Borealis' Borstar® PP and Fibremod™ technologies

Driving the unmatched success story of polypropylene in the automotive industry

Maurits van Tol
SVP Innovation and Technology
Borealis AG

SPE Houston
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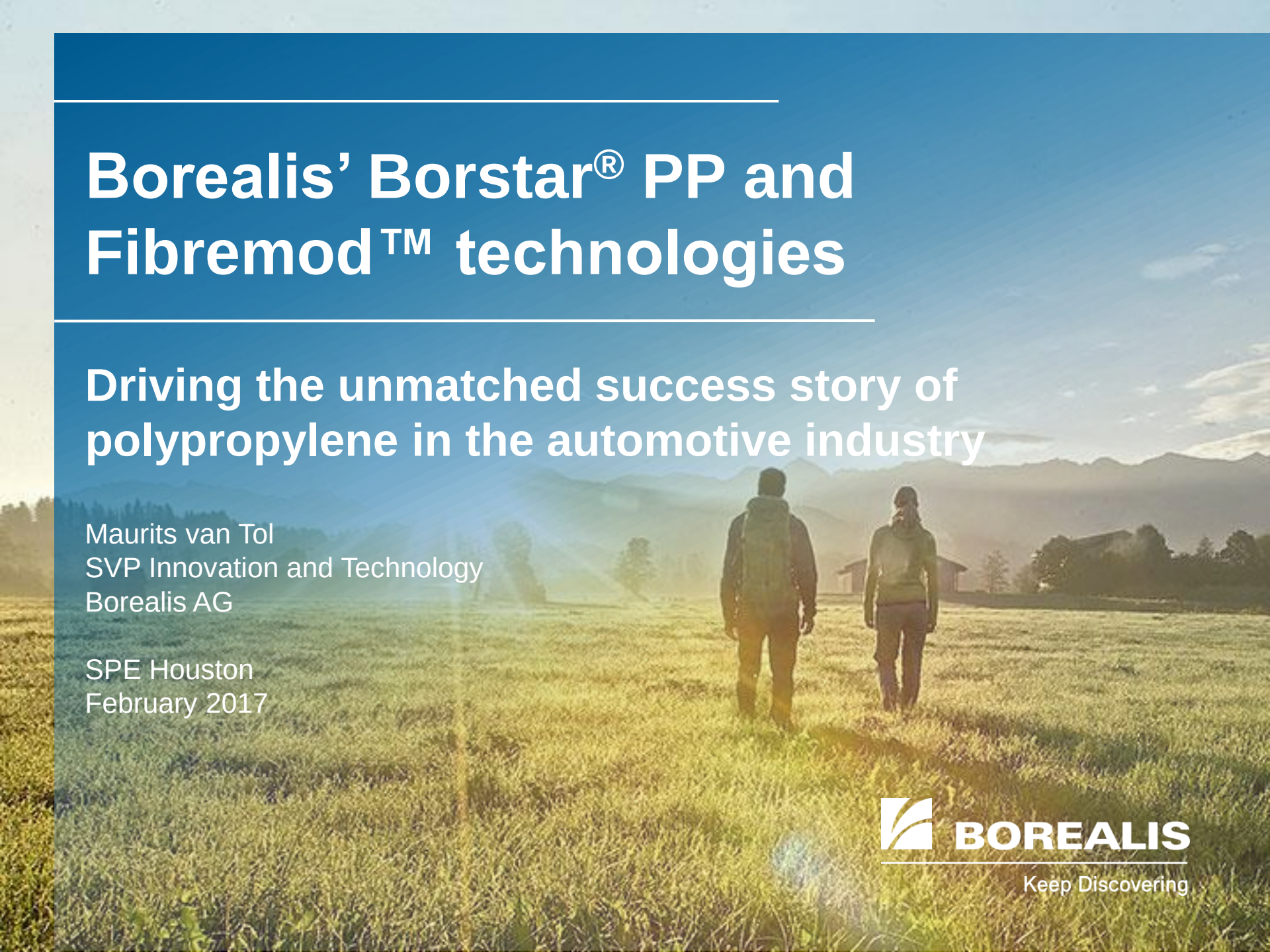

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Keep Discovering

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Keep Discovering…..

Borealis at a glance

2nd largest polyolefin producer in **Europe**

6,500
employees

EUR 7.7 billion
sales revenue in 2015

Operates in over **120 countries** on **5 continents**

Head office in **Vienna**, Austria

EUR 988 million
net profit for 2015

Sales of **polyolefins**, **base chemicals** and **fertilizers**

Ownership structure

IPIC, Abu Dhabi
OMV, Austria

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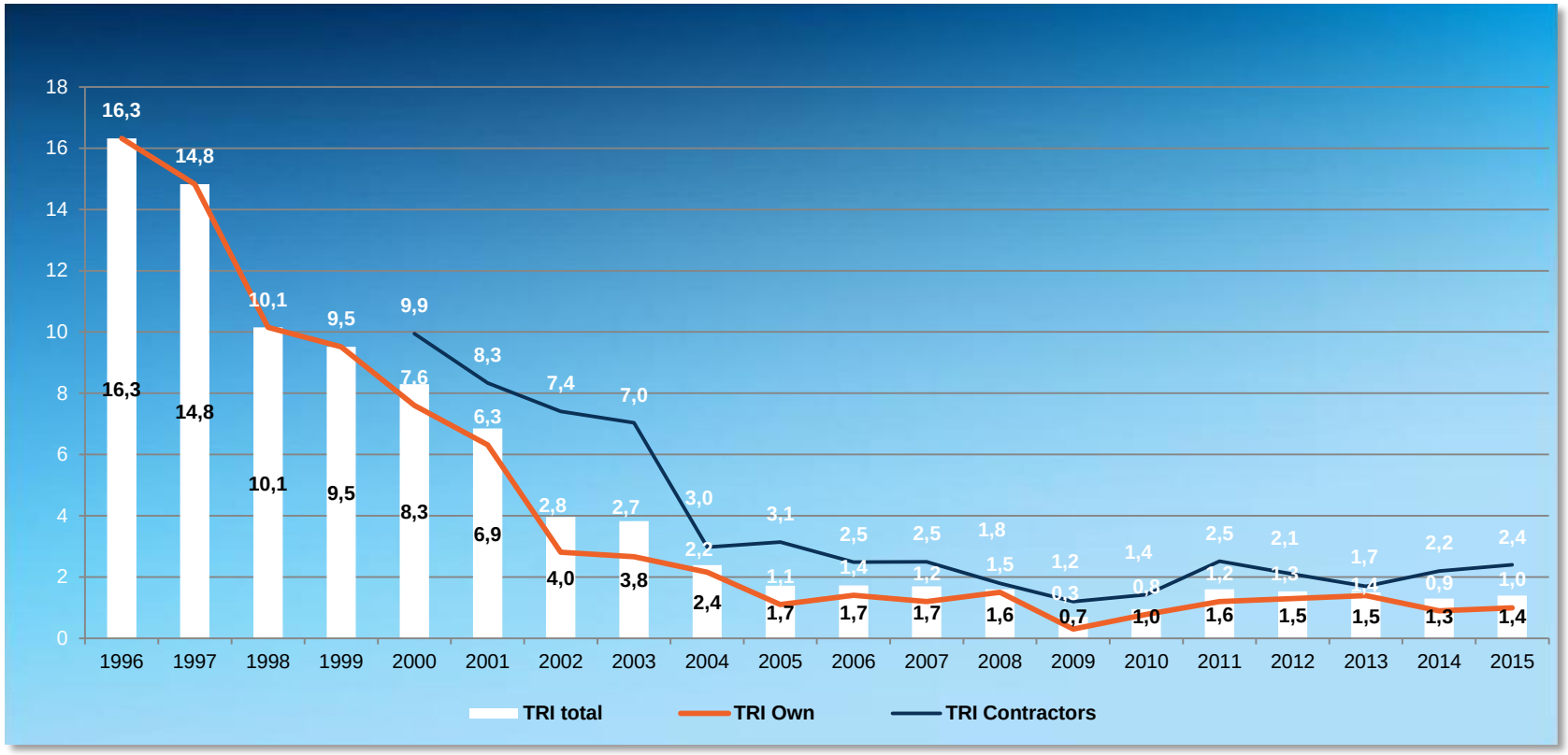
World-class safety standards

