

Translucent PP-Compound for backlighting applications – Challenges and opportunities

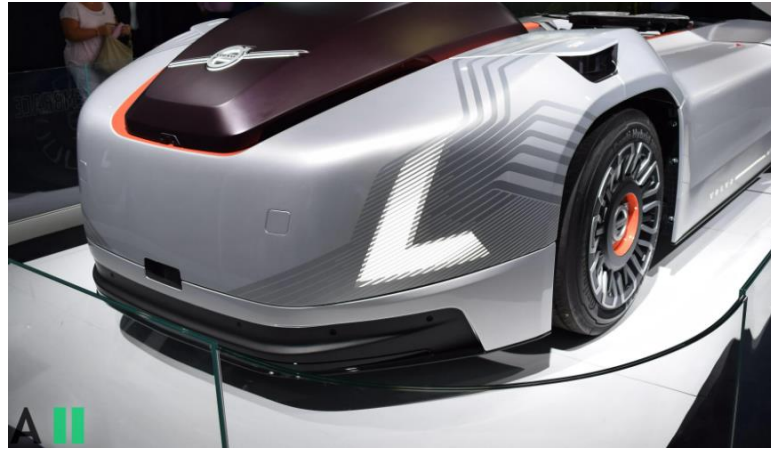
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Material Meets Engineering (MME) Conference
Frankfurt, 30th June, 2022

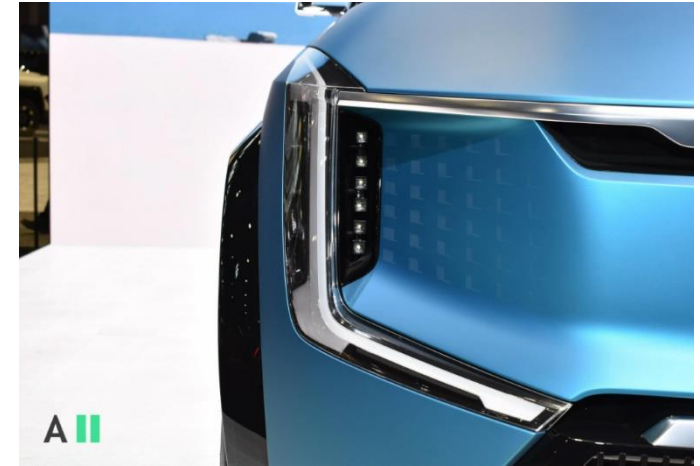
Growing trend: Lighting signature for exterior & interior



VW ID. LIFE Concept 2021 (IAA Mobility 2021)
Source: APG internal



Volvo Truck Concept (2018)
Source: A2MAC1.com



KIA EV9 Concept (2021)
Source: A2MAC1.com



Hyundai concept 8 (IAA Munich)
Source: APG internal



Iveco S-Way (Solutrans 2021)
Source: APG internal



RENAULT SCENIC Vision Concept (2022)
Courtesy of Renault group

Automotive : Current material solution

- **Polypropylene PP & PP-Compound based on copolymer**

- The main Material used for exterior & interior automotive
 - Bumper, Body Panel, Interior trims, Door panel...

- **Typical Features**

- Cost competitiveness
- Low Density Material
- High quality finished part surfaces
- Ductility at low temperature to respect Impact requirements
- Paint-ability according to customer specifications
- Long Term Ageing aspect behavior (UV...)
- Perceived Quality of vehicles functions (Scratch, Creep, Dimensional stability...)
- Car users Health & Care (Fogging, VOC Emissions & Odour)

