

PE film solutions for modern packaging

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SHAPING *the* FUTURE with PLASTICS

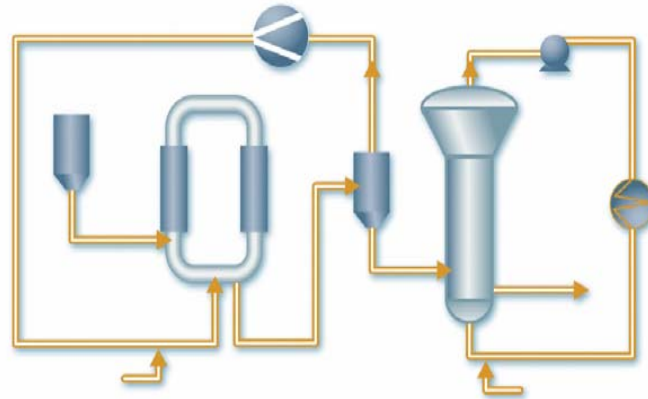
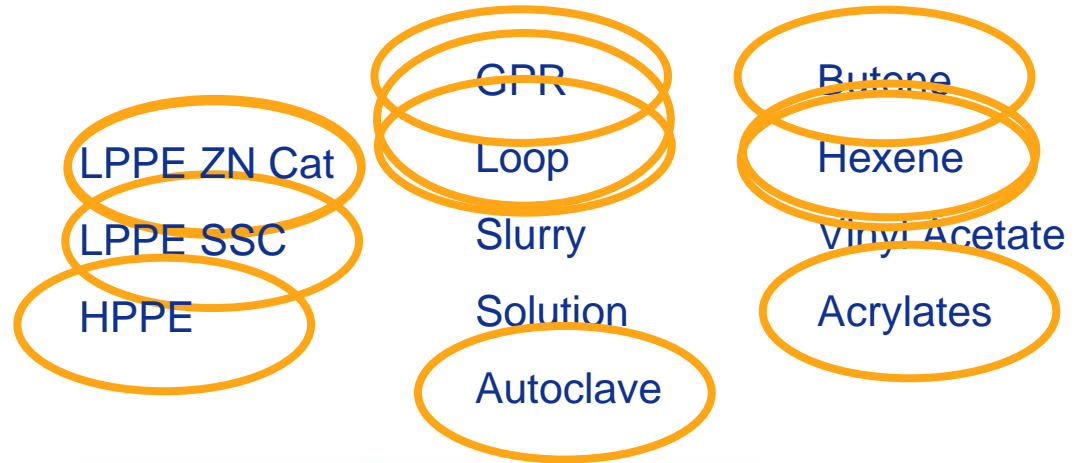
Market Dynamics

Needs	Technology
	Solutions
Faster	Resin processability Film performance: Sealing, stiffness Machine developments
Cheaper	Thinner films with better performance New packaging solution Material replacement
Nicer	Print quality and optical performance Laminated structures
Environment	Material reduction per unit packed Energy consumption per unit packed
Safer	Reduced migration and taste/odour Limit package breakage