TRI frequency - Own Employees vs. Contractors 1996 – 2015



Note: TRI is defined as total recordable incidents per million hours worked

Life Saving Rules

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Portfolio of leading Polyolefin technologies

Polyolefin Technologies

Borstar® PE
Bimodal LLD, MD & HDPE

Borstar® PP
Multimodal PP

Borealis SIRIUS Catalyst Technology

Borceed™
Plastomers and Elastomers

Borlink™
Wire & Cable Technology Platform

Post-Reactor Technologies

Daploy™ HMS PP
High melt strength PP

Fibremod™
Engineered Fibre Compounds

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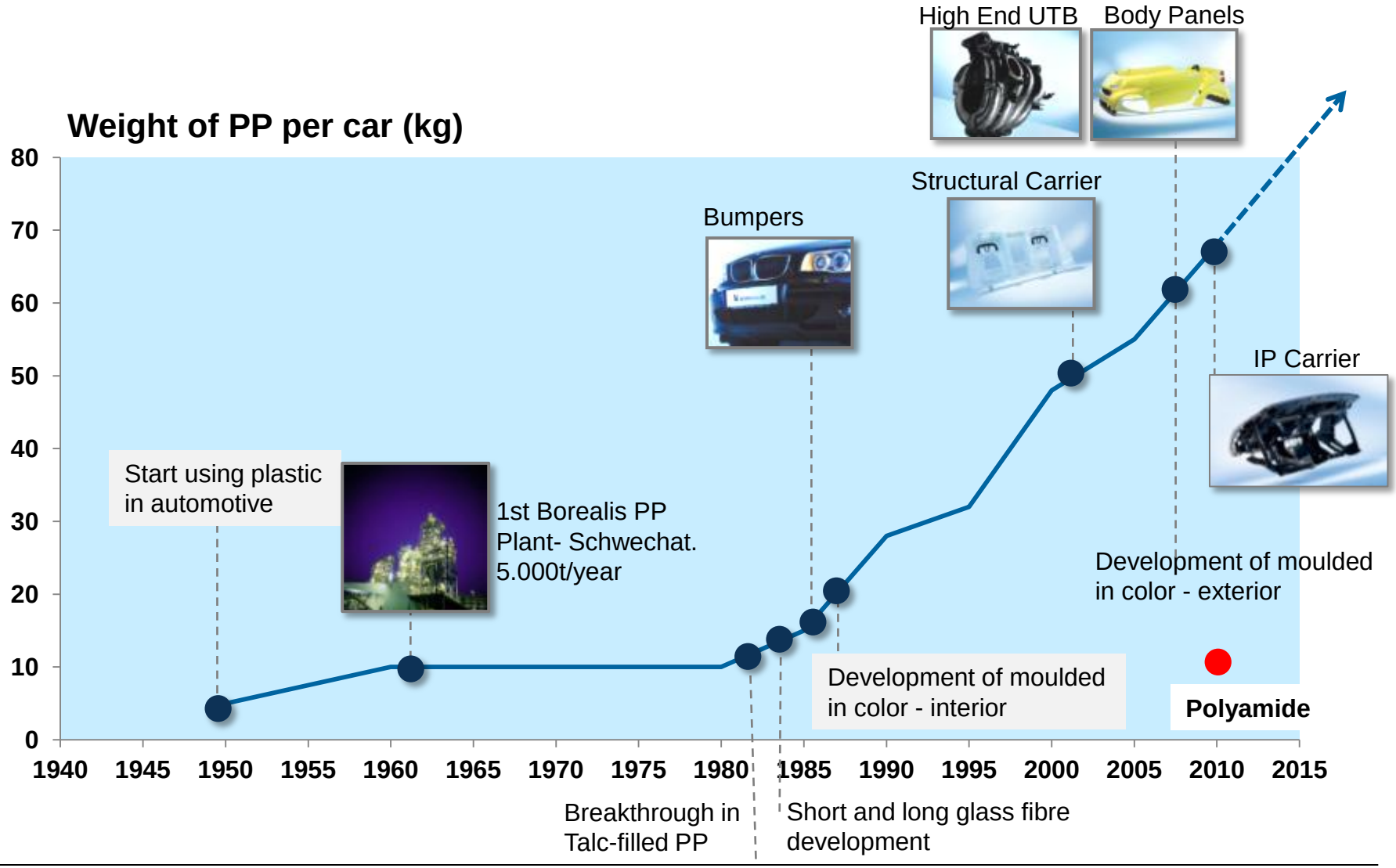
Polypropylene continuously advances into new applications by improved product properties



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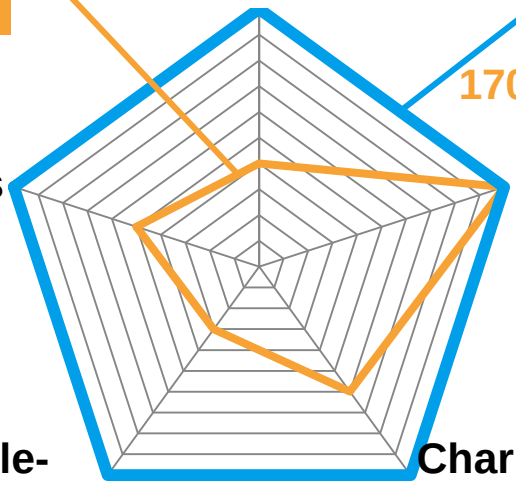
Advanced TPOs - Key technology enabler for ever improved automotive compounds

Borealis Daplen™ talc compound *1990*

Borealis Daplen™ talc compound *2016*



PP compound innovation has stretched the boundaries several times following increasing automotive requirements