- **Drawback**

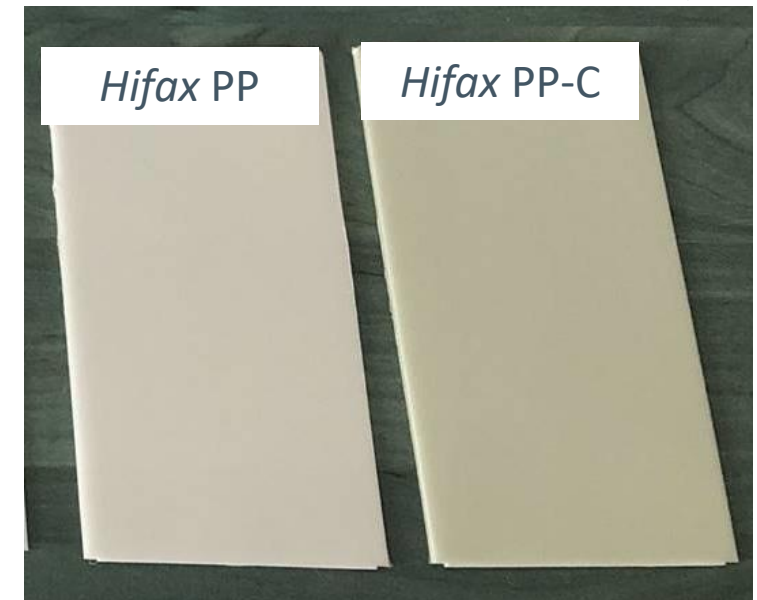
- Low or no transparency property



Courtesy of Renault group



Courtesy of Renault group

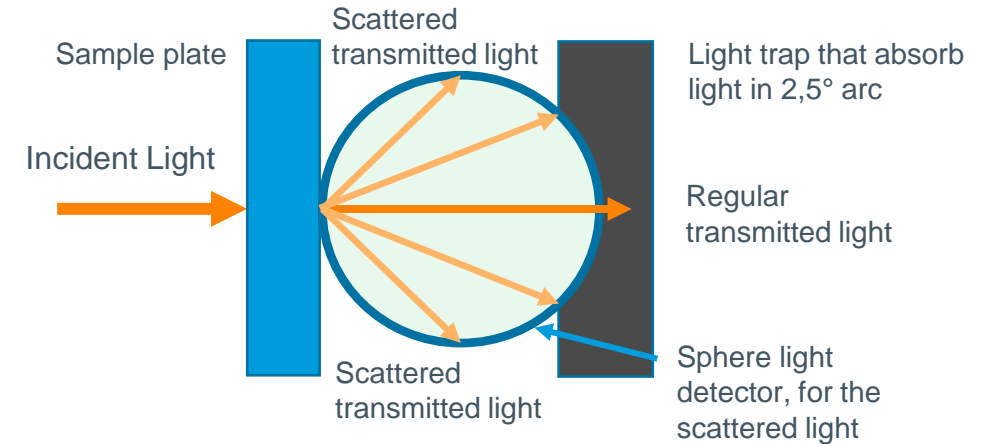


Source: lyondellbasell internal

Optical properties : Luminous Transmittance & Haze

On top of standard mechanical properties, 2 optical properties are scoped:

- **Luminous Transmittance** -> “Light Transmission” property of the material
 - ASTM D 1003 definition : Luminous Transmittance measures the amount of light that passes through a sample (total light transmission). This measurement define the material capacity to be transparent to light. A material with 100% Luminous Transmittance is totally transparent
- **Haze** -> “light translucency” property of the material
 - ASTM D 1003 definition : Haze measure the amount of light that passes through a sample that is scattered more than 2,5°. This measurement define the material capacity to diffuse the light (and then mask the light source). A material with 100% haze is totally “milky” or “cloudy”.



Source: lyondellbasell internal

$$\% \text{Haze} = \frac{\text{Intensity of Scattered transmitted light (more than 2,5°)}}{\text{Intensity of Scattered transmitted light} + \text{Intensity of Regular transmitted light}} \times 100$$

Source: lyondellbasell internal

Existing Transparent PP : RAndom COpolymers (RACO)

■ Polypropylene PP RAndom COpolymers (RACO)

- Thermoplastic resins produced through the polymerization of propylene, with ethylene or butene bonds introduced in the polymer chain.