The involved technologies

Polymerisation

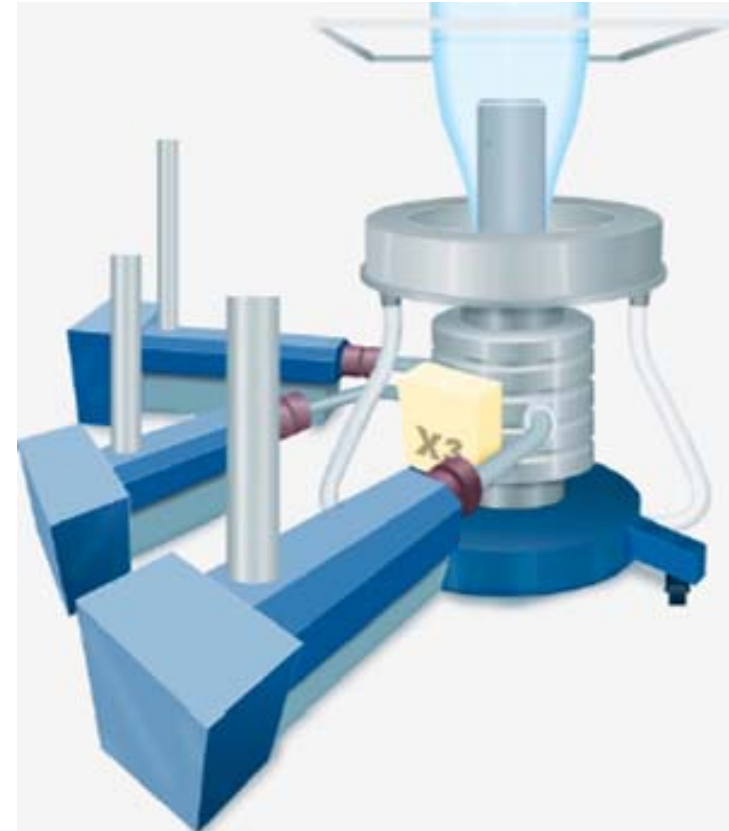
- Catalysts
- Reactor configuration
- Comonomer
- Additives



The involved technologies



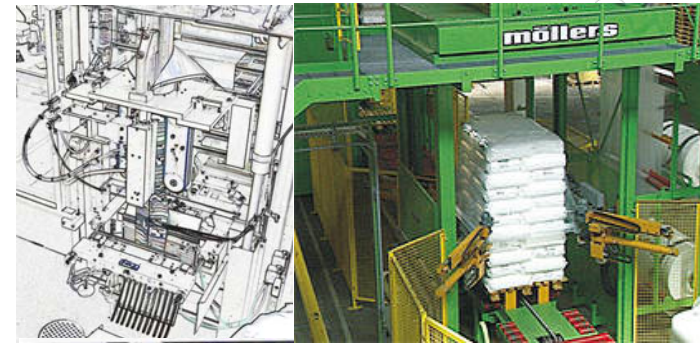
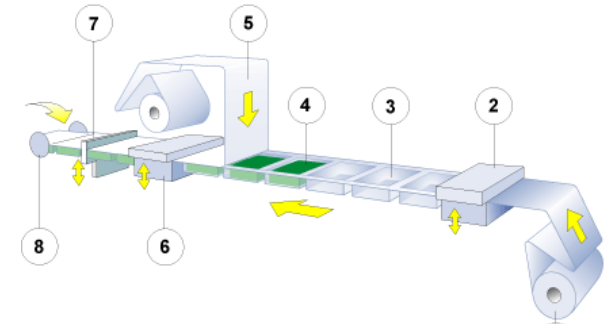
- Die design
- Co-extrusion
- Thickness control
- Tension control
- Surface treating
- Post orientation
- Material combinations:
- LDPE
- LLDPE/mLLDPE
- Borstar LLDPE
- HDPE
- PP



The involved technologies



- Printing
- Lamination
- Bag making
- VFFS
- HFFS
- Wrapping
- Sealing
- Vacuum-formers
- Palletisers
- Shrink tunnels



Borstar enhanced LLDPE products

	FB2230	FB4230	FB4250T	FB2310	FB4370	FB1350
MFR ₂ [g/10 min]	0.2	0.4	0.4	0.2	0.4	-
MFR ₂₁ [g/10 min]	22	40	40	20	40	15
Density [kg/m ³]	923	923	925	931	937	935
Vicat softening point	104°C	104°C	102°C	108°C	110°C	109°C
DSC melting point	124°C	124°C	124°C	127°C	128°C	128°C

New Borstar Products

- FB4250T
 - => Transparency as low MFR LDPE
 - => Easy processing and excellent draw down
 - => Applications: monofilms, carrier bags, pouches
- FB4370
 - => Increased stiffness with good toughness
 - => Easy processing and reduced melt pressure
 - => Applications: coex films, FFS packaging, lamination
- FB1350
 - => Medium density with semi high Mw
 - => Applications
 - 1) Geomembranes
 - 2) MDPE for high neck extrusion and also blends and coex

mLLDPE (“Single site LLDPE”)