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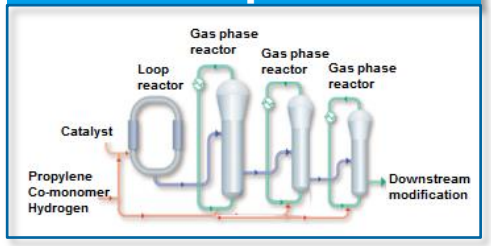
Multimodal Borstar® PP Technology - Key feature to tailor end product properties

Borstar process



Borstar PP – A unique technology platform

- The Borstar process gives freedom in molecular design resulting in highly differentiated PP
- Multimodality for advanced properties, such as strength and processability, clarity and toughness
- Stiffness control through MWD design, Borealis nucleation technology and high isotacticity catalyst
- High EPR incorporation (RTPO's)

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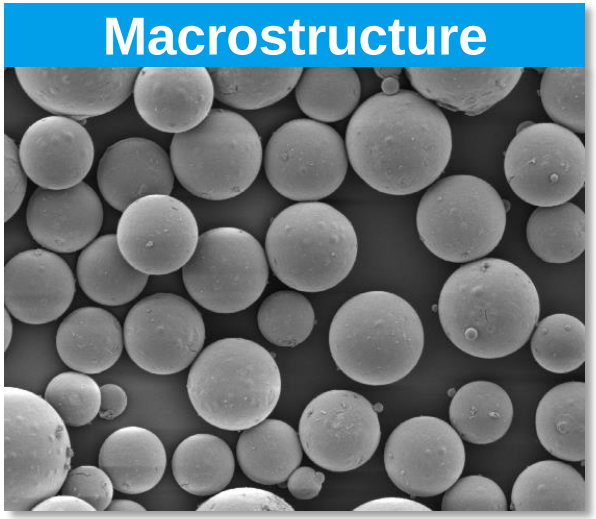
Borealis Sirius catalyst technology – Key to advanced PP products with Borstar®

- High degree of control on the catalyst's nano and micro structure with subsequent fine-tuning of polymer properties
- Excellent control of catalyst particle internal and external morphology for an optimal polymerisation behaviour
- Versatile catalyst chemistry allowing flexibility in the choice of modern donor technology



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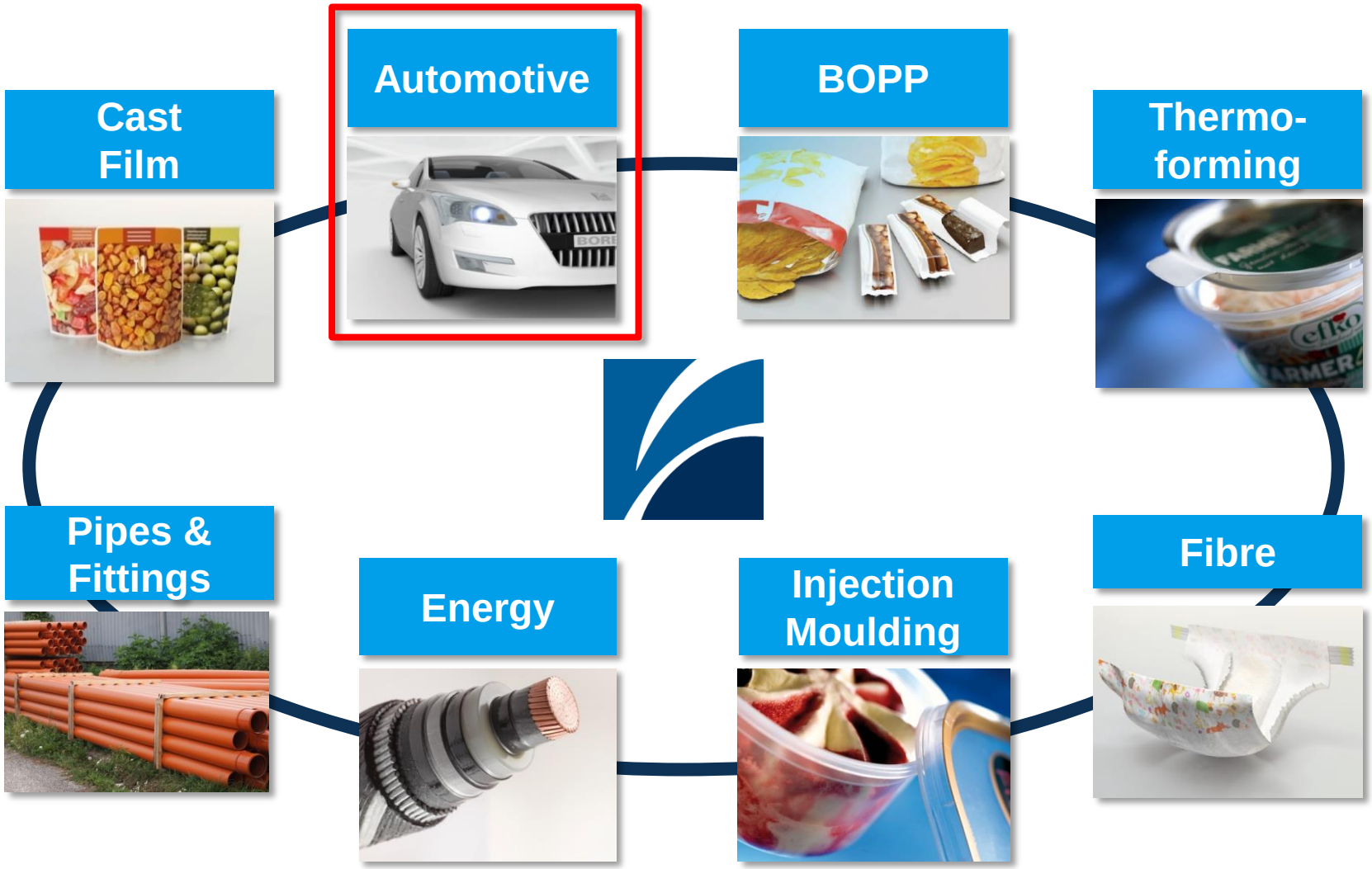
Borstar® PP – Product portfolio for a very wide range of value added applications



