



Solutions for a Better Tomorrow

Circulen, Schuladur Polyester ranges

Bruno Viala / New Business Development

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Agenda

■ Company news

- Latest numbers
- Sustainability news

■ Polyesters in APS

- *Schuladur Ax* range
- Example applications – open discussion
- *CirculenRecover EP Ax* latest developments





Solutions for a Better Tomorrow

Company overview



LyondellBasell is a strong, global company delivering outstanding performance

LEADING⁽¹⁾

#1

Producer of **polypropylene compounds** globally
Licensor of **polyolefin technologies** globally
Producer of **polyethylene** in Europe
Producer of **polypropylene** in Europe and North America
Producer of **oxyfuels** in Europe and North America

DIVERSE



Many of our **materials** go into products that people use every day, such as food packaging, electronics, children's toys and fuels.

GLOBAL



Every day, our **employees** work around the clock to safely **advance solutions** to our world's biggest challenges.

GROWING



Increased U.S. ethylene capacity by **40%** since 2012
Startup in 1Q20 of our **Hyperzone HDPE** plant
Building the world's largest **POTBA plant**
Expanding in China with **integrated cracker JV** and **PO/SM JV**
Expanded footprint in Louisiana in 4Q20 with **Integrated PE JV**

(1) Sources: LyondellBasell and IHS Markit. Note: Product rankings are as of December 31, 2020.
(2) Note: Includes all wholly-owned capacity and our proportionate share of joint venture capacities

Links

The screenshot shows the LyondellBasell website homepage. At the top left is the LyondellBasell logo with the tagline "Advancing Possible". To the right is a search bar with the placeholder text "What are you looking for?". Below the search bar is a dark navigation menu with the following items: "About Us", "Products & Technology", "Sustainability", "News & Events", "Careers", and "Investors". The main content area features a large banner with the word "UNLOCK" in large, colorful letters (U: blue, N: light blue, L: pink, O: orange, C: green, K: green). The background of the banner shows various household items like a blue mesh laundry basket, a white sneaker, a white suitcase, a white laundry detergent bottle, and a white bucket. To the right of the banner is the Circulen logo, which consists of a colorful circular graphic and the text "circulen by lyondellbasell". Below the logo is the text "Sustainable Solutions for Customers" and a blue button labeled "Learn more".

www.lyondellbasell.com/Circulen

LyondellBasell sustainability drive

2 MMT¹

of recycled and renewable based polymers will be produced and marketed annually by 2030

FOR EVERY DOLLAR

we invest in venture funds that address the plastic waste challenge, we help catalyze another 5 dollars from co-investors

ZERO

plastic pellet loss to the environment from our facilities

¹2 million metrics tons

[» LEARN MORE](#)

NET ZERO

greenhouse gas emissions from operations by 2050²

30%

absolute emissions reduction from operations by 2030^{3,4}

50%

minimum of electricity procured from renewable sources by 2030

²Our 2050 net zero goal includes scope 1 and 2 emissions

³Our 2030 goal includes scope 1 and 2 emissions

⁴Relative to 2020 levels

ZERO

incidents, injuries and accidents

ACHIEVE

gender parity in senior leadership globally by 2032

INCREASE

the number of people from underrepresented groups in U.S. senior leadership roles to reflect the general population ratio by 2032

ASSESS

a minimum of 70% of our key suppliers globally using sustainability criteria by 2025

www.lyondellbasell.com/sustainability

Polyesters in APS: *Schuladur* Range, *Circulen*

Schuladur A grades – The Complete PBT Product Range

	Thermoplastic Polyester compounds
Schuladur A	standard PBT compounds
Schuladur A1	compounds based on PBT and PET with improve surface quality
Schuladur A2	warpage optimized compounds based on PBT and ASA (improved weather resistance)
Schuladur A3	warpage optimized compounds based on PBT and ASA
Schuladur A4	compounds based on PBT and PC
Schuladur A5	compounds based on PET and PC
Schuladur A6	compounds based on PET and PA
Schuladur A7	compounds based on PBT and Copolymer
Schuladur E	high stiffness PET compounds
Schuladur HT	high temperature resistant PCT compounds
Schuladur PCR	compounds based on PBT + Post Consumer Recycled PET
CirculenRecover EP A	compounds based on partially Pre-consumer or Post-consumer waste PBT / PET