Properties in film applications: typical features

mLLDPE gives better adhesion to PP than Z-N LLDPE

+ High dart drop

+ High strength

+ Low haze

+ High clarity

+ Low extractables

+ Good organoleptics

+ Low uniform melt temperature

+ Low heat seal temperature

– High viscosity

– Low output and high process pressures

Borecene mLLDPE film products

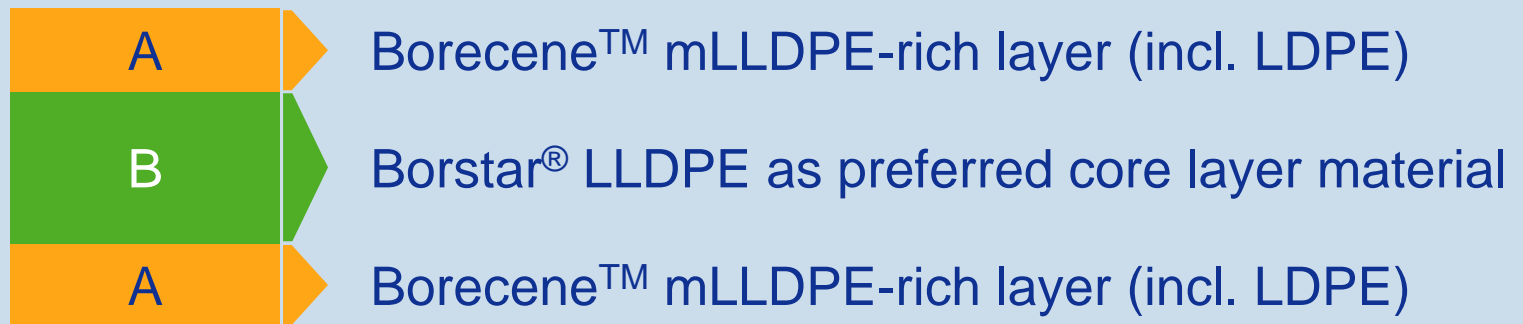
- FM5220 (1.3 / 922)
- FM5270 (1.3 / 927)
- FM5340 (1.3 / 934)
- FM5226 (1.3 / 922), Slip+AB
- FM5276 (1.3 / 927), Slip+AB



Borecene™ mLLDPE and Borstar® LLDPE in coextruded structures

An excellent combination for flexible packaging!

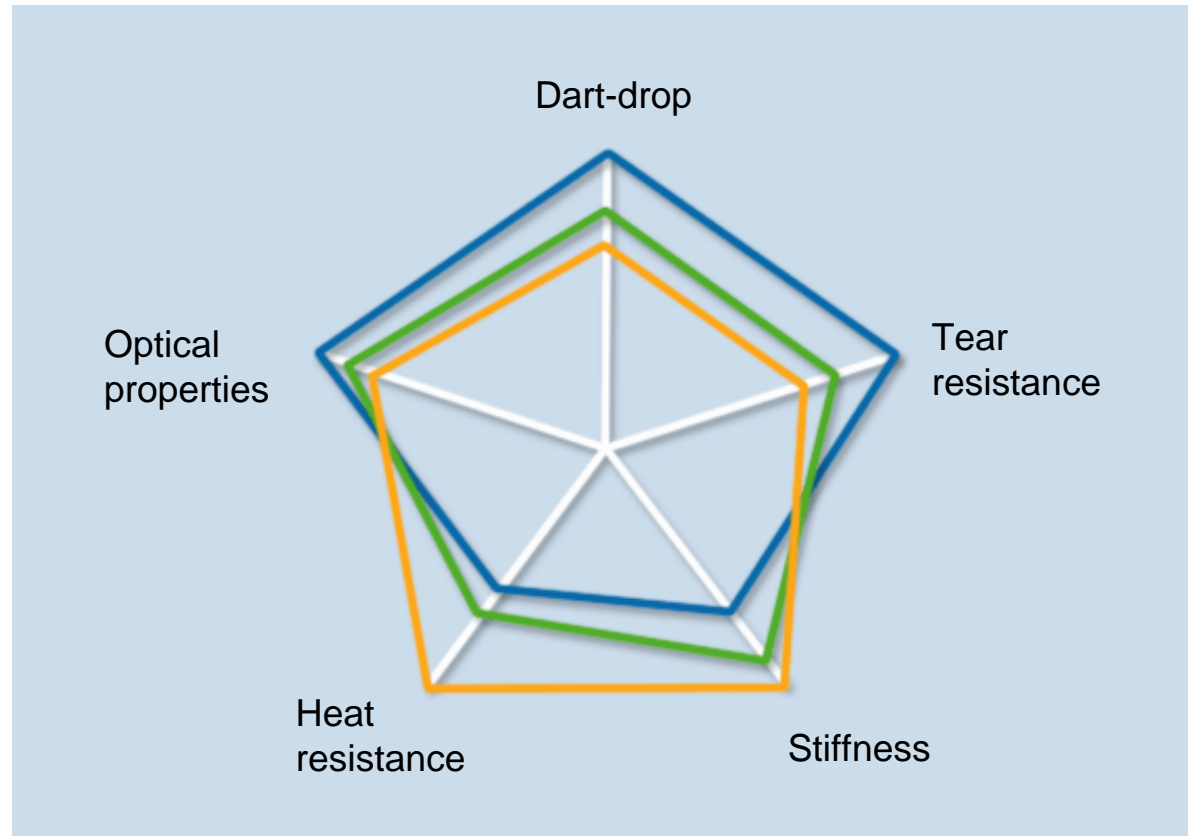
- High clarity and gloss
- Extrusion of mLLDPE rich films with excellent bubble stability!
- Excellent sealing & high strength