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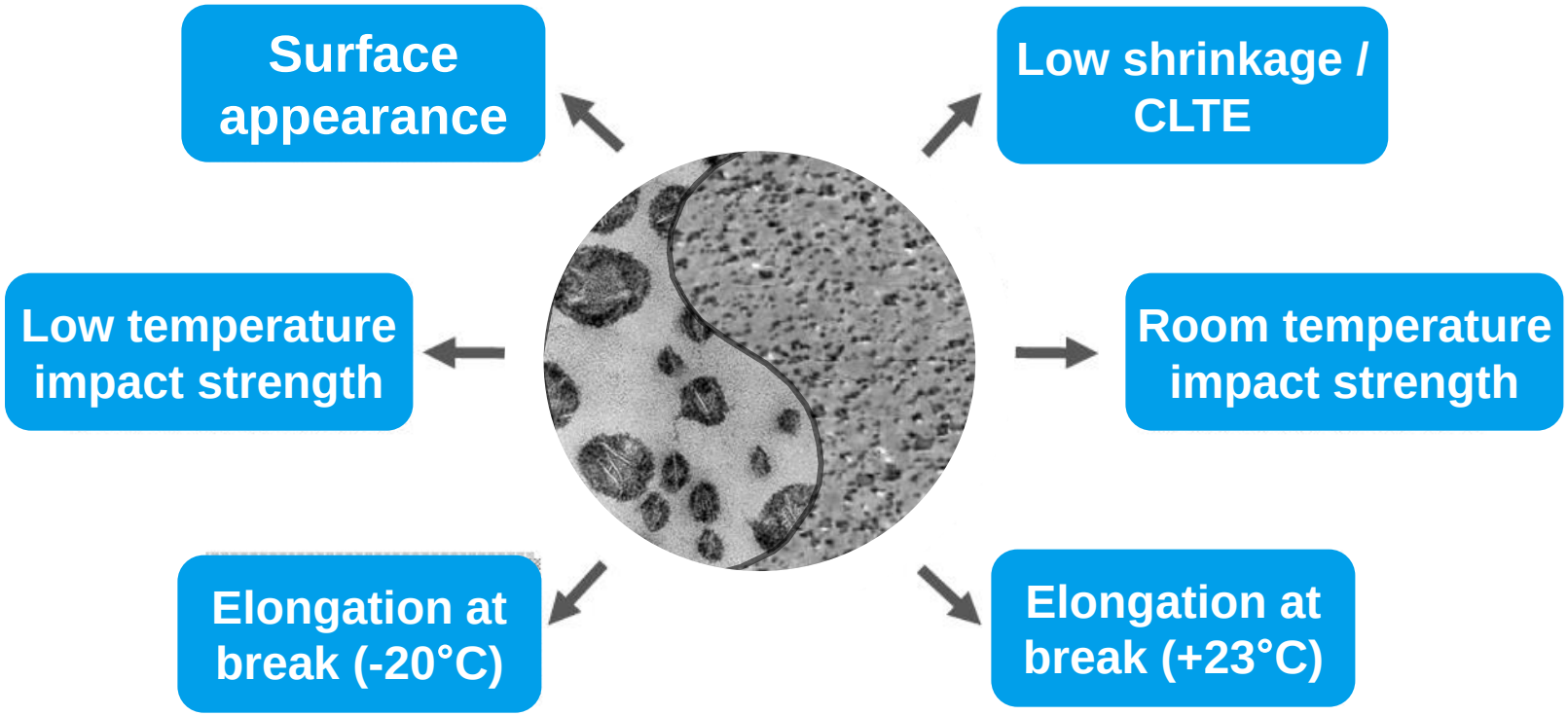
Very demanding requirements in the automotive industry for advanced TPOs



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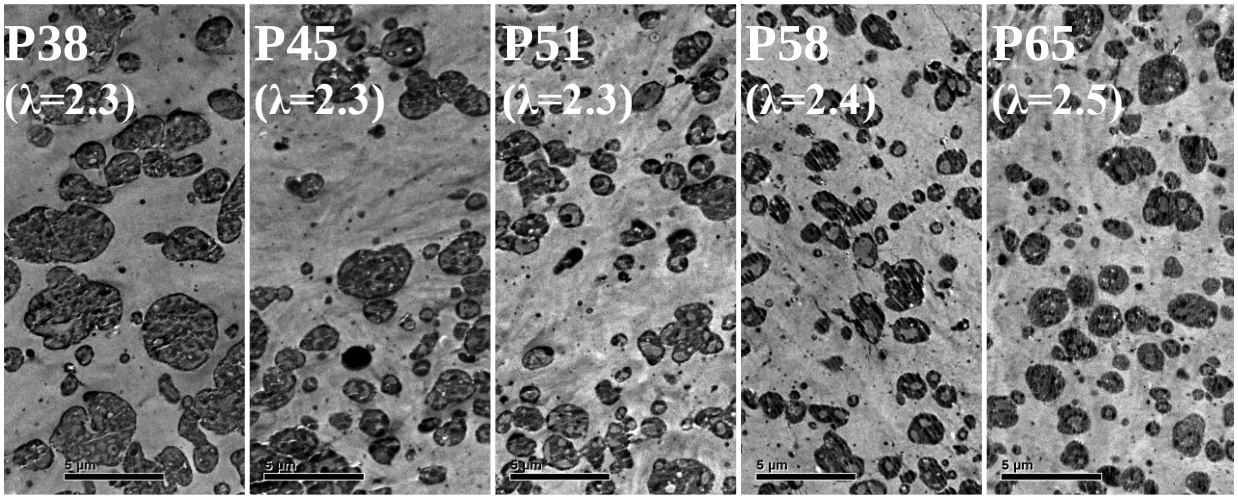
Example: Performance of heterophasic copolymers (TPO)

PP/EPR in-reactor blend	P38	P45	P51	P58	P65
C3-content of XCS, wt%	38	45	51	58	65
IV of XCS, dl/g	3.2	3.2	3.2	3.2	3.2
MFR, g/10min	13	15	20	17	15



