



# Design freedom through film insert molding with direct coating

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# Covestro Product Portfolio

Our main product groups



## Polycarbonates

Granules for a wide variety of applications



## Coatings, Adhesives & Specialties

Raw materials for coatings, adhesives and specialties



## Polyurethanes

Raw materials for rigid and flexible foams



# Covestro Polycarbonate Products

A versatile portfolio



The Covestro Makrolon logo, featuring the word "covestro" in a small circle and "Makrolon" in large, bold, pink letters.	<b>PC</b> Polycarbonate	high transparency, high toughness, high heat resistance, high flame retardance, good electrical properties
The Covestro Apec logo, featuring the word "covestro" in a small circle and "Apec" in large, bold, orange letters.	<b>PC</b> High Heat Polycarbonate	high transparency, high toughness, tailor-made Vicat up to 205°C, good electrical properties
The Covestro Bayblend logo, featuring the word "covestro" in a small circle and "Bayblend" in large, bold, blue letters.	<b>PC/ABS- or PC/ASA Blends</b> Polycarbonate/Acrylonitrile- Butadiene-Styrene copolymer	high toughness even at low temperatures, high heat resistance, good paint ability, good flowability/good processing behavior
The Covestro Makroblend logo, featuring the word "covestro" in a small circle and "Makroblend" in large, bold, green letters.	<b>PC/PBT- or PC/PET- Blends</b> PBT – Polybutylene terephthalate PET – Polyethylene terephthalate	good resistance to chemicals, high toughness even at low temperatures, high heat resistance, good paint ability



# Product Portfolio Specialty Film



## **Makrofol® DE**

On Makrolon® based film with high transparency and optical quality.  
Very good formability

## **Makrofol® UV**

Co-extrusion film based on Makrolon® with a functional layer for UV protection.  
Good formability

## **Makrofol® SR**

Co-extrusion film based on Makrolon® with a functional layer of PMMA. Improved scratch and chemical resistance.  
Good formability

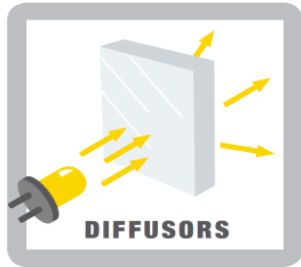
## **Makrofol® HF/HS**

Extruded PC film, provided with UV-curable coating.  
Very good scratch and chemical resistance combined with excellent formability (only HF).

## **Makrofol® LM**

Makrolon® based film with integrated light management functions such as diffusion, reflection or Black-Panel-Effects.

# Overview Light Management (LM) Films



**Makrofol® LM309**  
bulk scattering by additives  
300µm / 500µm

**Makrofol® LM228**  
bulk scattering by additives  
300µm / 500µm

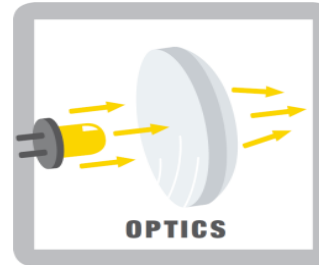
**Makrofol® LM905**  
bulk scattering by additives  
300µm / 500µm

**Makrofol® LM322**  
bulk scattering by additives  
300µm

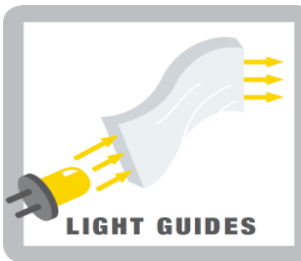
**Makrofol® LM243**  
bulk scattering by additives  
150µm / 300µm / 375µm / 500µm



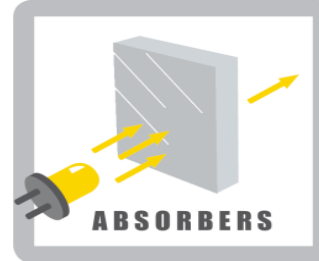
**Makrofol® LM903**  
reflection by additives  
400µm / 500 µm