Although all Borecene coex. films exhibit excellent properties ...

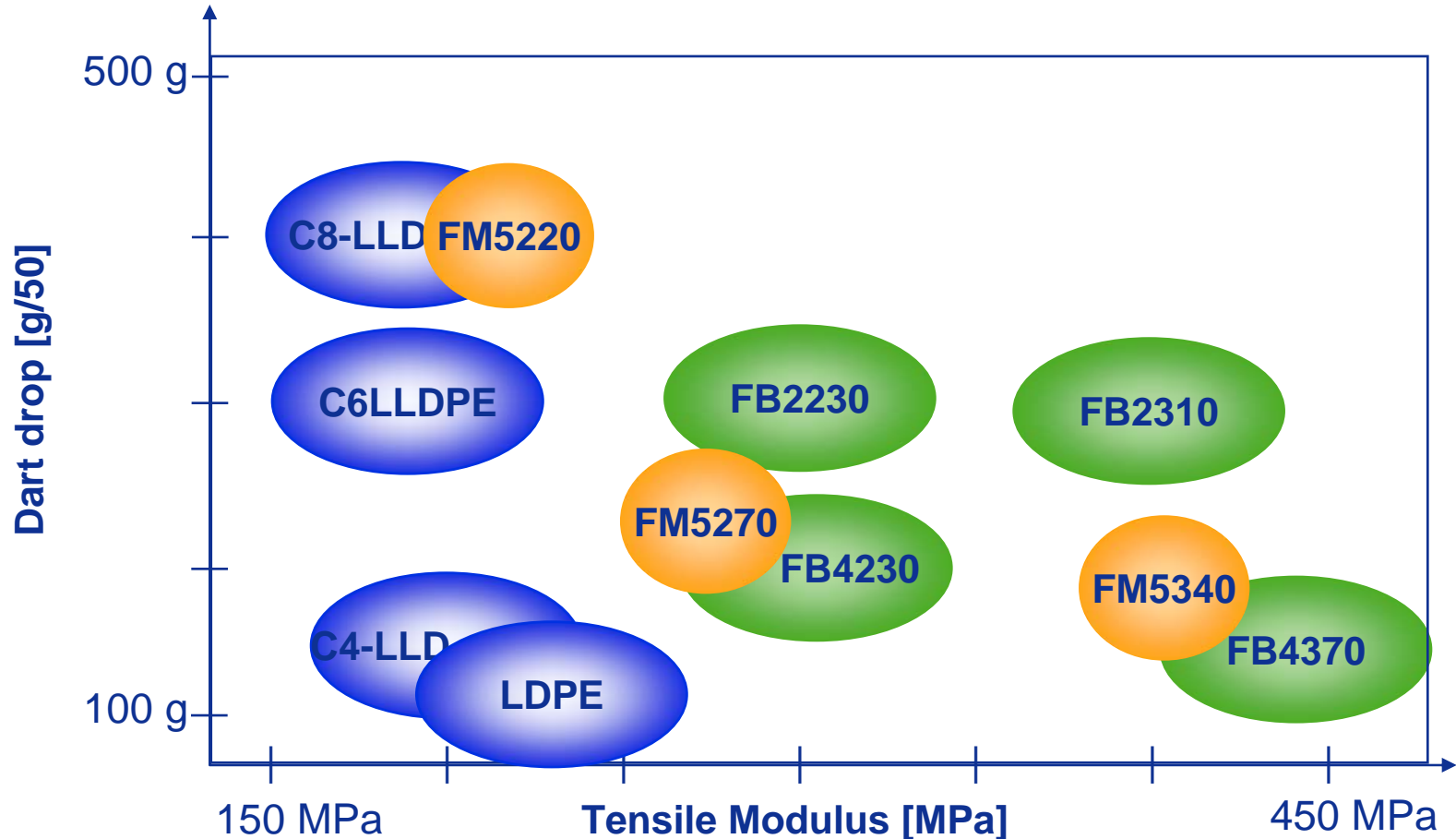
- ... Fine-tuning can be achieved by selection of main core layer material
- Main component core layer:

- Borstar LLDPE (FB2230)
- Unimodal HDPE VL5580
- PP: Borclear™ RB707CF



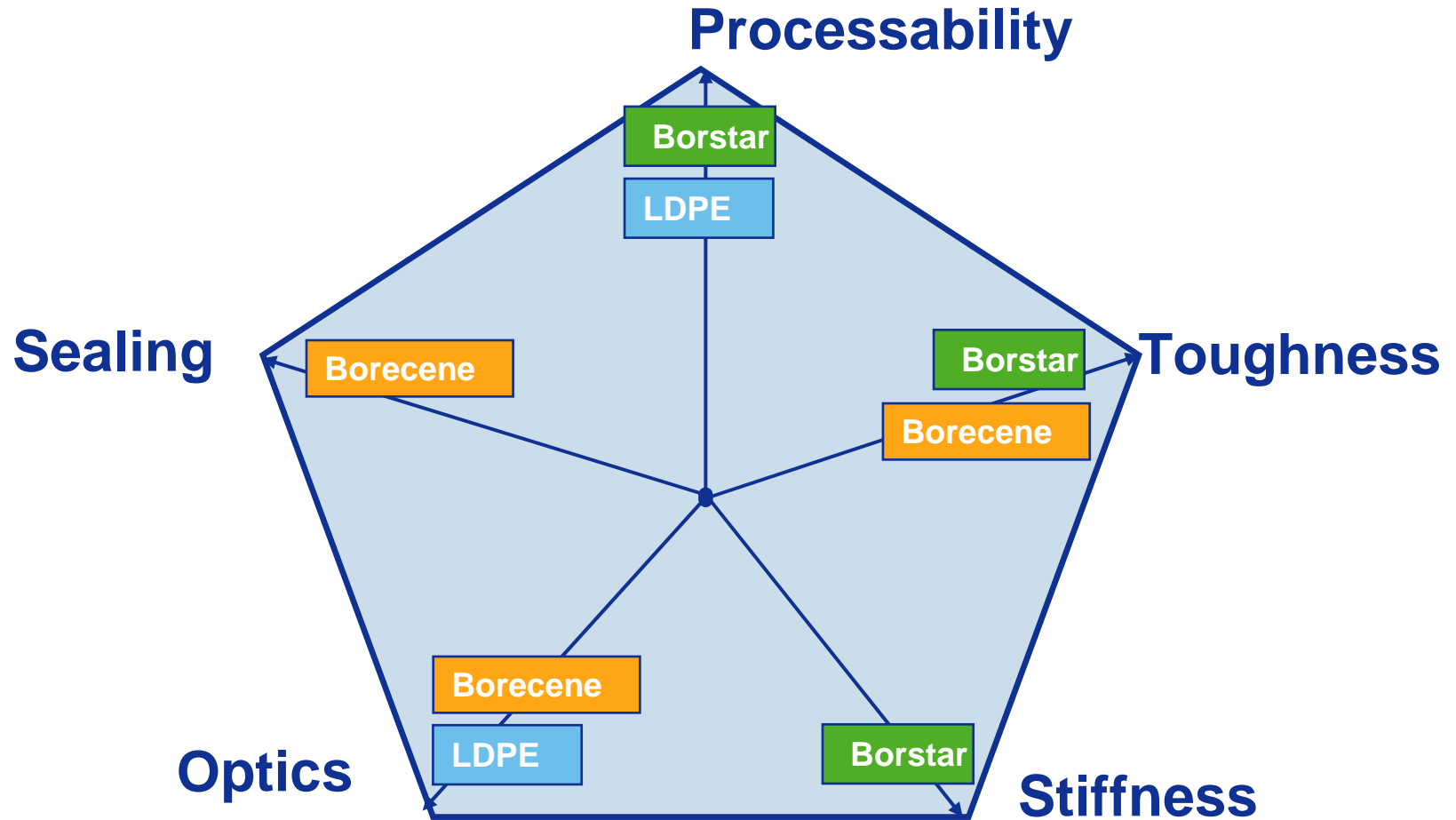
Tailoring the balance of properties

impact strength vs. stiffness for 40µm monofilm



Key properties @ customer

How to enhance them?



Example : Shrink films

- Tubular and flat printed and non-printed
- Hoods and collation
- Transport protection or point of sale



Key advantages with Borstar

- Low hot shrink force
 - No hole burning
- High cold shrink force
 - Collation and holding forces
- Strength / toughness
 - Less puncture with sharp edges
- Stiffness
 - Film handling and printing
- Matt surface
 - Easy to open and install

Borstar Mono Solutions

- Borstar FB2310/FB4370 in blends with LDPE
- FB4250T with high BUR

Borealis Coex Solutions

- 3 Layer ABA films
 - A layer = Borecene + LDPE
 - B layer = Borstar + LDPE
 - High gloss film with good mechanical and shrink properties

