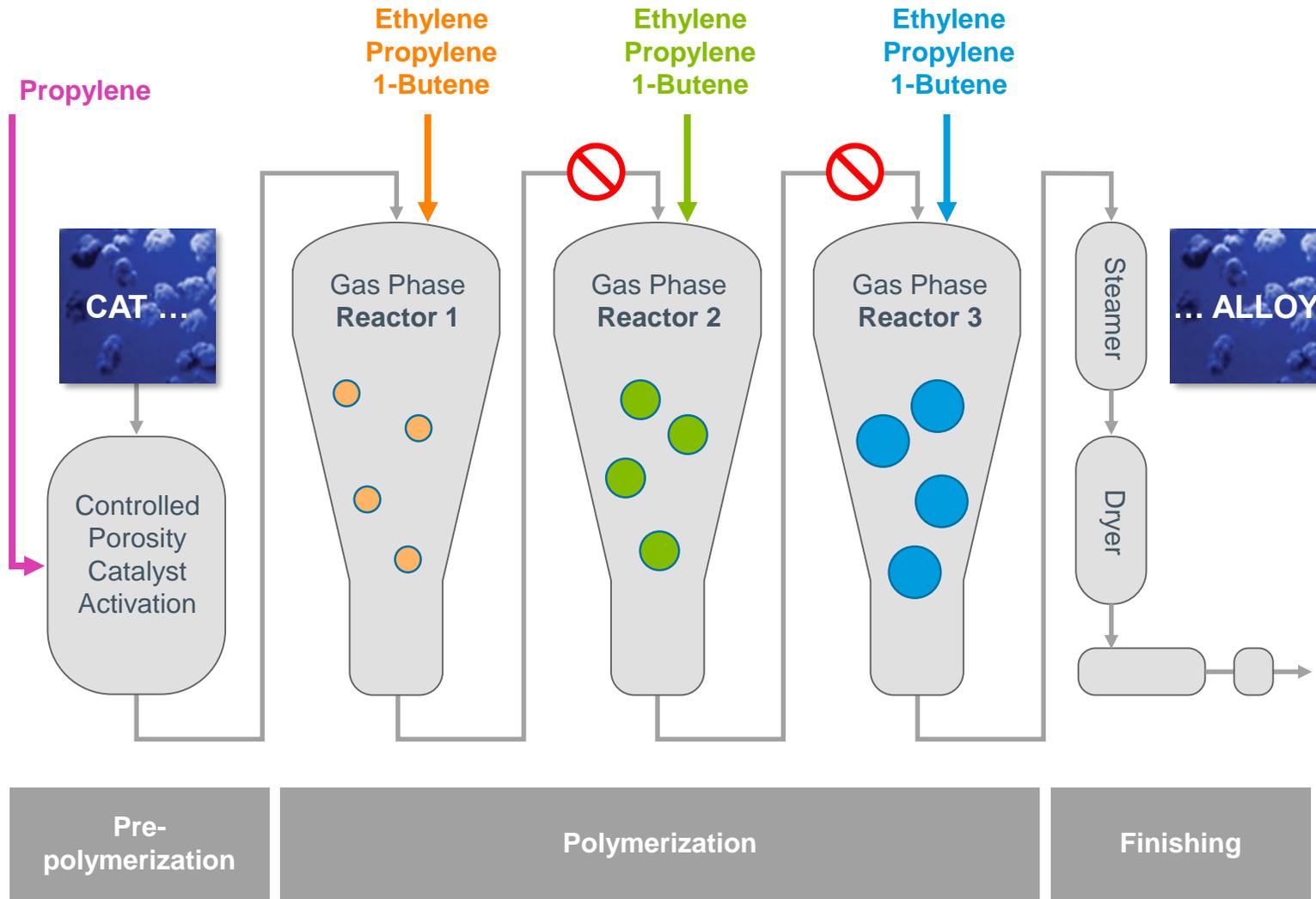


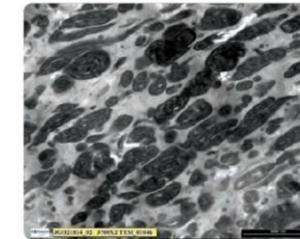
***Catalloy* technology process**  
***Adflex* product properties**

**V. Baudier, G. Biondini, S. Pasquali**

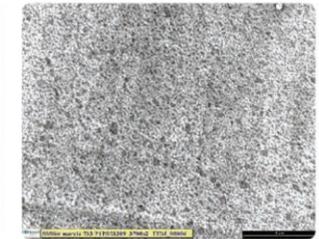
# Catalloy production process – an ‘ALLOY’ not a blend



Ethylene  
Propylene  
Rubber Blend



Hifax CA10A



TEM (transmission electron microscopy)  
3700x

During production, the *Catalloy* technology evenly distributes the rubber phase within a co-continuous PP phase, yielding superior properties when compared to a physical blend.