Low — C3 content of XCS — High

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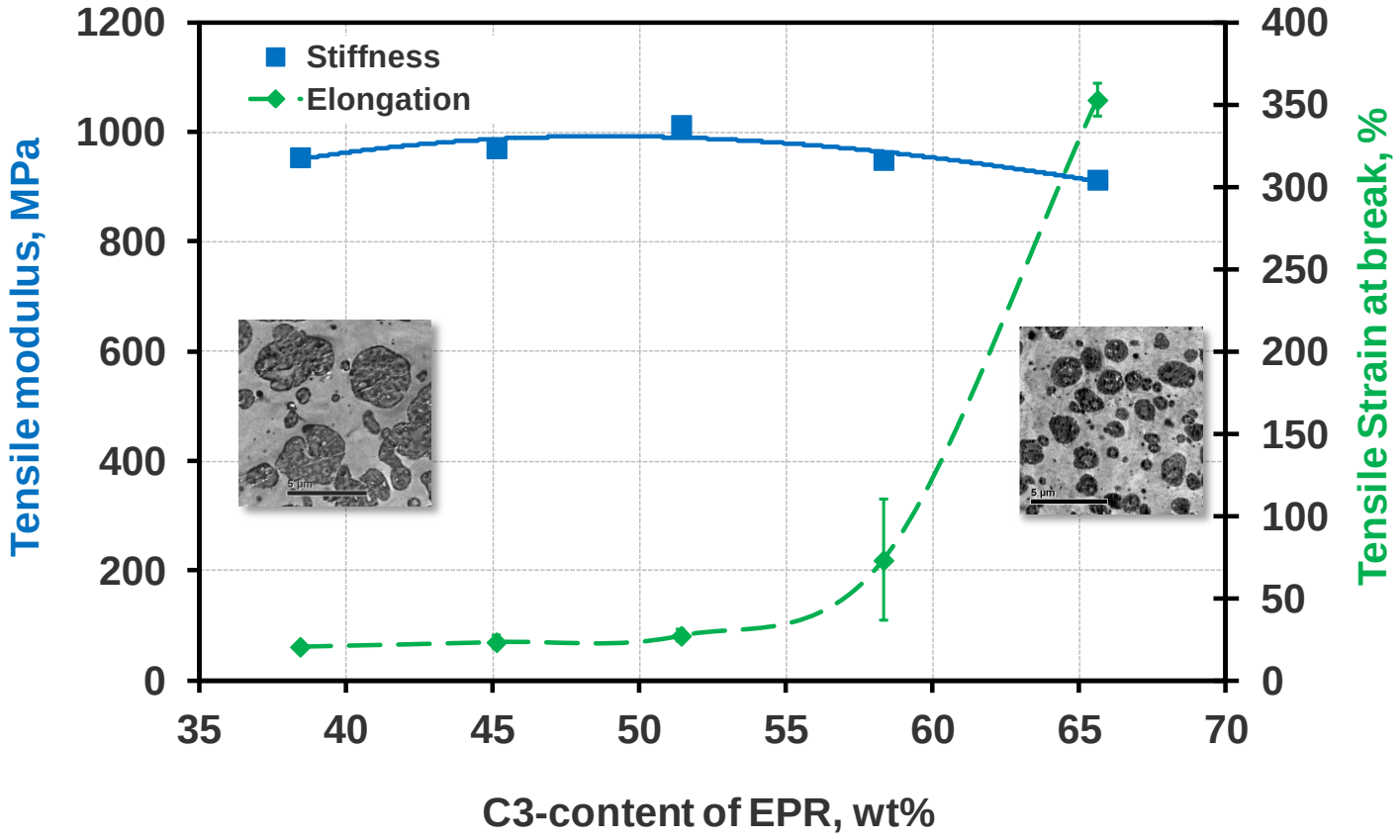
Comparable stiffness, but superior tensile strain with advanced TPOs enabled by Borstar PP



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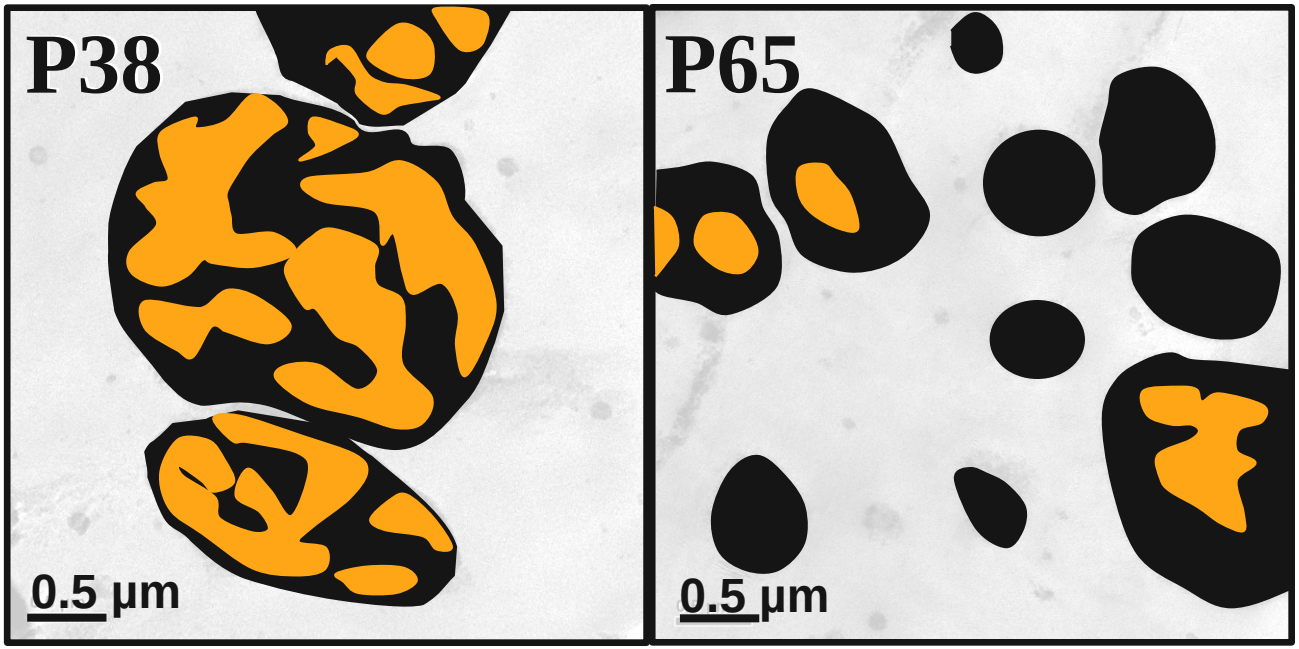
Internal structure of dispersed phase of heterophasic copolymers



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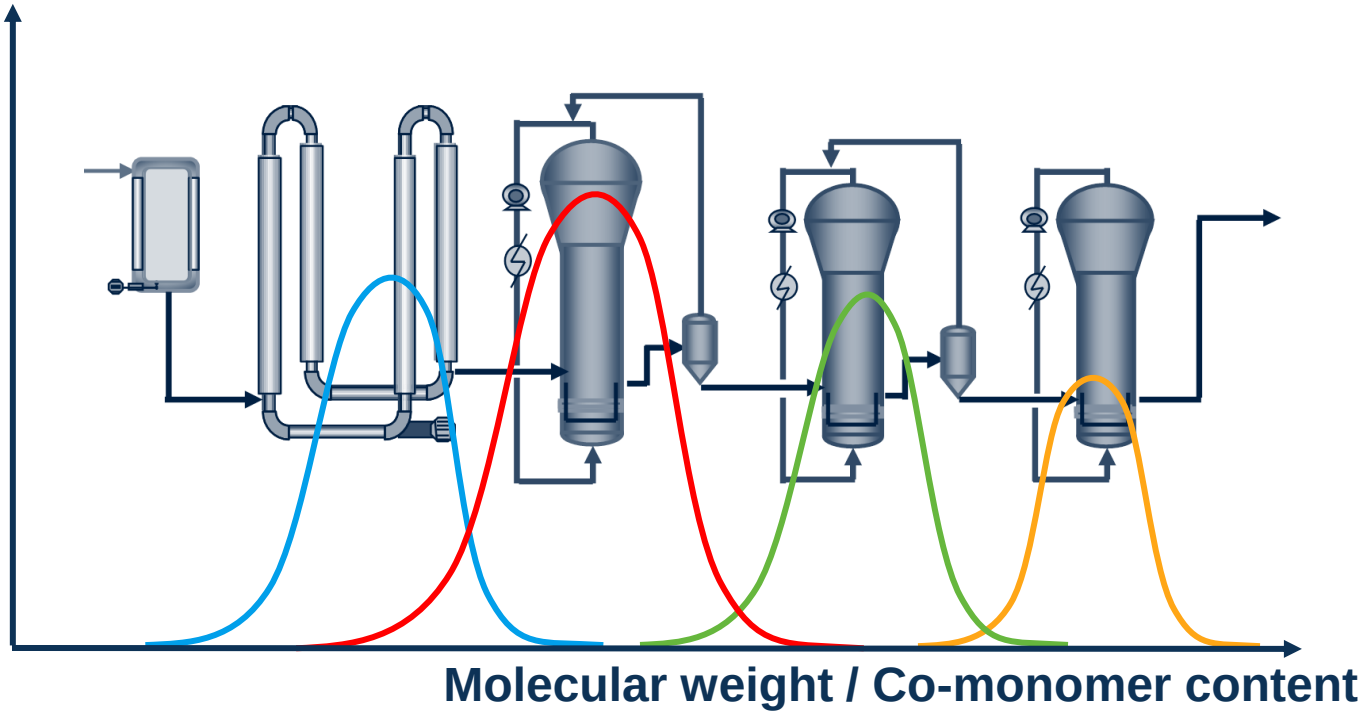
Borstar® PP Technology – Multimodal PP process for the production of superior TPO‘s