Schuladur A grades – Range architecture

Base Resin	Fillers	Features	Symbol	Color code	Packaging
A = PBT	Unreinforced	Medium viscosity, unfilled	MV	Natural	Bulk
A1 = PBT/PET	Glass Fiber	Low viscosity, unfilled	NV	Blk	Octabins
A3 = PBT/ASA	Carbon Fiber	Flame Retardant	FR	Other...	25kg bags
PCR = RPET	Glass Beads	High impact	HI		Other...
	Mineral	Laser Weldable / IR transparent	LW		
		Recycled Content	RC		
		... And many more			



Example: **Schuladur A3 GF30 FR1 BLK968001**

SCHULADUR A grades – Typical applications

■ Typical applications

Consumer goods:

- Specialist applications
- Strength
- PCR content sustainable solutions

Cosmetic packaging:

- Barrier properties
- Durability
- PCR content sustainable solutions

Power control units:

- Connectors
- Casings



Plugs:

- Plug “guns”
- Inlets
- Charging stations
- Antistatic solutions



Automotive:

- Ref next page

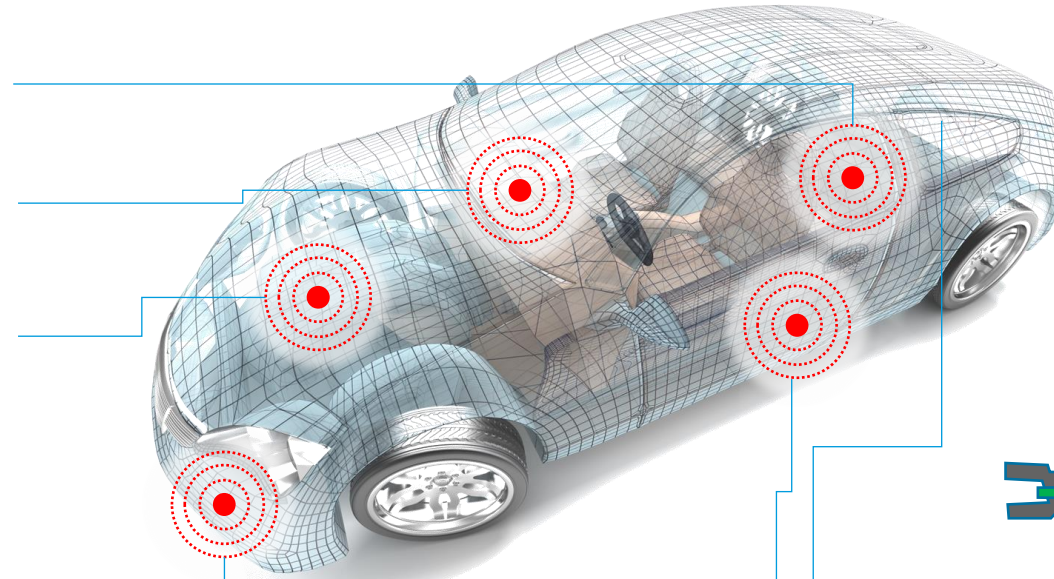
SCHULADUR A grades – Typical applications

■ Typical applications



Power control units:

- Connectors
- Casings



Sensors

- Laser welding
- Laser marking
- Signal compatibility



SCHULADUR A grades – Typical applications

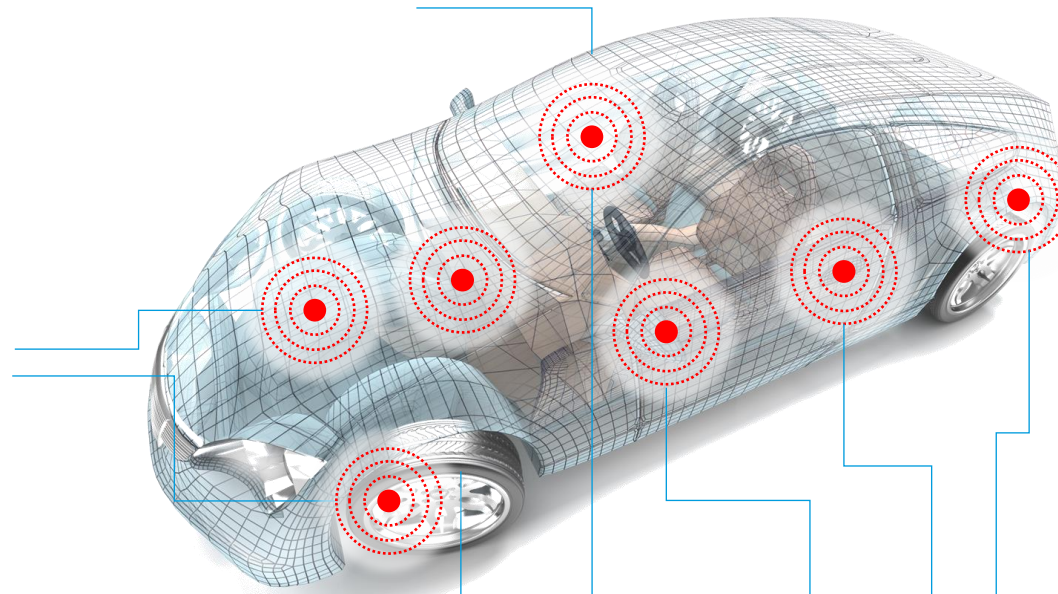
■ Typical applications

Motors, pumps:

- Motor caps & covers
- Pump inlets

Roof bar

- Attachment structure



Specific trim

- Windshield wiper covers
- Mirror housings
- Handles and fans
- Casings
- Fuel caps / charging caps



Charging units:

- Guns
- Inlets
- Charging stations
- Antistatic solutions
- Fuse boxes

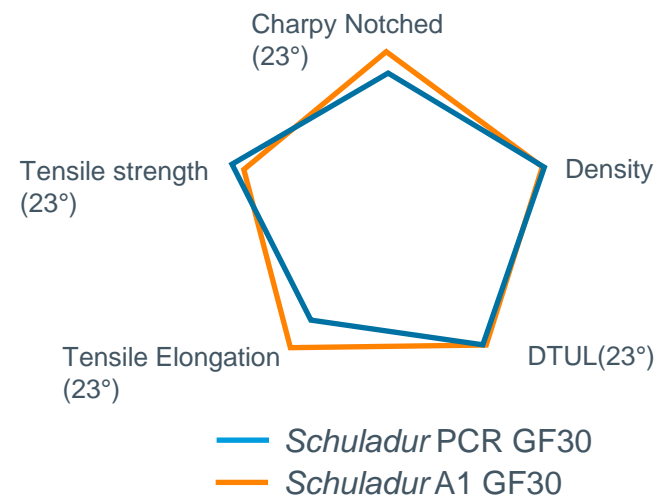
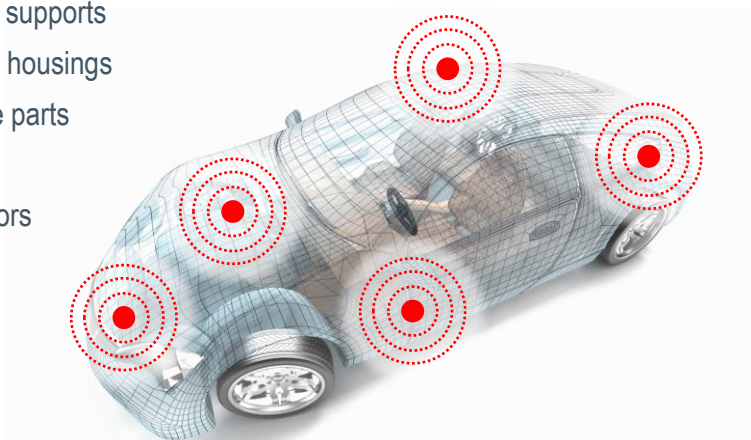
SCHULADUR – PBT in APS