## Grades from Catalloy technology: *Hifax*, *Adflex*, *Softell* and *Hiflex* product families

### *Hifax*

#### **Outstanding impact for durable industrial and automotive applications.**

Grades with an outstanding balance of mechanical performance, processability, high thermal resistance and aesthetics. Utilized by customers in durable applications, such as building and construction (e.g. single ply roofing), industrial, (e.g. wire and cable) and automotive (e.g. interior and exterior parts).

### *Hiflex*

#### **Improved impact stiffness and shrinkage performance balance.**

The *Hiflex* TPO resins combine the uniqueness of LyondellBasell's existing *Hifax* and *Adflex* TPO resins, offering easy processing, flexibility, durability, low density, high thermal resistance and low gloss, with improved impact, stiffness and shrinkage performance balance when used in a compound.

**NEW**

### *Softell*

#### **Generation of soft products for industrial and consumer applications.**

Combining toughness with flexibility, customers select these resins due to their resistance and elasticity. *Softell* resins provide an enhanced soft-touch feel and slip resistant grip used in electrical appliances and tools. Additional benefits include the ability to bond well with other polyolefins and additives and the capacity to effectively incorporate fillers.

### *Adflex*

#### **Very soft, flexible polyolefins.**

Our *Adflex* family are very soft and flexible TPO resins used by a wide number of our customers in applications such as specialty films, as a blending partner to improve impact performance, extrusion coating, bitumen modification and consumer applications. In addition to enhanced flexibility, the *Adflex* resins exhibit excellent impact performance at low temperatures, outstanding haptic properties and soft touch.

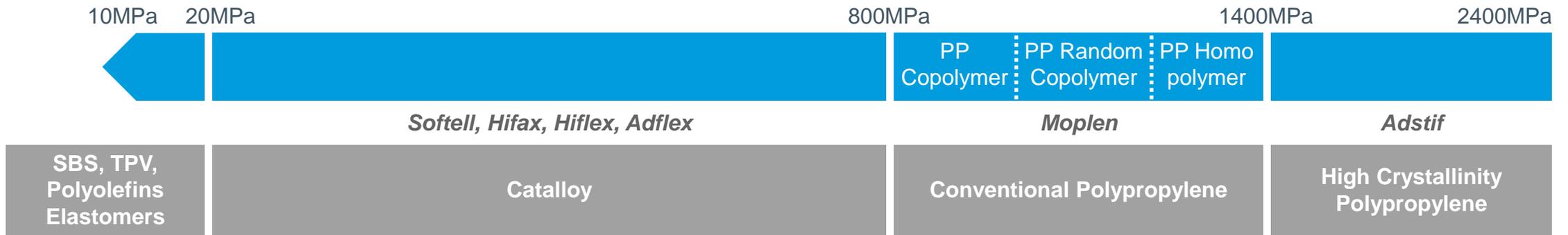


## Grades from *Catalloy* technology: key properties

Grades from *Catalloy* technology enable the control of key properties such as:

Low Density  
 Optical Properties  
 Tear and Puncture Resistance    Stiffness and Impact Balance  
 Thermal Resistance    Dimensional Stability  
 Flexibility & Softness    Easy Processing  
 Compatibility with Polyolefins  
 Low-Temperature Impact  
 Durability / Weatherability

### Flexural Modules



## Applications at a glance: Packaging

(Injection, Inj. / Extr. blow molding)

**Adflex resins enhance the performance of rigid and flexible molded goods.**

**Adflex resins used as modifiers can:**

- enhance the cold-temperature impact performance of transparent applications while retaining clarity in extrusion blow molding and injection molding.
- offer enhanced impact resistance and squeeze ability by blending *Adflex* resins with other polyolefins in molding, extrusion, or laminated flexible tubes for personal care products.
- offer low warpage, dimensional stability, flexibility and a tight fit in lidding applications.
- be used in the manufacture of injection molded containers, crates and bins to improve the impact resistance.