■ Typical customer applications :

- High clarity / transparency packaging for household & food

■ Typical Features

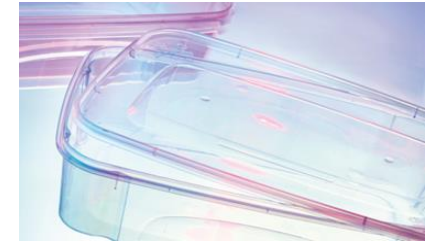
- Very good transparency & aesthetic characteristics

■ Drawback

- Low Rigidity & limited notched Impact resistance
- Not suitable for automotive

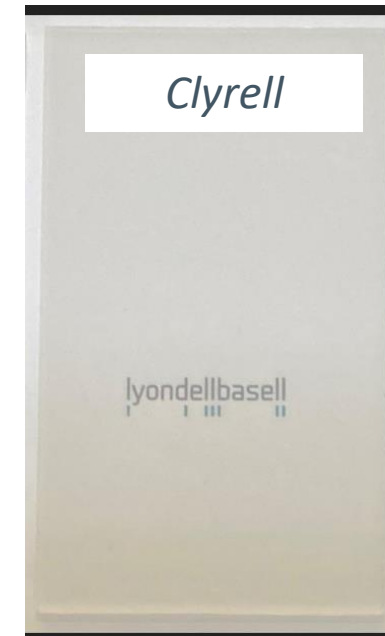


Source: lyondellbasell internal



Source: lyondellbasell internal

PROPERTIES	Method	Moplen	Clyrell
MFR (g/10 min)	ISO 1133-1	11	22
Tensile modulus at 23°C (MPa)	ISO 527-1, -2	1150	1150
Charpy notched impact at 23°C (KJ/m ²)	ISO 179	6	22
Charpy notched impact at 0°C (KJ/m ²)	ISO 179	2	5.5
Light Transmission on 3mm plate (%)	ASTM D 1003	75	80



Source: lyondellbasell internal

New solution: Translucent PP-Compound

■ Translucent PP-Compound

- Advanced compounding technology allow to combine good optical properties & better mechanical properties

■ Typical Features

- Medium Luminous Transmittance but High Haze -> Designed for Translucency
- Reduced yellowing effect
- High Rigidity or High Impact can be achievable

Characteristic	Method	<i>Softell</i> TRG 2509Y NAT AG0932G09	<i>Softell</i> TRG 2659X NAT AG0932G10
MFR (g/10 min)	ISO 1133-1	14	14
Flexural modulus at 23°C (MPa)	ISO 178-A	1800	1400
Charpy notched impact at 23°C (KJ/m ²)	ISO 179	20	30
Charpy notched impact at -20°C (KJ/m ²)	ISO 179	4	6
Light Transmission on 3mm plate (%)	ASTM D 1003	68	59
Remark		High Rigidity	High Impact



Source: lyondellbasell internal

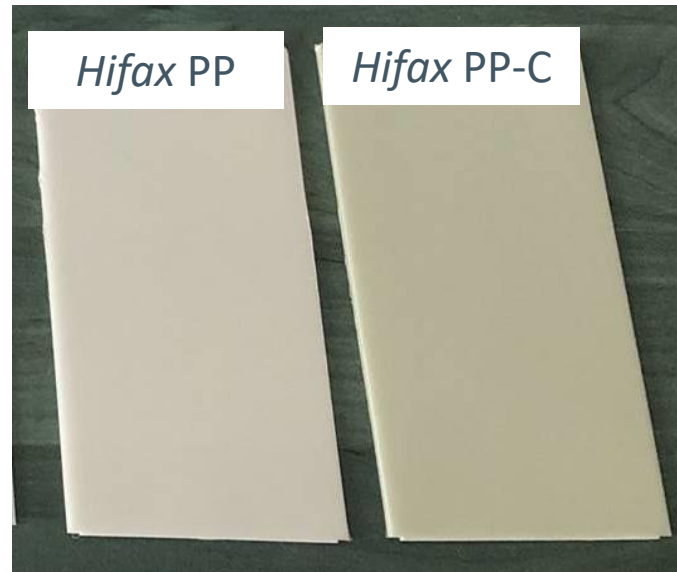


Source: lyondellbasell internal

New solution: Translucent PP-Compound

Summary

Properties	PP & PPC Copolymer	PP RACO	Softell TRG 2509Y NAT	Softell TRG 2659X NAT
Rigidity	+++	+	+++	++
Impact	+++++	++	++	+++
Light transparency	0	+++	++	++

