBLE PACKAGING & EXTRUSION DIVISION
2024 FlexPack PLACE Conference
April 14-17, 2024 • San Diego, CA • Wyndham San Diego Bayside

Think Beyond Ink – *Coating Solutions Enabling Circularity*

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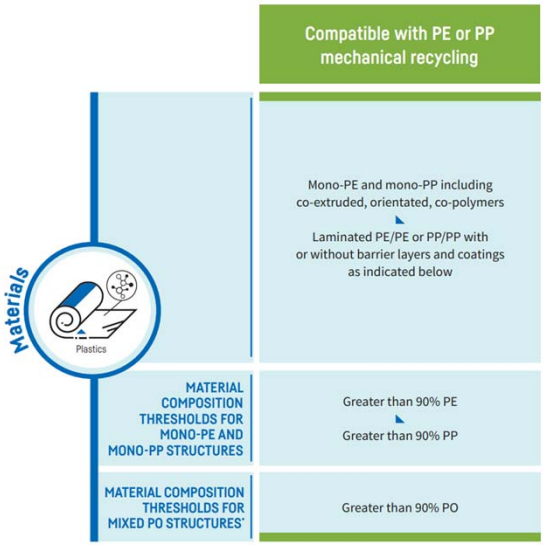
Overview

- Design for Recycling
- Protection coatings
- Barrier coatings
- Heat-stable inks
- De-inking & De-lamination coatings

Design for Recycling (D4R) is increasingly supported by certification bodies, companies & consortiums. Guideline examples:

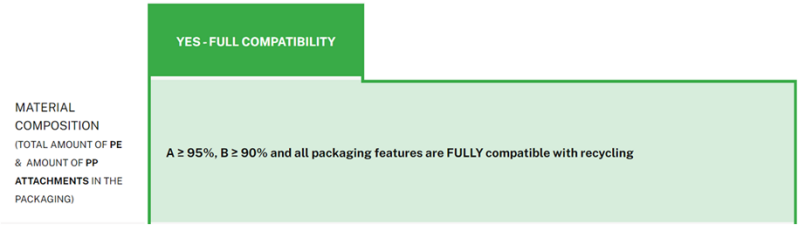
CEFLEX
A CIRCULAR ECONOMY FOR FLEXIBLE PACKAGING

Collaboration of >180 European companies



RecyClass

Trade association of >80 European companies



APR®

Trade association of >240 international companies

TESCO

Packaging Preferred Materials & Formats Guidelines 2022

Green
Preferred for UK recycling via kerbside or store

Materials	Formats & Designs
Glass	Paper/board with plastic; single side lamination <10% by weight (incl. windows)***
PET (Rigid)	
Polyethylene	
Mono flexible films	Mono PET lidding film on PET tray perm-welded
Polypropylene	
Steel & Aluminium	
Cardboard	Mono material spouted pouch
Paper	
Non Siliconised Glassine	

What alternatives to PET//PE laminates are available?

Requirement	PET/PE	BOPP/PE	BOPP/cPP	OPE/PE
Flexo-printable	++	++	++	++
Gravure-printable	++	+	+	+
Optics for reverse print	++	+	+	+
Seal quality	++	++	o	++
High barrier	++	+ (with EVOH)	+ (with EVOH)	+ (with EVOH)
Heat resistance for high packaging line speed	++	+	+	o
Recyclability	–	o (suitable only for chemical recycling)	+ (only rigid stream exists today)	++ (rigid and flexible steams already exist)

For most applications mono-PE laminates are the preferred solutions

Role of Inks & Coatings to make mono-plastic packaging a reality

Inks and lacquers for new PO substrates (e.g., MDO/BOPE)

- Ink systems for lamination and surface print
- Optimized adhesion
- High bond strength

Overprint lacquers to secure performance

- Heat resistance for high-speed filling lines
- Rub, scratch & chemical resistance
- COF
- Matte, gloss and various haptic effects
- Solutions for cold and hot seal applications