**Makrofol® LM297**  
light shaping by surface structure  
130µm / 280µm / 450µm

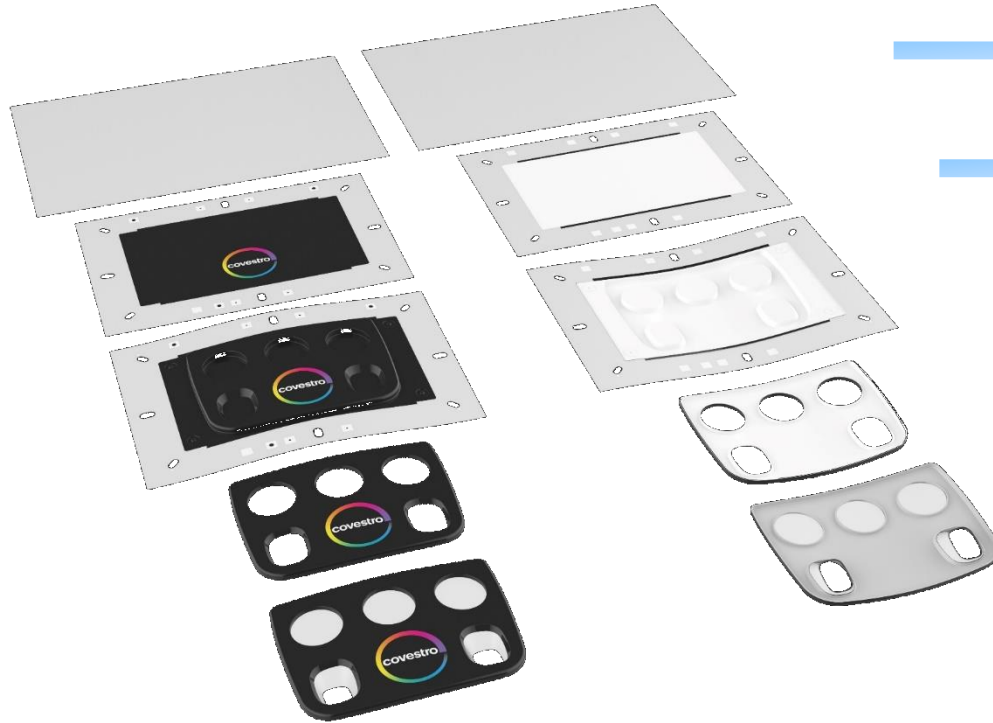


**Makrofol® LM907**  
clear film for LGF applications  
500µm / 700µm



**Makrofol® LM296**  
25% or 50% transmission  
500µm / 750 µm

# Film Insert Molding (FIM) Process Technology



Unprinted sheet

Printing

Forming  
(UV-Curing for HF-Products)

Cutting

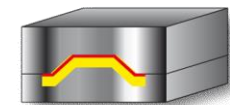
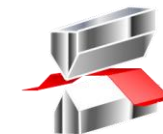
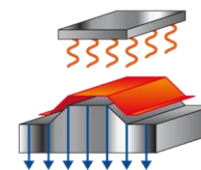
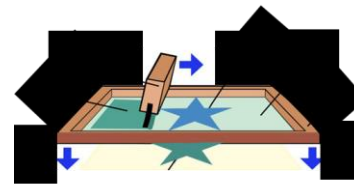
Molding

Printing

Forming

Trim

Molding



# Technology Support

Covestro Technical Center Films Dormagen



## Film selection

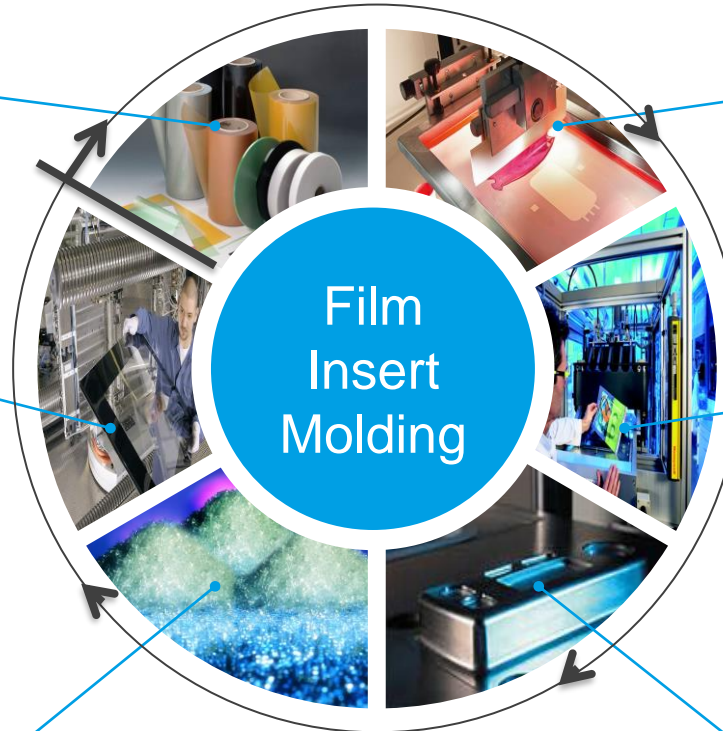
formability, surface, scratch and chemical resistance