Stiffness and Impact Balance

Thermal Resistance

Room and Cold Temperature Impact

High Softness

High Clarity

Enhanced Toughness

Dimensional Stability

## Grades from *Catalloy* technology: *Adflex* properties

	Low Temperature	Low Modules			Low Shrink
	Q300F	Q100F*	C200F**	X100G	X500F
Melt Flow (ISO 1133)	0.8	0.6	6	8	7.5
Flexural Modulus	330	100	200	80	550
Tensile Strength at Yield	9	No Yield	8	6	14
Elongation at Break	550	500	600	600	700
Charpy Impact Notched -20°C	100	110	30	105	45
Charpy Impact Notched -40°C	100	5	2	4	5
Haze 1mm Plaque (Internal LYB)	-	-	45	-	23
Gloss 1mm Plaque (Internal LYB)	35	85	-	-	110
Post Molding Shrinkage (Internal LYB)	0.7	1.7	-	0.8	0.5

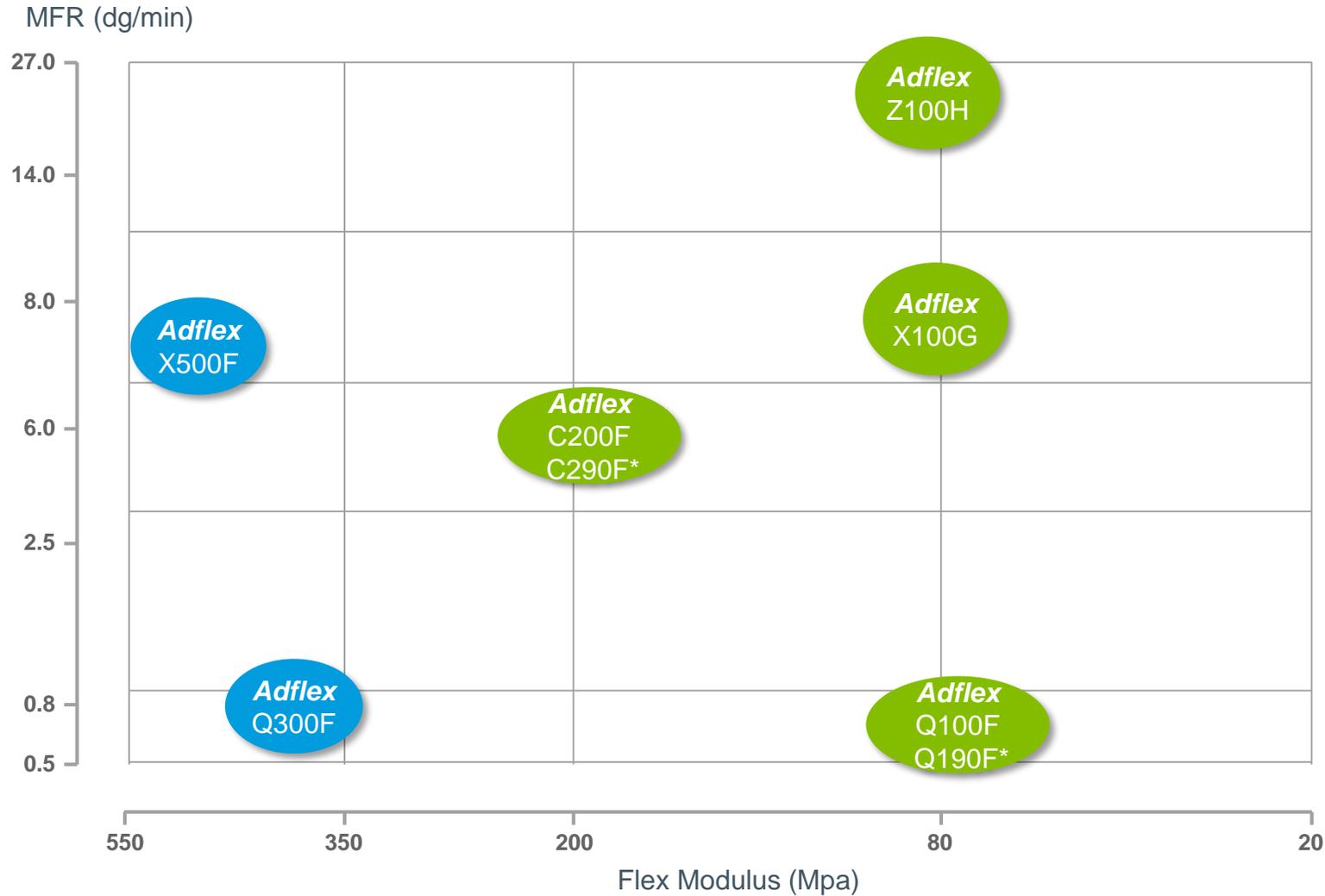
- Low temperature impact
- Excellent stiffness-impact balance
- Low gloss
- High thermal resistance