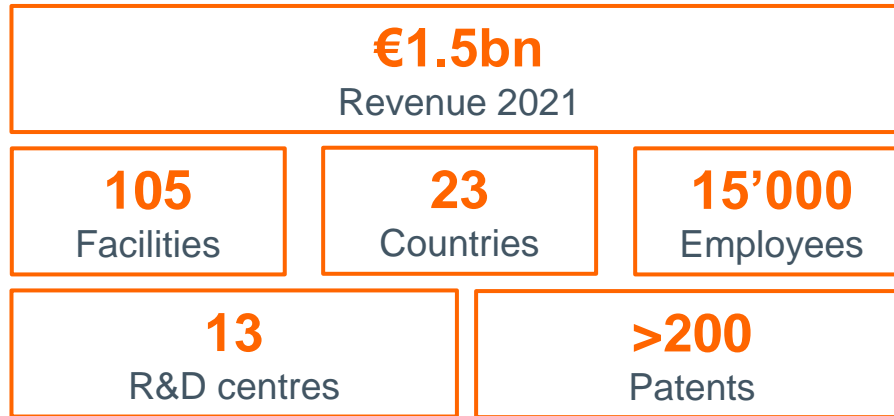


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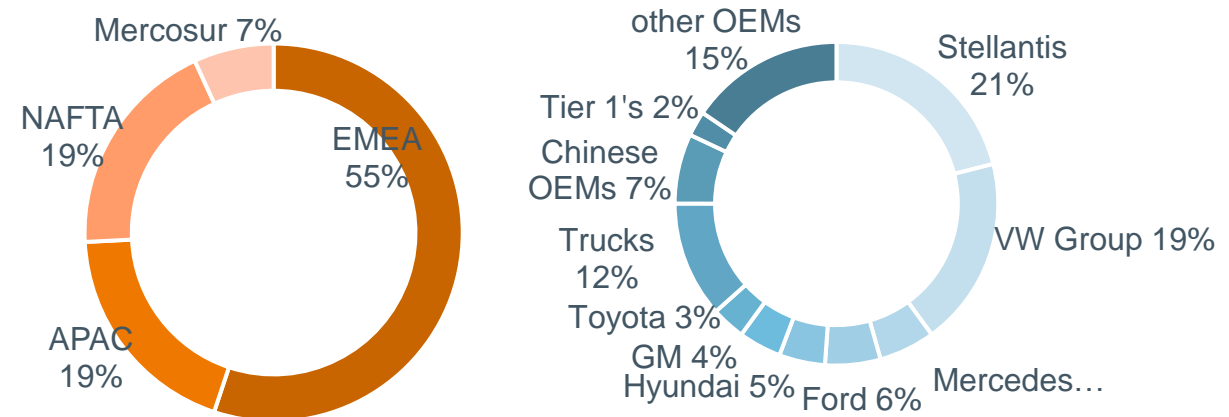
Adler Pelzer at a glance