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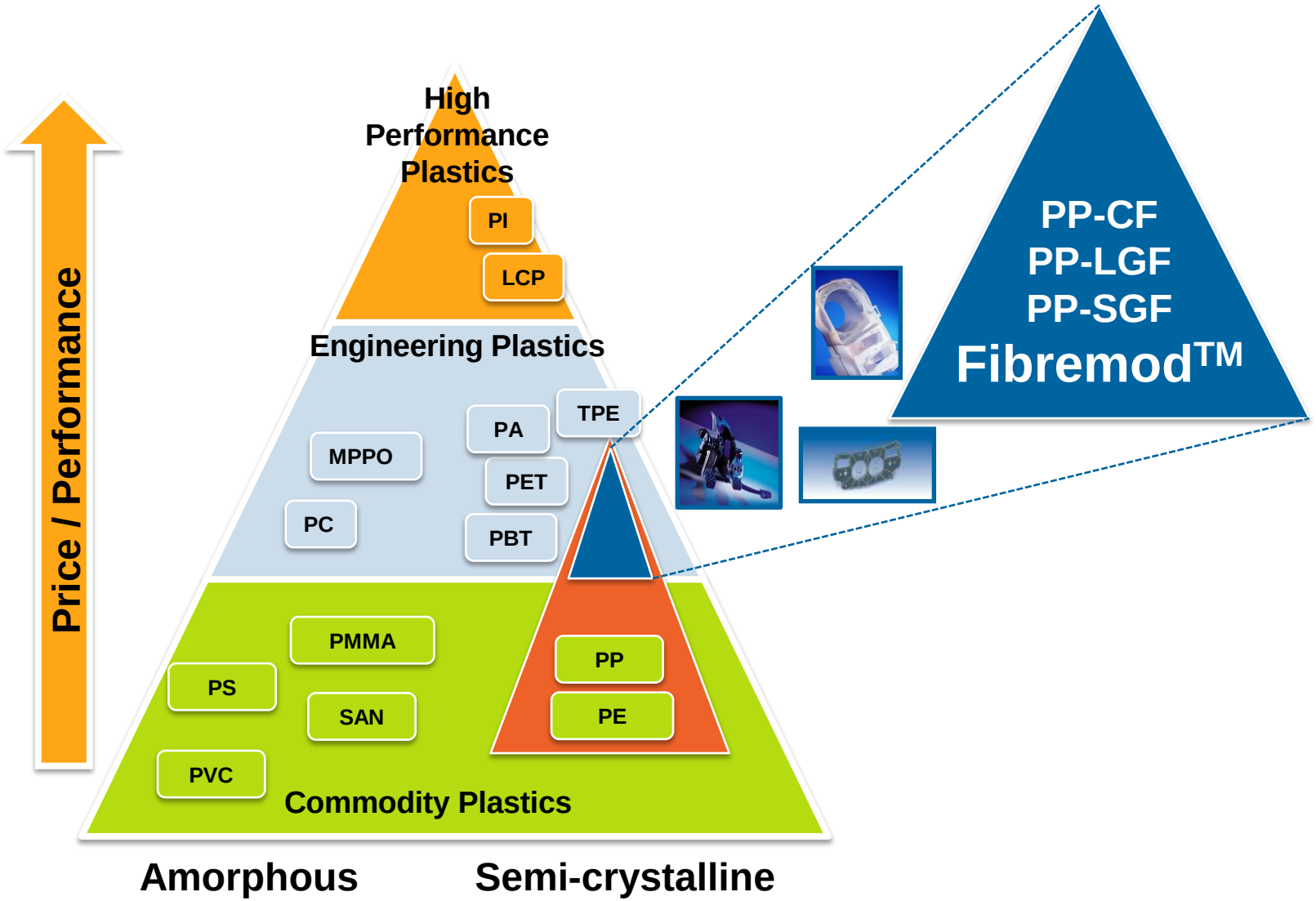
Fibremod™ – The Engineering Plastic of the future!



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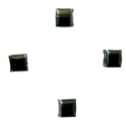
Fibremod™ - Excellent performance / cost balance for wide range of applications

Fibremod™ Technology Portfolio

Fibremod ™ Short Glass Fibre



- Static loads
- Best performance / cost balance

Fibremod™ Long Glass Fibre

- Dynamic loads
- Higher strength
- Less creep
- Excellent performance / cost balance

Fibremod™ Carbon Fibre

- Extreme stiffness
- Highest weight saving potential
- Outstanding weight / cost performance

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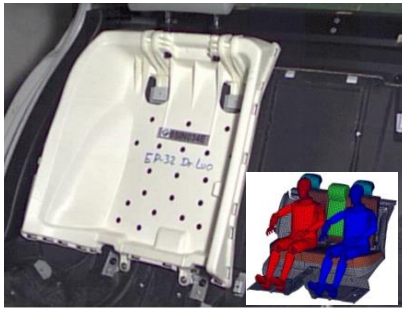
Excellent expertise in simulation - An important pillar of our success

Fibremod™ PP GF projects (examples)

IP carriers



Seat carriers

Pedal supports

Air intake manifold

Loadings close to the material's limits ➔
Detailed Engineering for finished part needed

Simulation at Borealis*

- 20 years of experience
- More than 5,000 customer projects

* from conversion engineering to applications engineering

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Fibremod™ Carbon –
The next PP revolution