- Softness
- Flexibility
- Broad MFR range
- Low temperature impact

- Low shrinkage
- Good clarity
- High gloss
- Low Glass Transition temperature

Non phthalate version: *Adflex* Q190F (\*) / *Adflex* C290F (\*\*)  
Source: LyondellBasell

# Super Soft grades from *Catalloy* technology properties

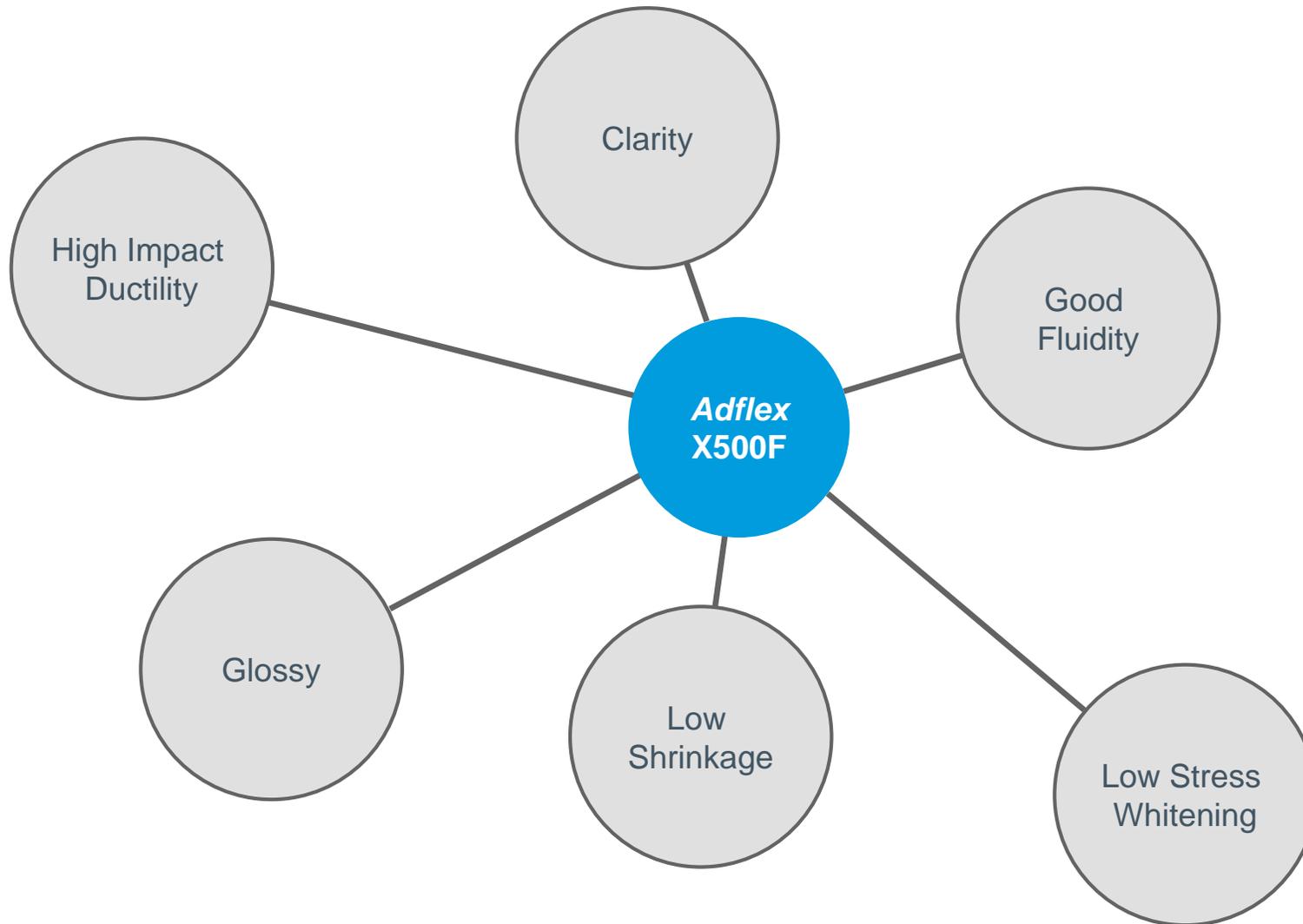


- Relative HIGH melting point (DSC)
- Relative LOW melting point (DSC)