Adler Pelzer Group

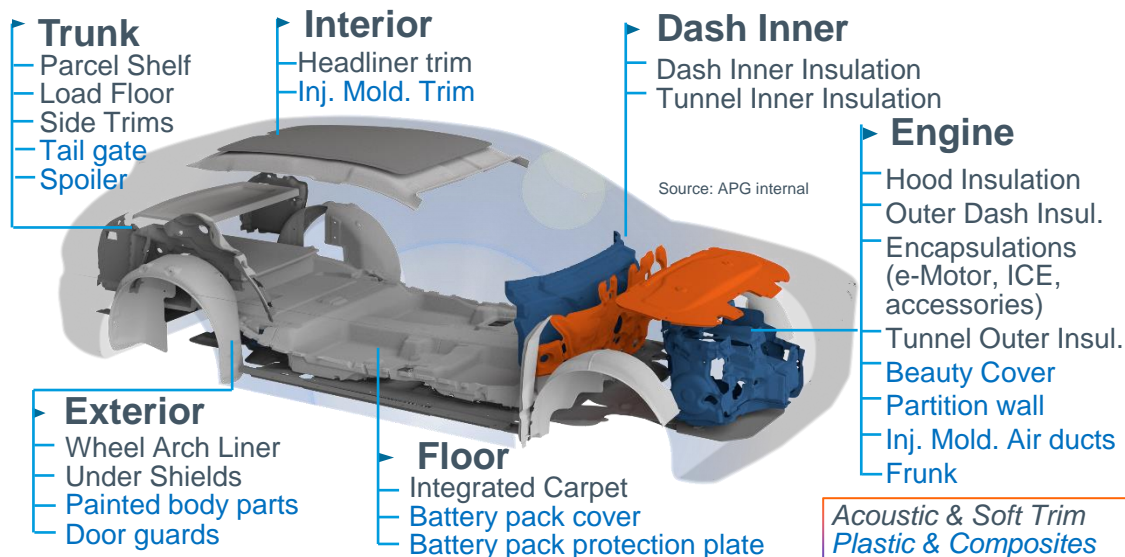
Key stats 2020 & 2021



2021 revenues breakdown



Key products offering



Customer Advantages

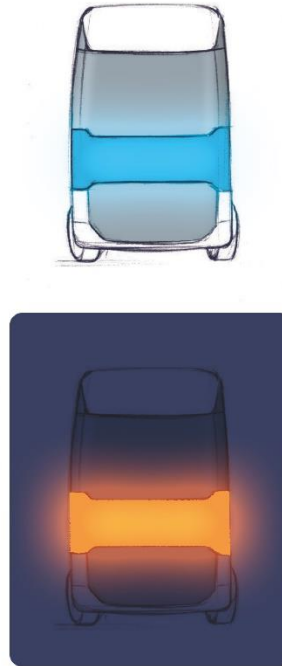
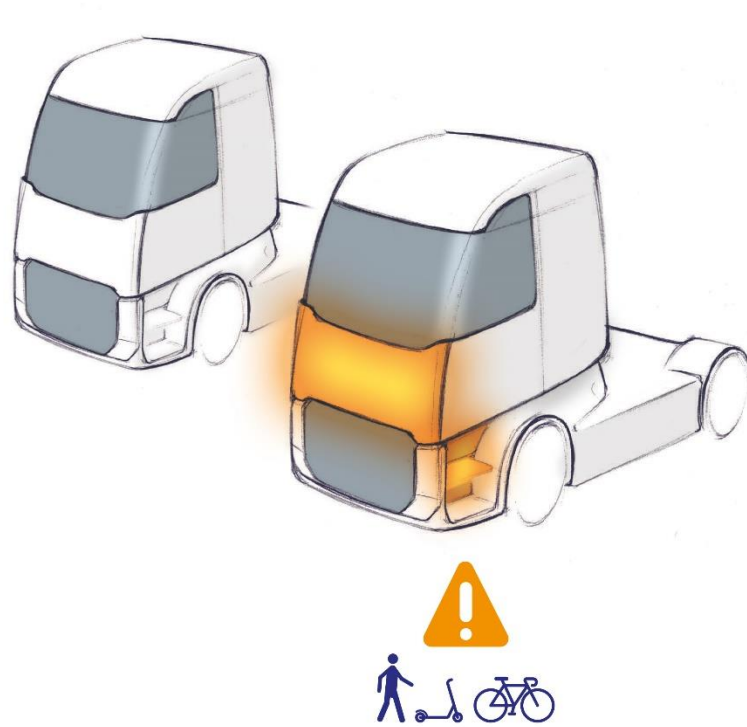
- Fully integrated supplier of **Acoustic, Thermal & Plastic** components & systems