■ Sustainability Case study: *Schuladur* PCR

- PBT blend with post-consumer waste PET
- High performance material – low warpage, impact resistance & UV resistance

Structure components:

- Roof bar supports
- Foglamp housings
- Structure parts
- Sensors
- Connectors



Well established solution on the market

Schuladur® PCR family

Properties	Units	Standards	GF 15	GF 20	GF 20 HI	GF 30	GF 45
MFR, 260°C / 2,16 kg	g/cm³	DIN EN ISO 1133	18	24	12	20	11
Tensile Modulus	MPa	ISO 527-2	6.700	8.100	6.200	11.000	15.500
Tensile Stress	MPa	ISO 527-2	110	125	100	140	160
Tensile Strain	%	ISO 527-2	2,4	2,5	3,5	2,1	1,7
Charpy Notched							
23°C	kJ/m²	ISO 179/eA	5	6	11	8	8
-30°C	kJ/m²	ISO 179/eA		5	7	8	
Charpy Unnotched							
23°C	kJ/m²	ISO 179/eU	25	30	60	55	50
-30°C	kJ/m²	ISO 179/eU		28	60	50	
HDT @ 1,8 MPa	°C	ISO 75	186	200	190	205	208



CirculenRecover EP A1 – going forward

■ New grades of PBT-PET with recycled content will follow the new branding “Circulen”

- SCHULADUR derived new formulas will be called ‘CirculenRecover EP A1 P2 xx’
- Currently being developed:
 - Laser Welding (laser transparent version) - LW
 - Laser Marking improved (increases the contrast of laser markings) – LM

■ Balanced compound based on PBT + post-consumer PET

- PET – post consumer
- From known and secured sources
- Continuing the learning & legacy of the *Schuladur* PCR range
- We are working on Food Contact approvals with Post Consumer content.



Advancing innovative solutions

Schuladur & CirculenRecover EP A1 – Moving forward

■ Current developments

- Post-Consumer sources
 - Origin & content challenges
- Recycled origin fillers
 - Carbon Fibers
- Conductivity & resistivity
 - Thermal
 - Electric
 - Signal conductivity or shielding
 - Anti-static
- Impact modified grades
- Food contact grades range extension

■ Technology trends

- UWB, radar signals
- Automation & sensors (camera, sensor activation of functions, remote accessibility, autonomous driving)
- New drivetrains = new requirements (temperature, batteries, dielectric fluids, function controls)
- Screen controls vs buttons, device connectivity (phone, keys)
- Passenger experience (touch, feel, lighting, comfort, assistance & connectivity)



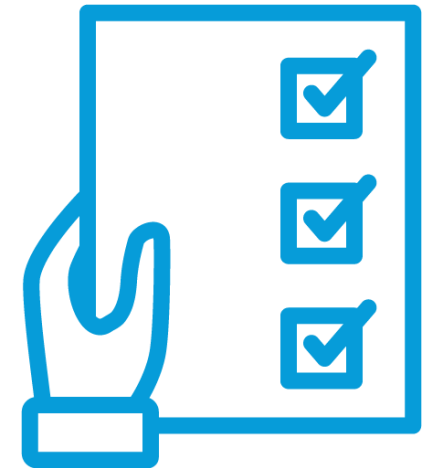


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Q&A

Schulamid Polyamides – Q&A

- Any questions?
- Actions – next steps



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