## Injection molding

insert cleaning  
film fixing  
handling  
gating principle, 1K, 2K,  
injection/compression, MuCell,  
DC/DS, ...

## Resin selection

mechanical , thermal, optical  
requirements  
process requirements



## Printing technology

Ink system  
printing process

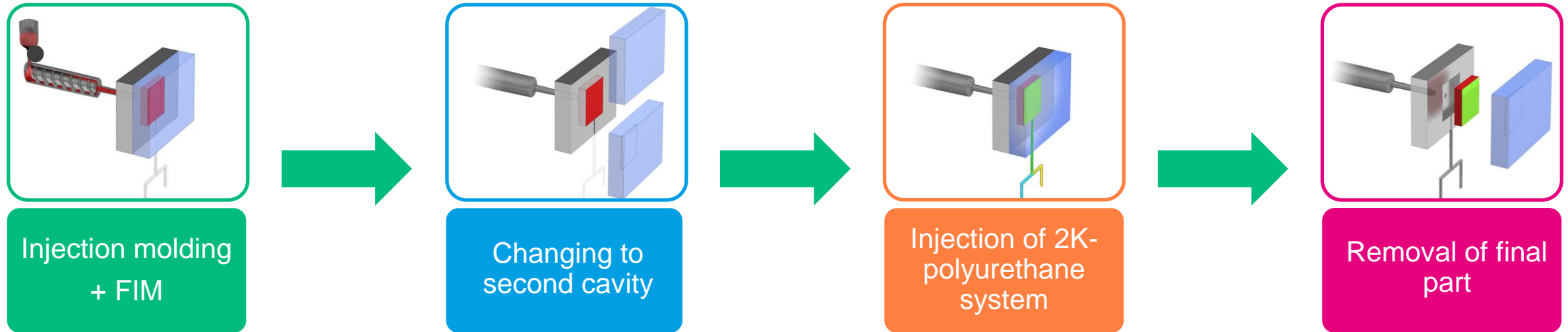
## Forming technology

High pressure forming  
thermoforming  
match metal forming

## Trimming technology

punching tools  
laser cutting, knife cutter  
band steel trimming

# Direct Coating – How the process works?



**Direct Coating (DC)** is a Covestro & partners technology development that combines **Thermoplastics Injection Molding** with the in-mold formation of an almost solvent-free 2K PU coating by **Reaction Injection Molding**.

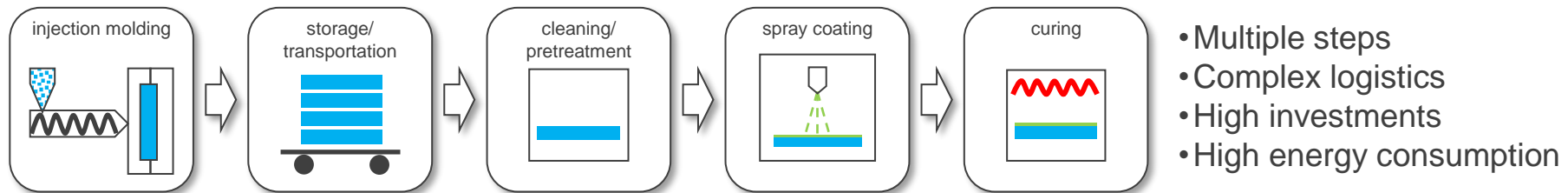


# Direct Coating – How the process works?

Comparing Direct Coating with conventional spray coating

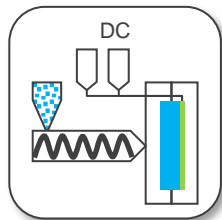


## Conventional spray-coated part



**VS.**

## Direct Coating



- Process integration
- Short process chain
- Less investments (no clean room, etc.)
- Less energy consumption
- Lower space requirements
- Fast color change