Adler Pelzer Group

Acoustic & thermal

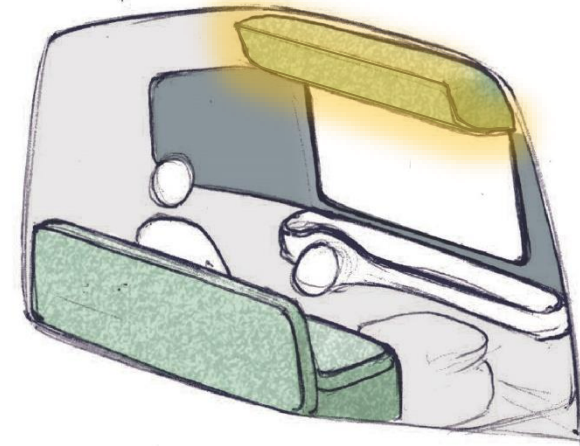


Plastics



Source: APG internal

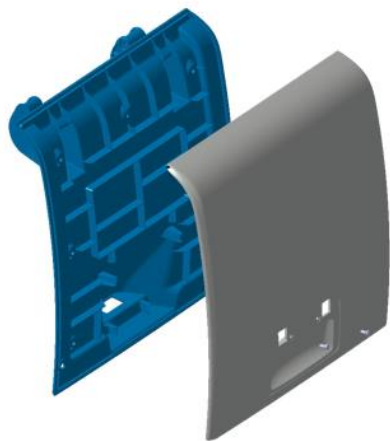
Safety
Cool looking / Light signature
EV differentiation / Battery level indication
AV communication



Source: APG internal

Comfort & attractiveness
Interior ambient lighting
Warm and snug light mood

Middle door upper
Interior storage compartment



Source: APG internal



Source: APG internal



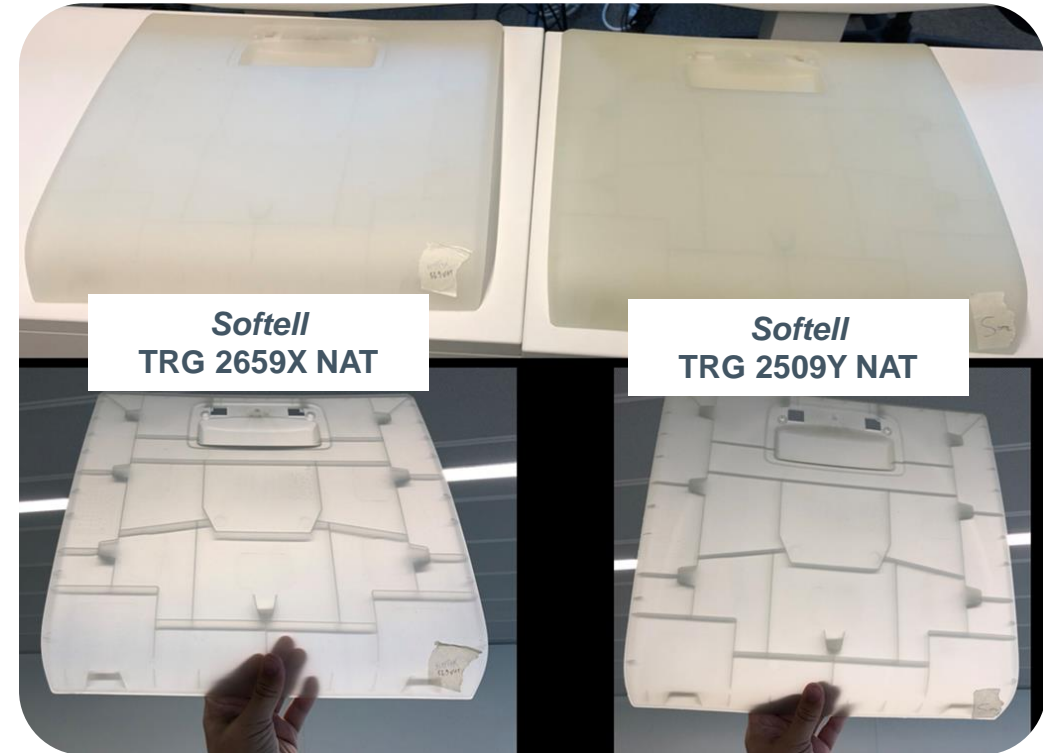
Source: APG internal

Drying 70°C/2h

Intensive purging of injection sleeve with natural PP to avoid black points

Max 230°C to avoid yellowing

Black spot due to gunshots at the end of material filling

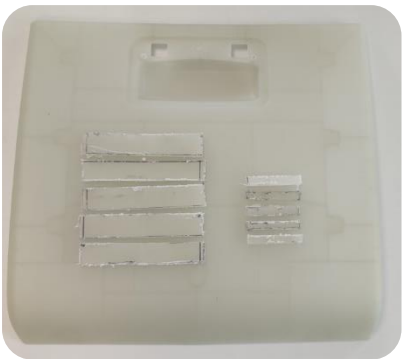


Source: lyondellbasell internal

No issue except demolding (shrinkage)