\*Non phthalate version

# Clear impact modifier: *Adflex X500F*

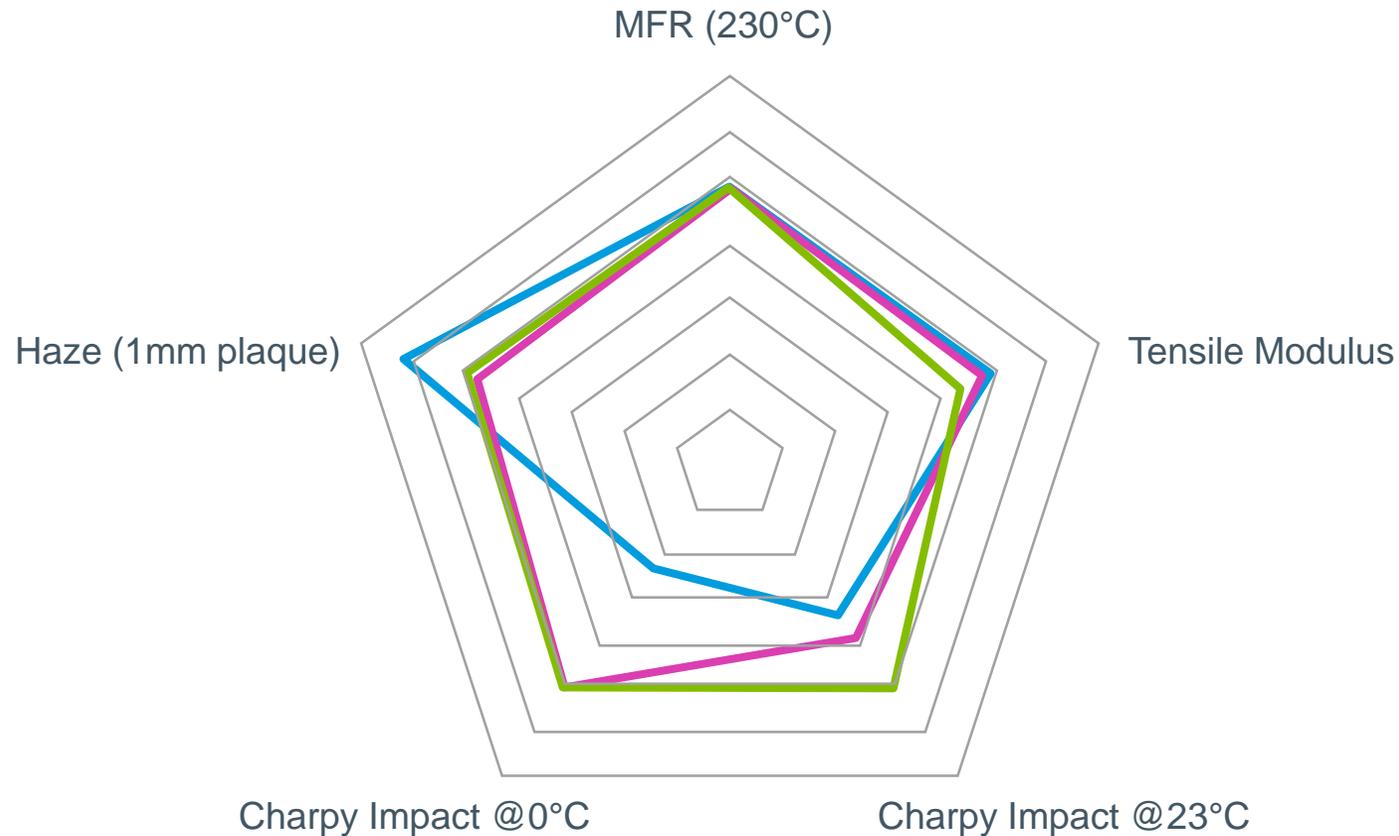
(Compound, Injection Molding)



	X500F
MFR	7.5 g / 10 min
Flexural Modulus	550 Mpa
Glass Transition temperature	-35°C
Izod -40°C	5 kJ/m <sup>2</sup>
Haze (1mm)	23
Shrinkage	0.5%