# Advantages of Direct Coating technology



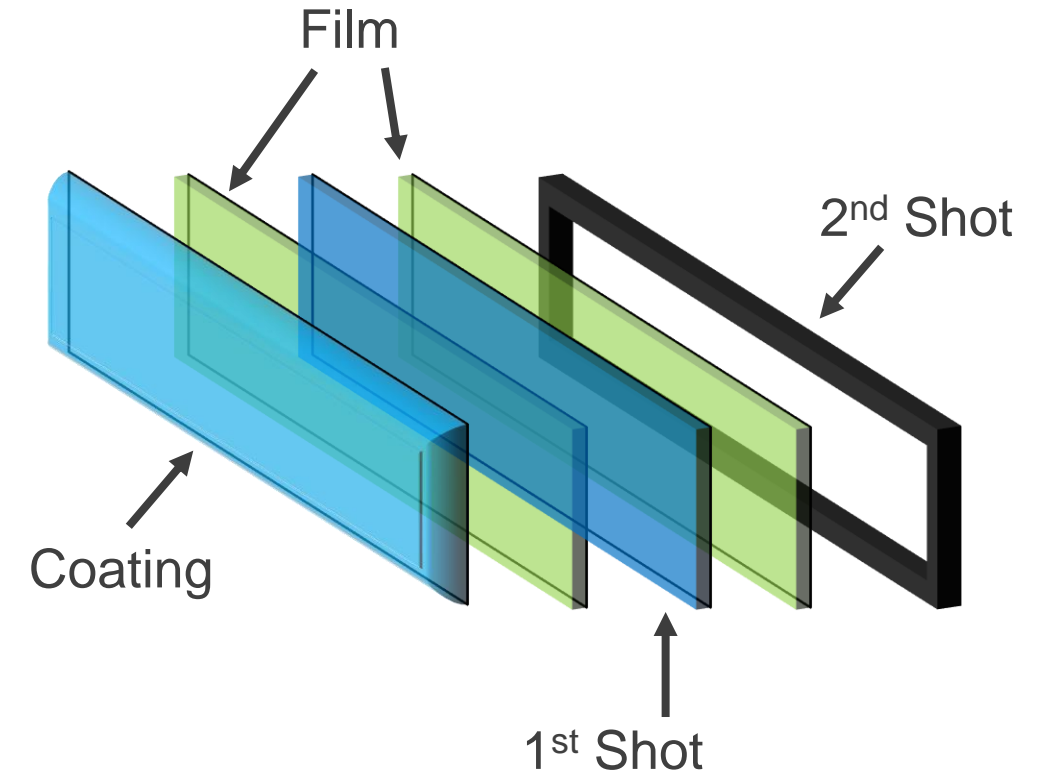
Direct Coating is a design driven technology

## Advantages:

- ✓ Sharpe 3D structures realized by PUR coating
- ✓ Guiding elements realized by PUR coating
- ✓ Replication of mold texture → Matt and high gloss on the same part surface
- ✓ Reflow effect
- ✓ No orange peel, no fat edges and no coating mass accumulation on edges

## Efficient processing for complex applications:

### Possible setup



# Covestro Direct Coating support

by Global Application Development team



## Combination of a thermoplastic's product portfolio and polyurethane coating raw materials

Material selection related to application / requirements

Makrolon®, Bayblend®, Markoblend®, Apec®, Desomdur®, Desmophen®, Makrofol®

## Related design & application development services

Part and mold design for injection molding and RIM process

Rheological calculation thermoplastic

Rheological calculation coating

Warpage calculation thermoplastic and coating

## Network of proven partnerships across entire value chain

Equipment-; mold manufacturers, coating supplier

## Testing facility

Adhesion tests, scratch resistance, etc.

# Direct Coating outlook for new application

Incredible number of new possibilities



## Possible areas/ parts:

Display, smart interior applications,  
dashboard,

exterior body panels, front grille,  
A-, B- and C-pillar, spoiler,

.....



## Surface properties:

High-gloss hard coating with self  
healing effect,

soft-feel, haptic elements,

.....



# Thank you for your attention

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