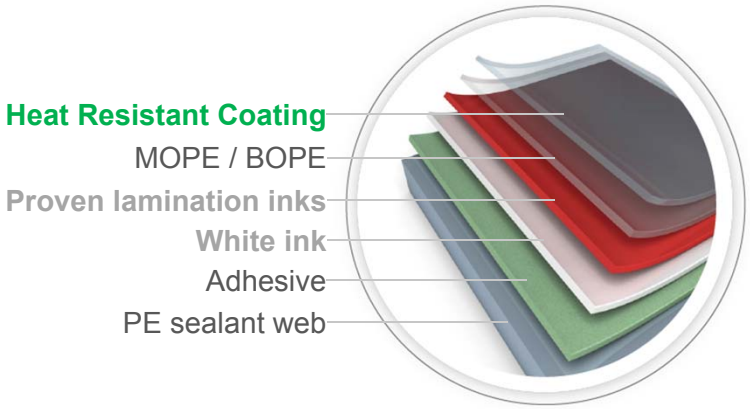
Barrier coatings for high level of protection of packaged goods

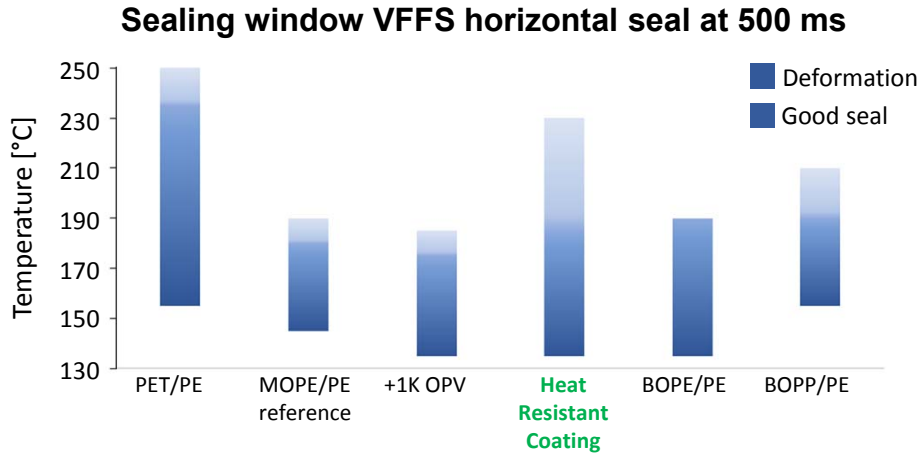
- Oxygen barrier
- UV-light barrier
- Functional coatings as enabler for barrier functions (e.g., protective OPV for AlOx/SiOx)

De-lamination / de-inking primers for higher quality recyclates from advanced mechanical recycling processes

All solutions are PVC-free to support recyclability

Heat-Resistant Protection Coatings



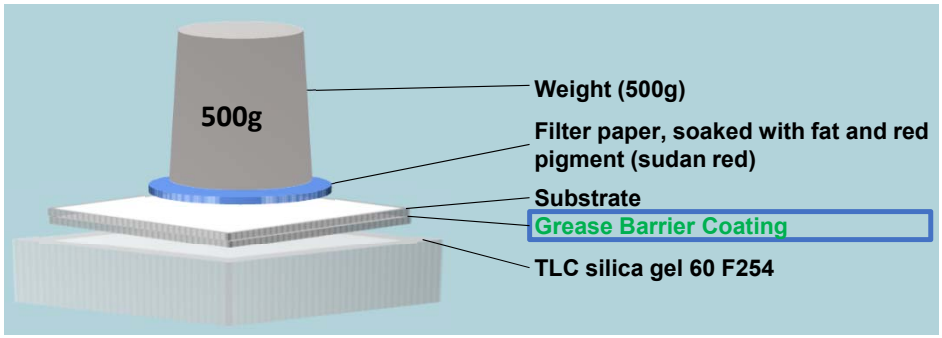


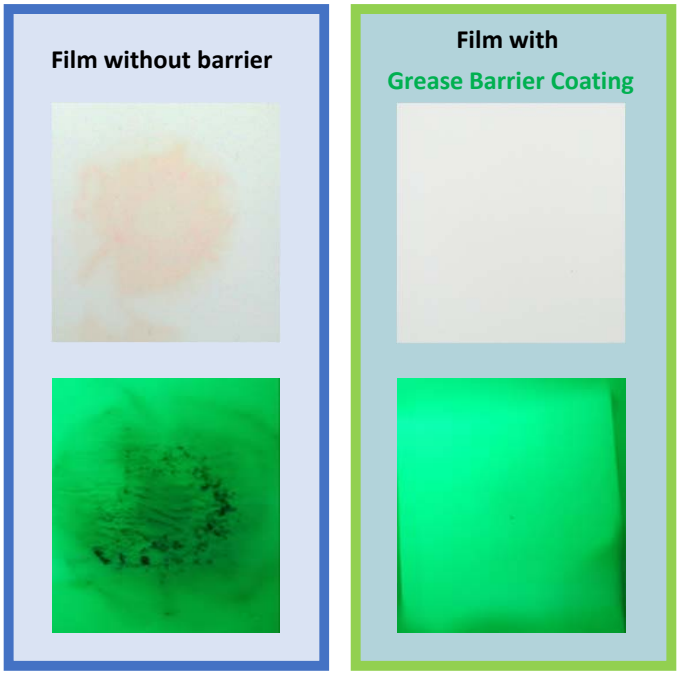
Sealing at 200°C:

- Maintaining packaging speeds on FFS lines:
  - Up to **57% gain** in **sealing window** vs MOPE ref
- Excellent rub and scratch resistance enabling **transition to surface-print** structures
- Available in matte and high-gloss finish
- Excellent adhesion to oriented PE substrate*

* Reverse-printed laminates require treatment from both sides

Grease Barrier Coatings





- Solutions for lamination and surface print available
- Available as transparent lacquer and opaque white, both 1K and 2K
- Allows for mono-material packaging; application via flexo or gravure

- ***The labeling "F 254" indicates the attachment of an UV absorber at a wavelength of 254 nm.***

Oxygen Barrier Coating

Oxygen Barrier Coating (OBC)

- Solvent-free OBC for flexible packaging
- Transparent lacquer for lamination applications; can be printed flexo or gravure
- OTR-values below 1 cc/m²/24h, outside and inside 50% humidity
- Alternative to pre-functionalized barrier films in laminate structures for **meat and cheese packaging**

Light Barrier Coatings

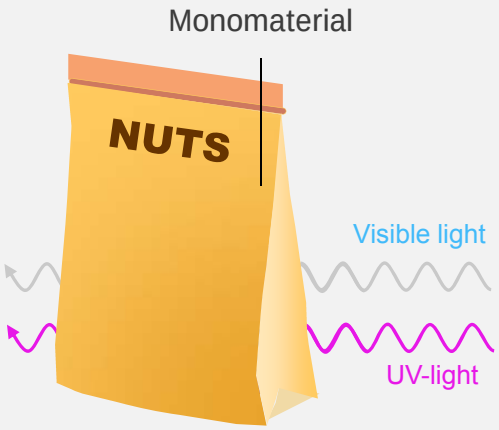
Today

Packed good is protected from light degradation.

Packaging material can not be recycled.

Packed good is not visible.

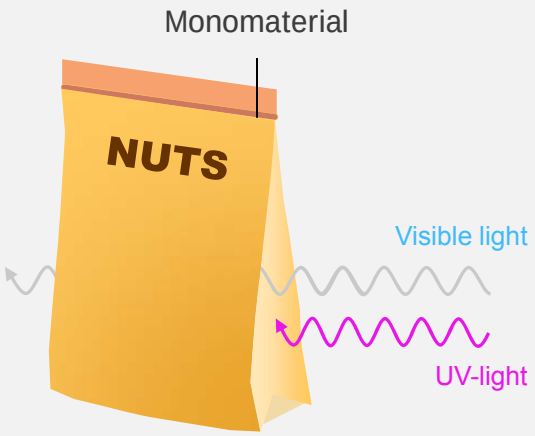
Transparent Solution without UV-barrier



Packed good is visible.

Packed good is not protected from UV-light

Solution with Light Barrier Coating

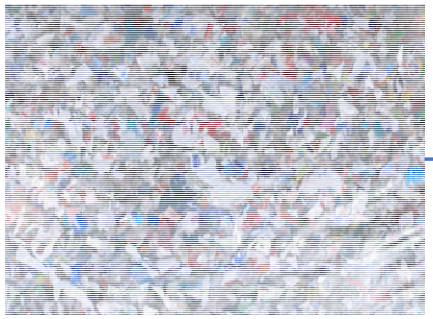


Packed good is UV-protected and visible.