Yellowing
More difficult to inject
Easier to eject (more rigid)

Characteristics	Method	Standard PPC	Softell TRG 2509Y NAT	Softell TRG 2659X NAT
Density		1,06	0,98	0,97
Flexural Modulus (Mpa)	ISO 178	100%	≈ -10% (> more rigid)	≈ -30%
Charpy impact strenght unnotched 23°C (kJ/m2)	ISO 179-1	100%	≈ -10%	≈ -10%

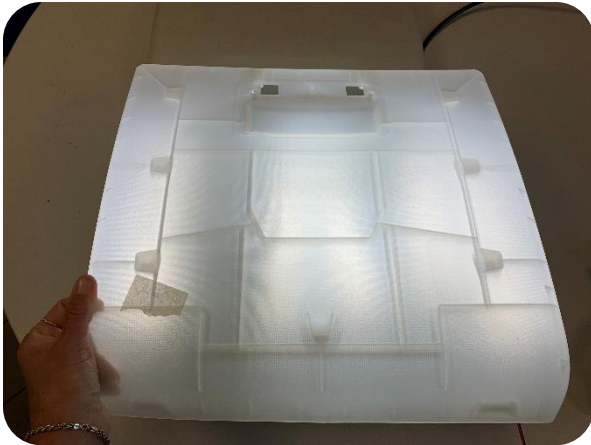


Source: APG internal



On part, Softell has almost good properties vs std PPC

*Trials realized on injected PP doors, repetability on material specimens to be improved (dimensions of specimens, localization on part with ribs, etc.)



Source: APG internal

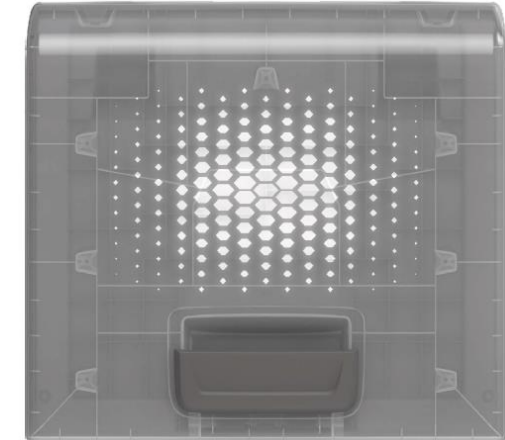
Good light transmission & diffusion



Source: APG internal

To avoid light spots

- > manage distance between LED & decorative part
- > ghost effect will reduce the effect