Packaging technology + PE innovation

EBA - Stretch hood film solutions

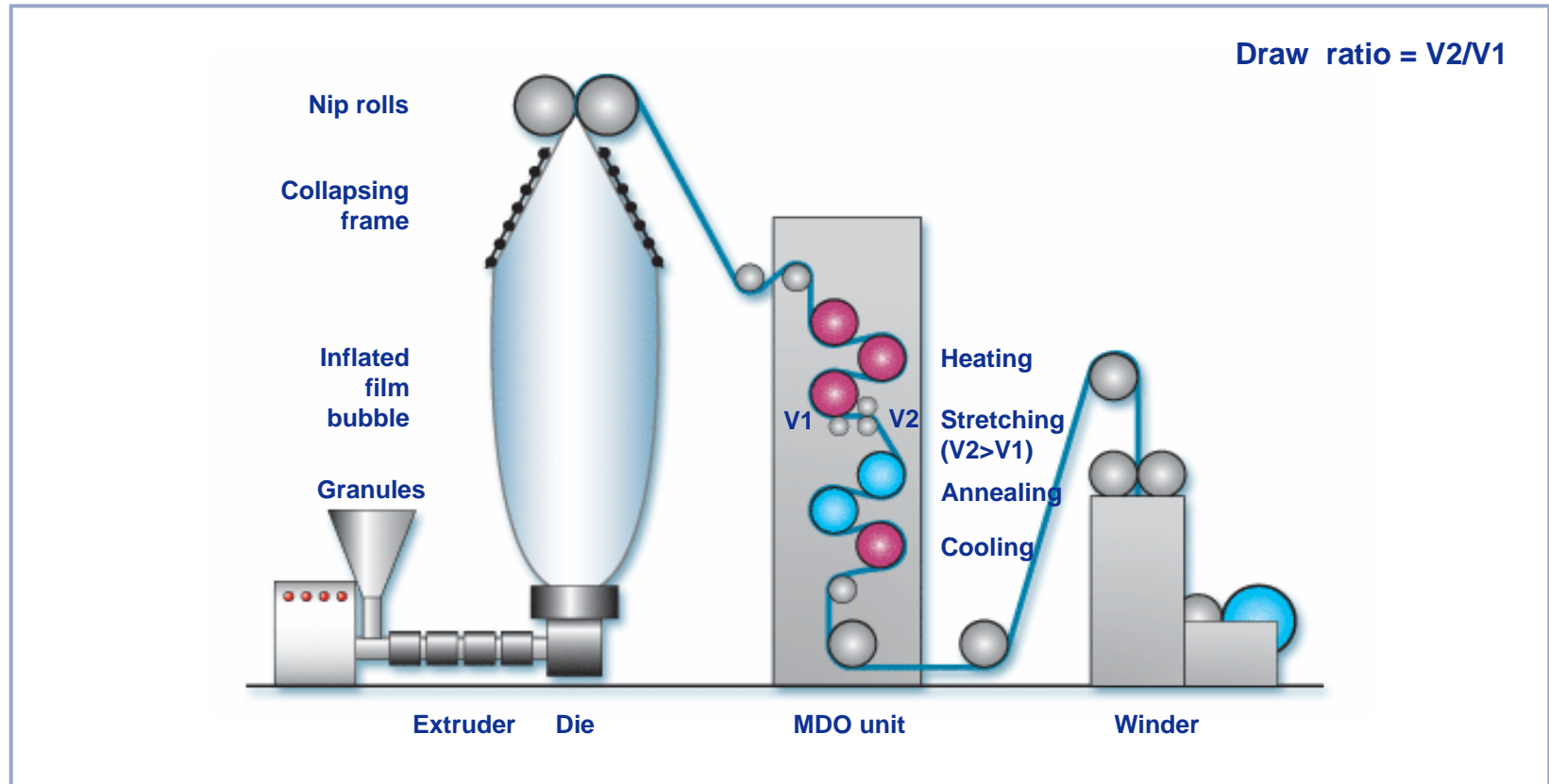
- Film elasticity !
- Tear resistance !
- Puncture resistance !
- Good optical properties !
- Bundling/holding force !

- Solutions
- **Co-extruded films**