- ✔ Monomaterial
- ✔ De-inkable inks and lacquers

Mechanical Recycling Challenges

Sorted input stream PCW



PCR

1) Washing
2) Extrusion > 200°C

Quality impairment of PCR*

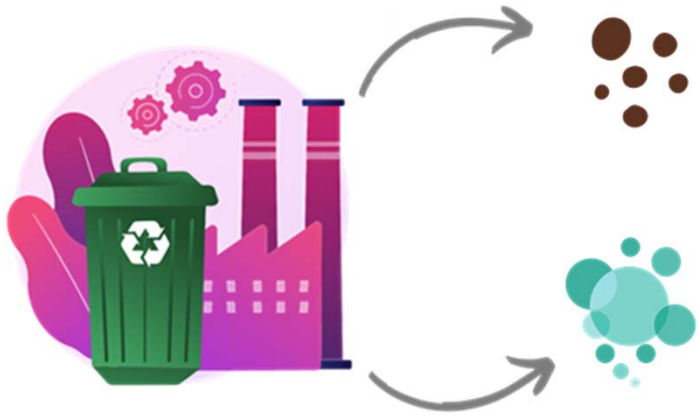
caused by contaminants like food residues, adhesives, barrier materials, inks, etc.

- Odor
- Gel particles, black spots
- Mechanical properties
- Discoloration
- Color fluctuations
- Optical uniformity
- Haze

- * Qualitative assessment, depending on the target application

Higher quality recyclates – HOW?

Option 1: Heat-stable ink solutions for high-quality **colored recyclates**



- \+ Odor / gel control
- \+ Utilizing existing film converter infrastructure
- − Limited recyclate application due to discoloration

- \+ Odor / gel control
- − Need for hot-washing capacity
- \+ Enabling high-end non-food film-to-film recycling

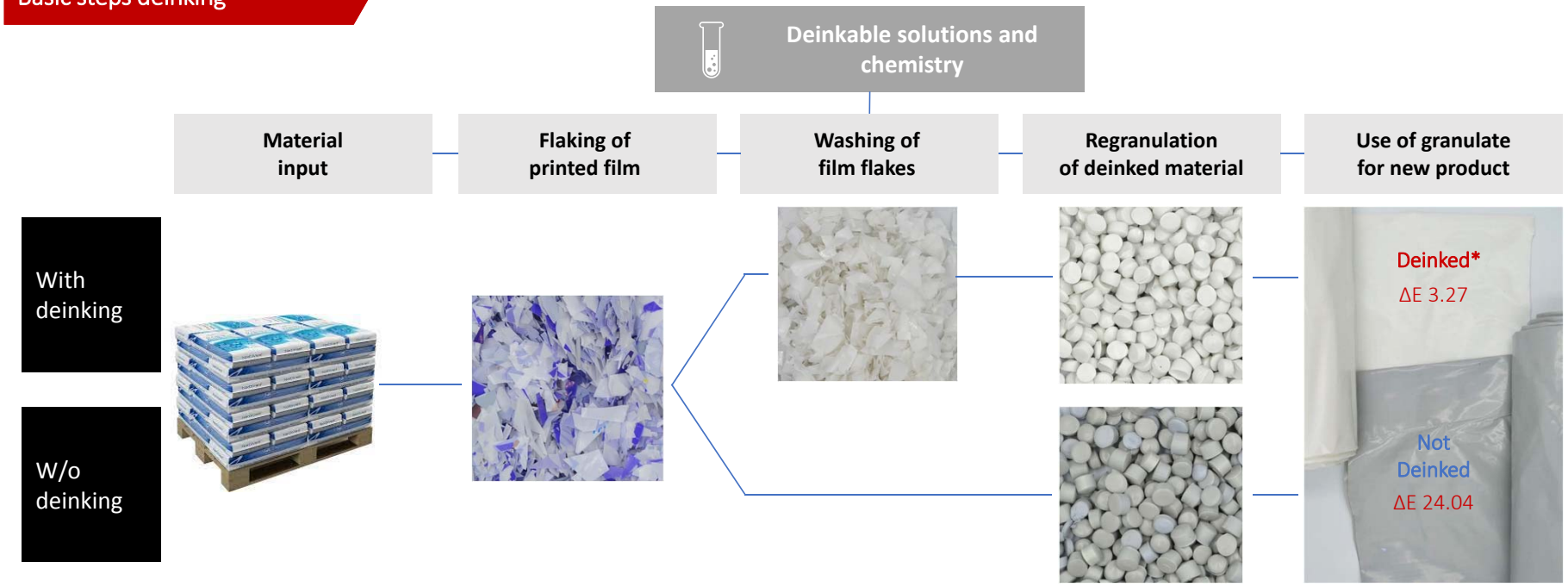
Option 2: Deinking chemistry and primer solutions for high-quality **natural recyclates**

Heat-stable Inks for mechanical recycling

- Removal of odor / gels, improvement of surface roughness and colour retention vs NC-based system observed.
- The broad portfolio of heat-stable binders allows recyclability improvement in all types of applications for both surface-printed and reverse-printed laminated structures.