- Lighter
- Stronger
- Faster

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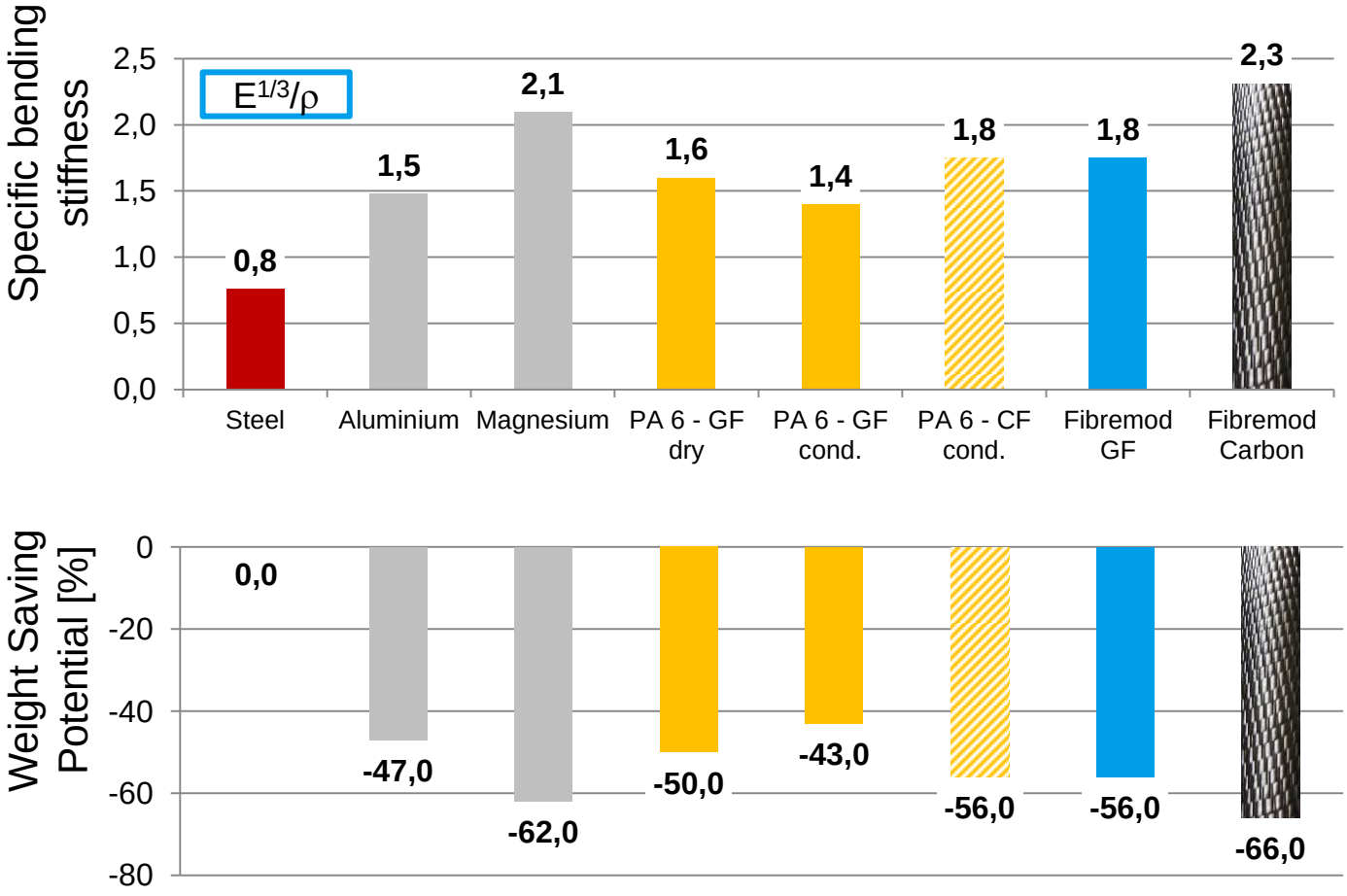
Fibremod™ Carbon – The material of choice for lightweight construction



Fibremod™ Carbon outperforms by	
Steel	66%
Aluminium	35%
Magnesium	9%
PA 6 – GF	35%
PA 6 – CF	22%

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Concept study - rear frame (Husqvarna FC250)

© KTM

© KTM

© Borealis

Challenge

- Increased driving performance
- Improved weight distribution
- Lowering of balance point

Solution

- Fibremod™ CB401SY

Expected Benefit

- More than 1 kg weight reduction on the frame
- Higher design freedom than metal construction
- Modularization and functionalization of part
- High torsion resistance

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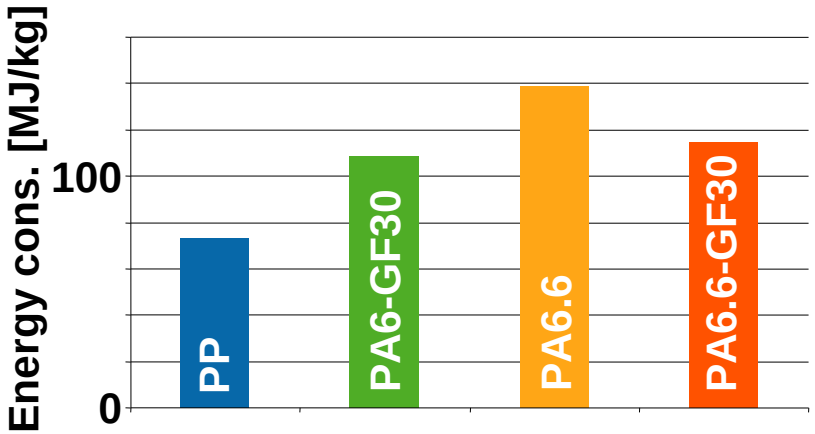
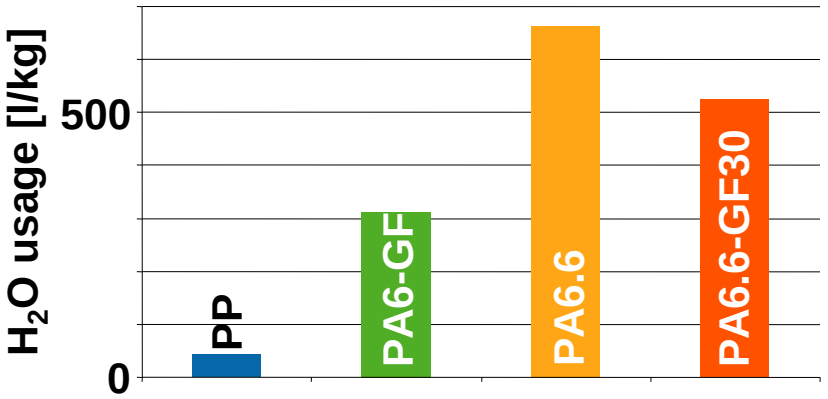
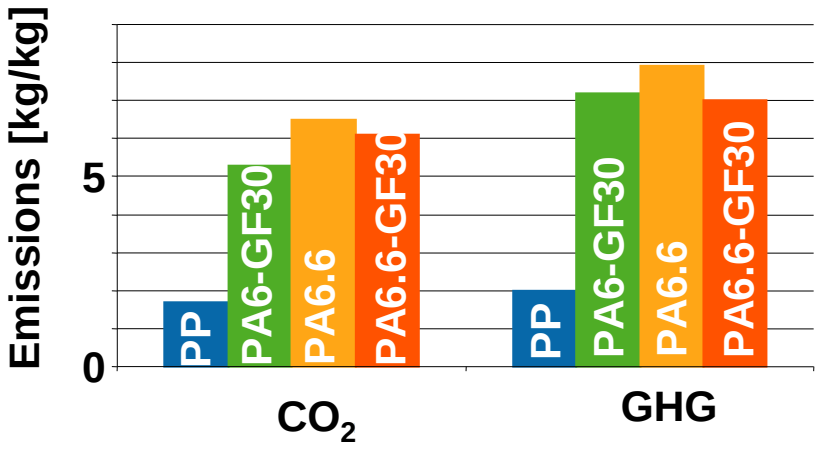
Environmental impact (cradle to the gate)