- **EBA copolymers**
- **Borecene / Borstar**



Processing + PE Product innovation

MDO Films



High Impact Strength and Stiffness

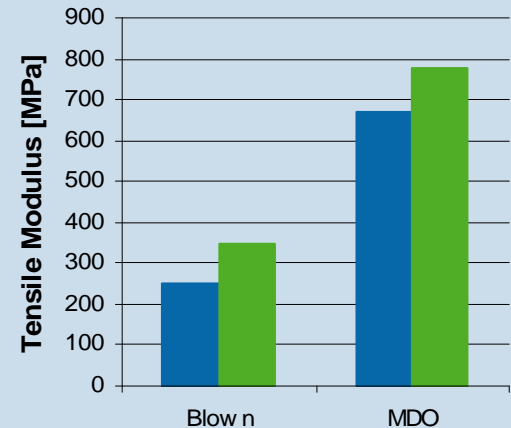
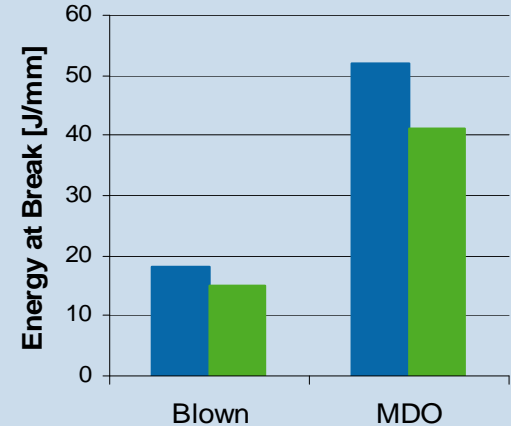
- Dynatest (DIN 53373)
- Energy at break