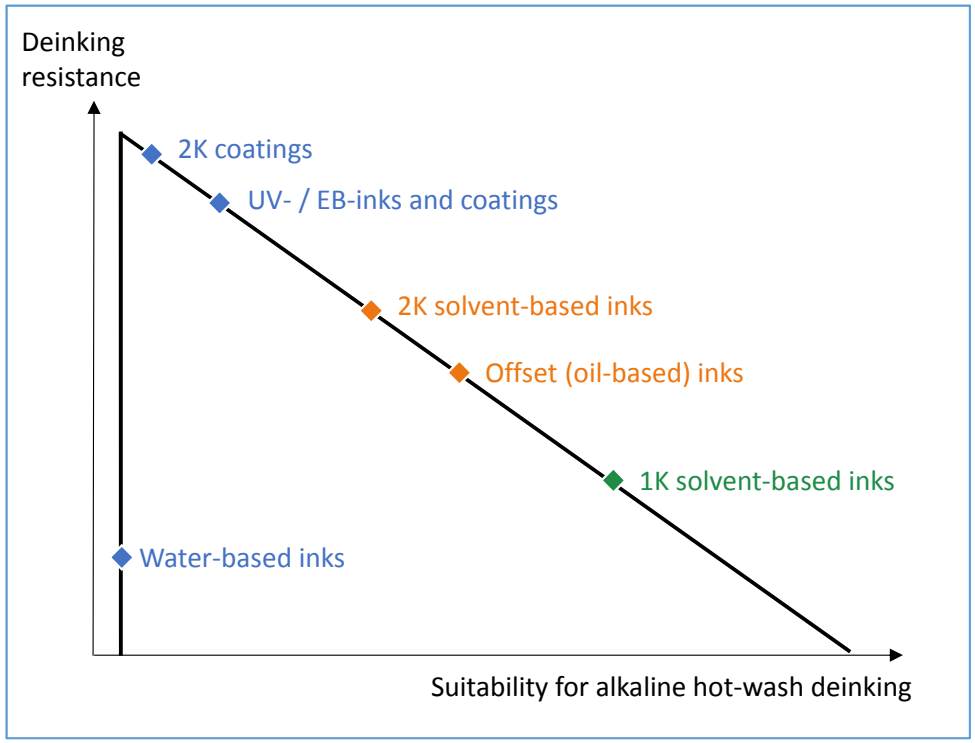
De-inking & De-lamination Coatings

Basic steps deinking



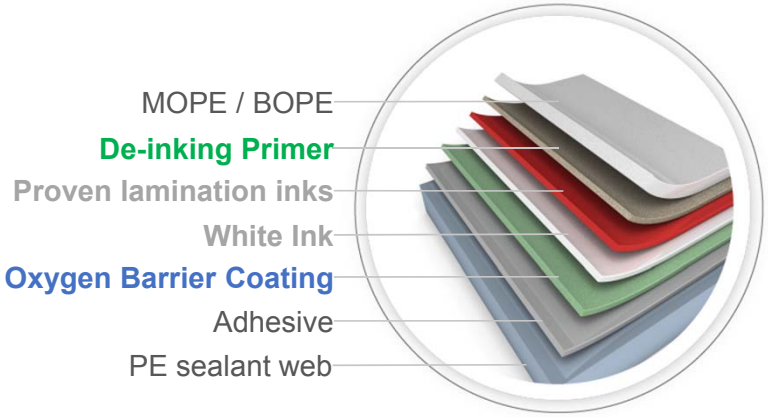
*No additives / masterbatch, 100% recyclate content in films

Science behind De-inking



- Deinking of any structure possible, but can require too harsh conditions for cost-efficient industrial application (time, temperature, chemicals)
- Despite easy deinking, hydrophilic water-based inks are too difficult to remove from washing water, resulting in contamination
- **1K SB inks** proven to be **optimal for deinking**