Source: LyondellBasell

# Impact modification of PP-Homopolymer for Injection Moulding application



- HP500N
- HP500N +10% X500F
- HP500N +15% X500F

**PP-Homopolymer *Moplen* HP500N 10 MFR modified with *Adflex* X500F**  
**The addition *Adflex* X500F improves significantly the clarity and impact performances of PP-Homopolymer**

## Applicative examples: *Adflex* resins as modifier

### *Adflex* X500F modifier in thermoformed trays:

- Transparency
- Dimensional stability
- Low stress whitening



### *Adflex* Q300F (soft touch) bottle outer skin

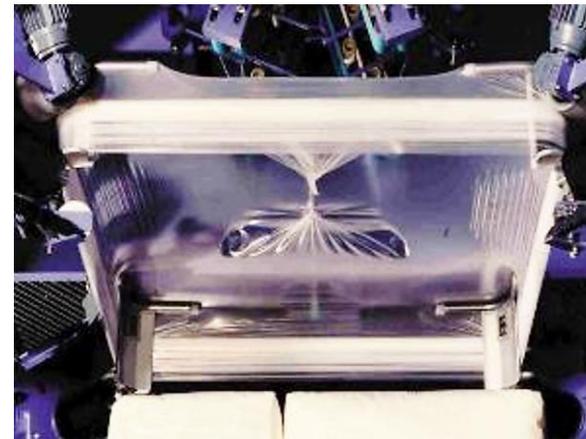


### *Adflex* C200F modifier in fresh produce packs:

- Transparency
- Flexibility



### *Adflex* Q100F modifier in industrial packaging (Impact resistance)



***Adflex* product range: advancing impact resistance, flexibility and aesthetics**

## Applicative examples: Soft-Touch applications

### Coextrusion (multilayers)

- Internal layer: PP Copolymer or HDPE
- External layer:
  - *Adflex* Q300F: best choice for soft touch
  - *Adflex* C200F: for glossy surface, and positive effect on stress whitening

### Monolayer

- PP copolymer + *Adflex* blends:
  - 50% *Adflex* Q100F + 50% PP Copolymer or
  - 80% *Adflex* Q100F + 20% PP Copolymer



**Blends with Random PP Copolymer for improved gloss & softness**

# Products from Catalloy technology

TEST METHOD	MECHANICAL		MECHANICAL						THERMAL			OPTICAL		Specific properties features	
	Density	Melt flow rate	Flexural Modulus	Tensile Stress at Break	Tensile Elongation at Break	Notched Charpy impact strength			Shore D Hardness	Tg DMTA	Heat Deflection Temperature HDT/B	Vicat Softening Temp. 10N	Gloss at 60° 1mm plate		Tm
	23°C	230°C/2,16 kg				23°C	-20°C	-40°C							
	ISO 1183	ISO 1133	ISO 178	ISO 527-1, -2	ISO 527-1, -2	ISO 179			ISO 868	Internal Method	ISO 75B-1, -2 (0.45 MPa)	ISO 306/A50	ASTM D2457		ISO 11357-3
UNIT	g/cm <sup>3</sup>	g/10 min	MPa	MPa	%	kJ/m <sup>2</sup>			Points	°C	°C	°C	-	°C	
<b>Catalloy Grades</b>															
<b>Adflex Q 100F</b>	0.88	0.6	100	10	500	NB	110	5	30	-25	40	60	85	142	Softness, flexibility, low temperature impact
<b>Adflex Q 190F</b>	0.88	0.6	100	10	400	NB	110	5	30	-25	40	60	-	142	Non phthalate version of Adflex Q100F
<b>Adflex Q 300F</b>	0.88	0.8	330	13	550	70	100	100	36	-45	50	78	35	163	Excellent stiffness- impact balance, low gloss, soft touch, high thermal resistance
<b>Adflex C 200F</b>	0.88	6	200	15	600	65	30	2	40	-20	41	80	-	142	Good softness and clarity
<b>Adflex C 290F</b>	0.88	6	200	15	600	70	15	2	38	-20	40	80	-	142	Non phthalate version of Adflex C200F
<b>Adflex X 500F</b>	0.89	7.5	550	22	700	65	45	5	46	-35	58	94	110	163	Good clarity and transparency, high gloss, high thermal resistance
<b>Adflex X 100G</b>	0.88	8	80	10	>600	NB	105	4	30	-25	40	56	-	142	Softness, flexibility, low temperature impact
<b>Adflex Z101H</b>	0.88	27	80	10	800	NB	100	2	30	-25	38	53	-	142	Very high flowability, high softness and high filler loading

NB=No Break N.A= Not Applicable

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