=> Increase 3-4 times

- E-Modulus (ISO 527)

=> Increase 3 times

=> Balanced in MD/TD

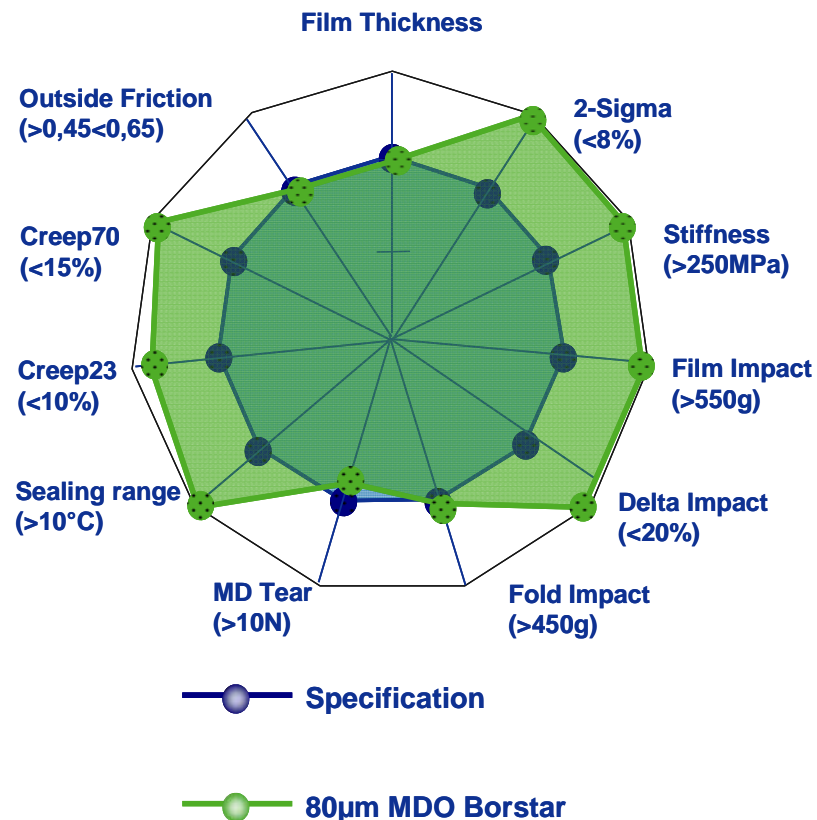


Better – Higher – New standards !

- Tensile strength
- Stiffness
- Toughness
- Optical properties
- Co-extruded formulations
- Package performance
- Less material consumption
- Creep resistance
- Packaging line speed
- Less package breakages
- Less product waste
- Product display
- Attractiveness
- Easy tailoring of properties

Properties of 80µm Shipping Sack

Property	150µm Spec	80µm OPE
Film thickness	100 %	80 µm
2-Sigma	< 5 %	3,1 %
Stiffness TD	> 350 MPa	520 MPa
Film Impact	> 550 g/50%	590 g/50%
Fold Impact	> 450 g/50%	500
Static COF	> 0,50	0,51
MD Tear	> 7 N	7,8 N
Sealing Range	> 10 °C	20 °C
Creep 23°C	< 10 %	5,0 %
Creep 70°C	< 15 %	4,2 %



Meets all specified requirements!

New MDO Application Opportunities



Shipping sacks



Stand Up Pouches



Candy Wraps



Courier/security envelopes



Compression Packaging



Lamination films



Magazine Wraps



Breathable films



Labels

.... And more

Technology innovations and solutions

A key technology driver for success

	Standard	Enhanced	Differentiated
HDPE	Unimodal	Bimodal	BorDry XFL0503 High Clear XF0601
LDPE	AC, Tub	Himod	EBA Stretch Hood
LLDPE		Borstar	Specialities
mLLDPE		Borecene	BorPlus

Thank you for your attention



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