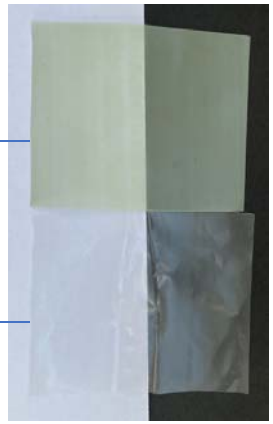
Deinkable structure



Delamination/deinking of MDO-PE/PE structure

W/o deinking

With deinking



- Addressing the problem **deinking of laminates** without affecting application properties
- **WB- and SB-primers** available for testing
- Delamination and deinking at industrial hot-washing conditions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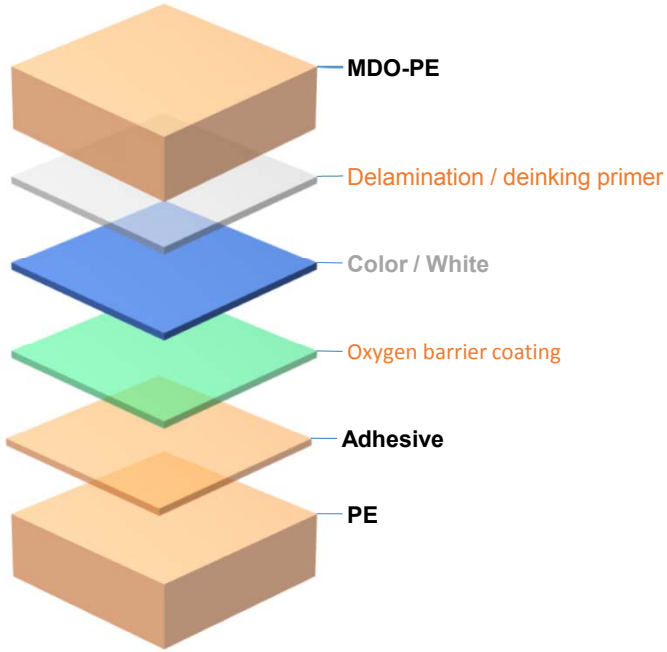
Deinkable and recyclable* PE barrier packaging solution
Tomorrow's performance today for barrier packaging


MDO-PE
Delamination / deinking primer
Color / White
Oxygen barrier coating
Adhesive
PE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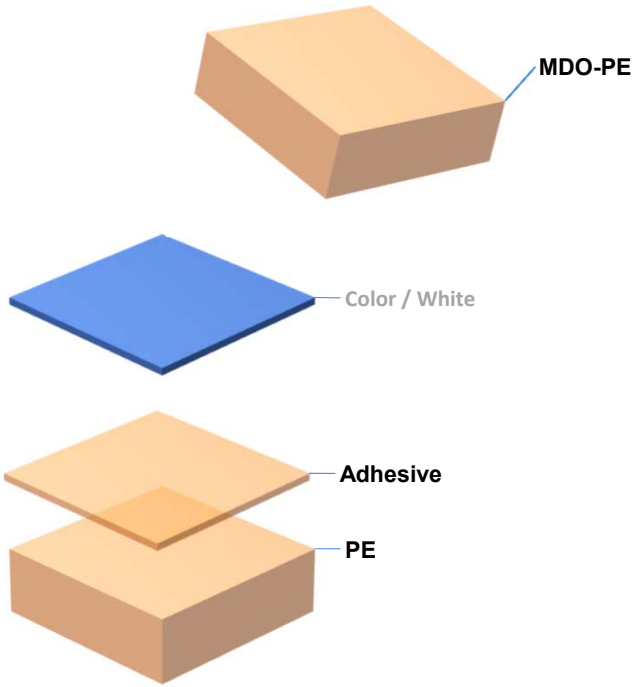
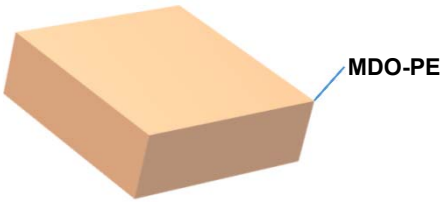
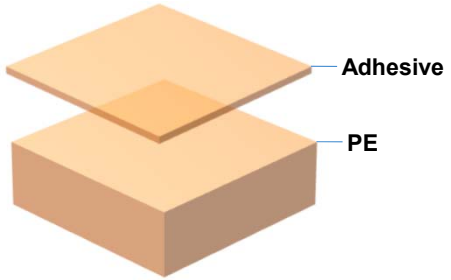

MDO-PE
Color / White
Adhesive
PE


MDO-PE


Adhesive
PE

Solutions for printed mono plastics
ink systems for surface and reverse print

Protection Coatings
protecting the film and print structure during sealing, filling and application

Oxygen Barrier Coatings
oxygen barrier properties comparable to extruded EVOH

Light Barrier Coatings
transparent lacquers will full UV-A and UV-B protection

De-inking & De-lamination Coatings
ensuring smooth deinking of reverse-printed laminated structures

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