Fibremod™ GB307HP vs Polyamide







Source: denkstatt sustainable thinking

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Daplen™ post consumer recyclate (PCR) grades - A sustainable, value adding solution

- **Daplen™ PCR grades** provide increased sustainability through combination of post-consumer recyclate (PCR) with virgin PP
- Examples: Daplen PCR grades for **automotive applications**:
  - **Daplen™ ME225SY** (25% PCR) for vehicle interiors such as door trim and trunk linings
  - **Daplen™ MD250SY** (50% PCR) for under-the-hood and exterior applications
  - **Daplen™ MD325SY** (25% PCR) for exterior applications
- **Daplen PCR grades** produced and marketed in Europe: High performance grades in consistent quality for Borealis' customers and partners

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Award-winning Innovations by Borealis

2016 European Plastics Innovation Awards

EUPC EUROPEAN PLASTICS CONVERTERS

PlasticsEurope Association of Plastics Manufacturers

SPE SOCIETY OF PLASTICS ENGINEERS

New Surfaces for Plastics Parts

Daplen™ EE112AE is the first Borealis material for primerless paint systems

Awarded in Plastics Today as one of their **top five automotive technology breakthroughs of the year in 2015**

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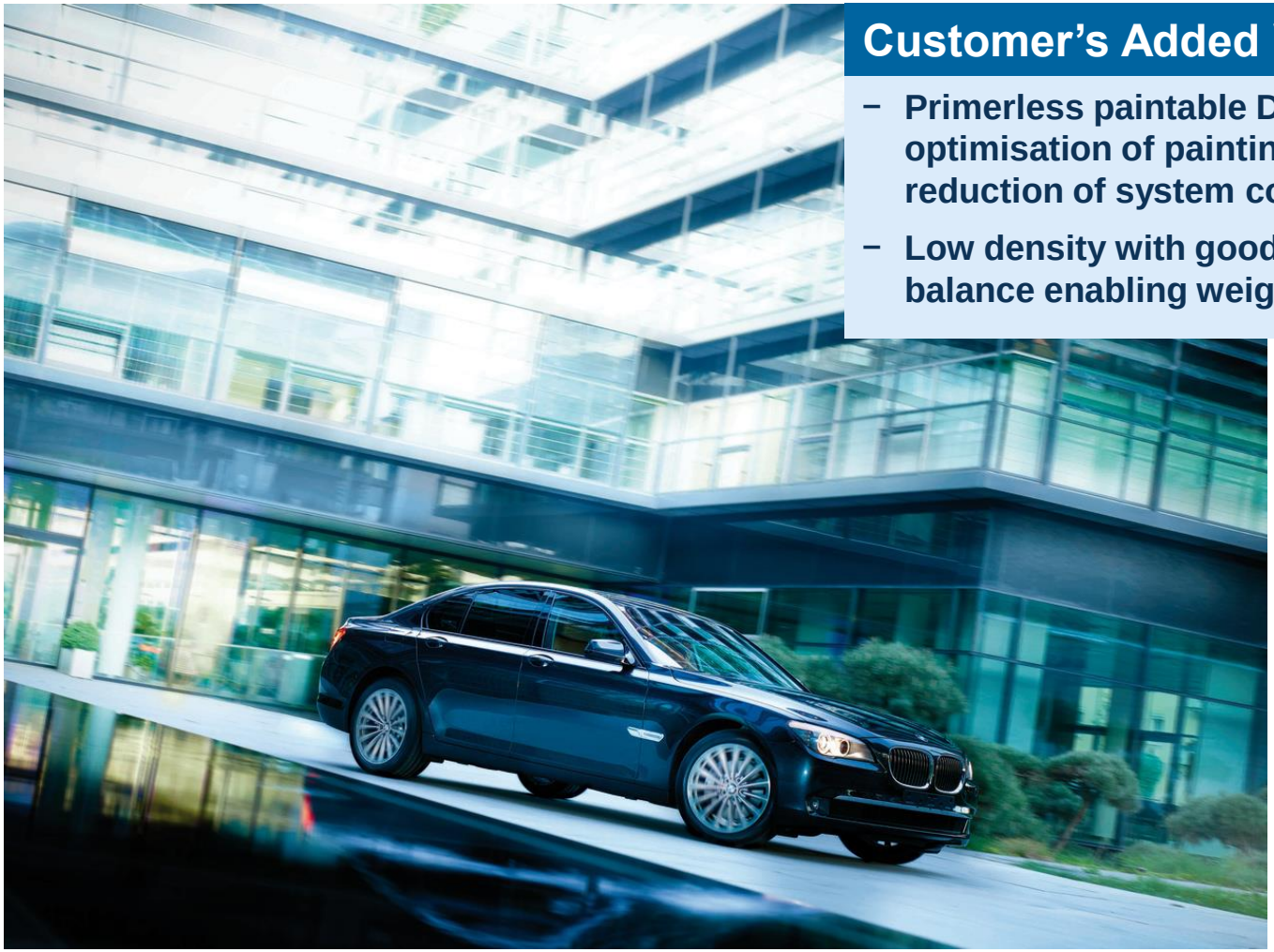
BMW 7 bumper
Light weight solution with Daplen™



Customer's Added Value

- Primerless paintable Daplen™ allows optimisation of painting cycle time and reduction of system cost
- Low density with good impact / stiffness balance enabling weight reduction

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Key Messages

1. Polypropylene has a successful track record of 35 years in the automotive industry with a six-fold increase in volume
2. Borstar® PP – Enabling PP technology for superior TPOs
3. Fibremod™ – For cost efficient high performance fibre-reinforced PP materials solutions
4. Fibremod™ Carbon – The next step of revolutionary PP innovations
5. Borealis is committed to the automotive industry with sustainable Borstar® PP, Fibremod™ and recycled material solutions
6. Based on the excellent sustainability profile, we believe polyolefins will continue to replace alternative material solutions
7. We welcome cooperation with external parties to further push the boundaries of polyolefin science and to grow our business through partnerships along the entire value chains we are active in

Thank you

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