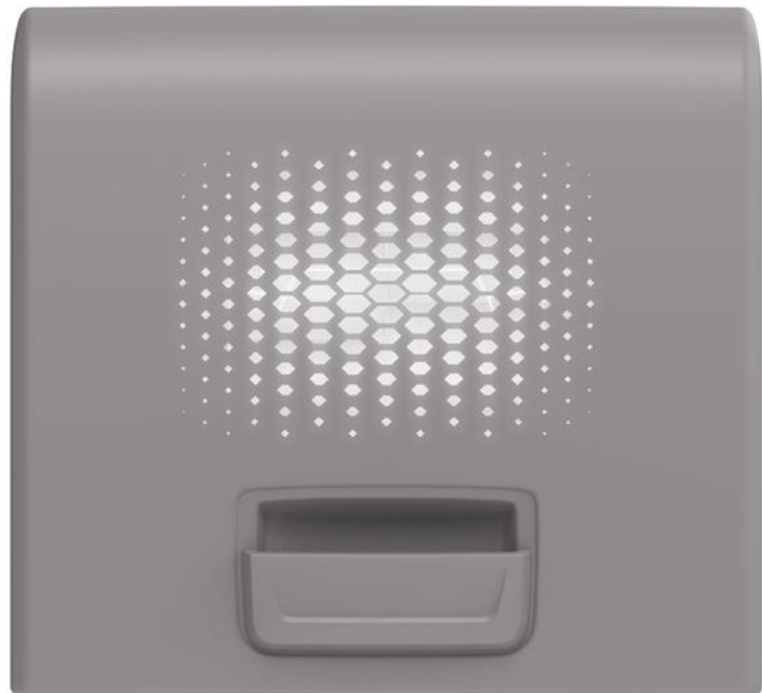


Source: APG internal

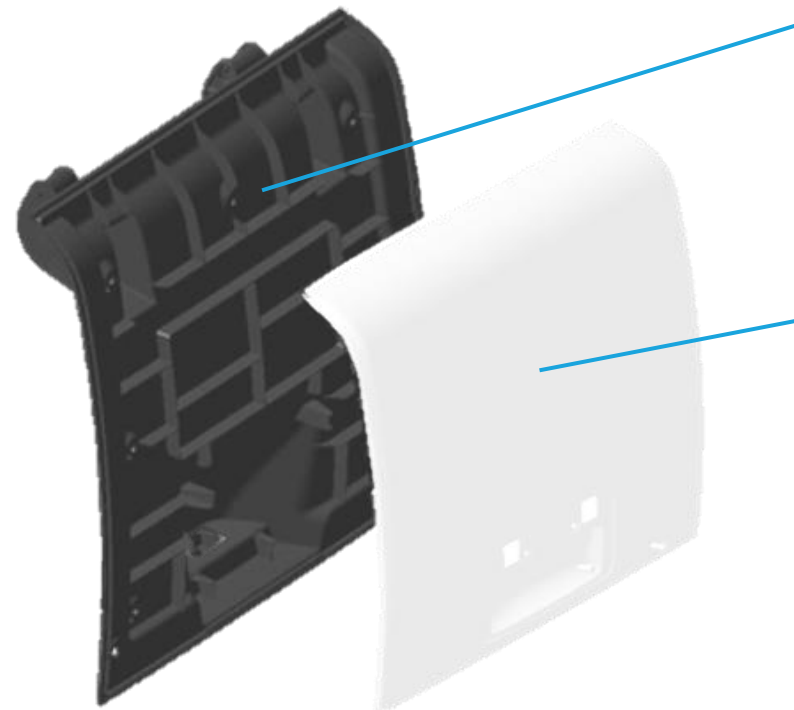
Ribs can be combined to final design
Not so visible behind ghost effect paint



The optical properties can be tuned with LyondellBasell according to the need



Source: APG internal



Opaque frame
With LED integration

Translucent skin
PP Lyon dell Basell

Ghost effect finition
Lighting design
through paint or film

Source: APG internal

By paint or by film



Source: APG internal

Specific development to achieve ghost effect by paint

Possible PP film alternative (in mold or post-process)



Red : NOK

Green : low intensity

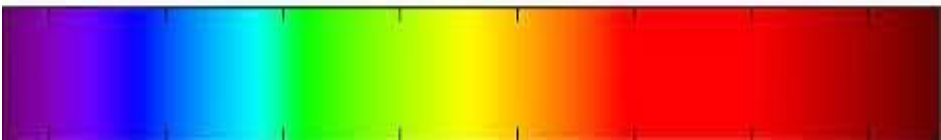


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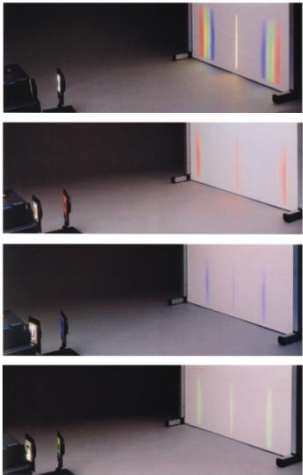
Part finition appear as a blue coloured filter : only blue is well transmitted, other colours are absorbed.



Chromatic cercle



Wavelenght (nm)





Source: APG internal



Source: APG internal

Free lighting design possibilities

Lighting system completely integrated & hidden

STS Group (APG group) & LyondellBasell collaboration

New PP combining both mechanical & optical properties

Can be tuned for optical properties (light transmission, diffusion)

Challenges & next steps

- Sustainability (bio-sourced and/or recycled plastic & recyclability)
- Ageing resistance for long term application

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