BOREALIS

SHAPING *the* FUTURE *with* PLASTICS

Copyright © 2005
Borealis A/S

BOREALIS
SHAPING *the* FUTURE *with* PLASTICS

New PP Materials for Cast- and Blown Films

FEST.A CROPAK 2008
National Park “Plitvice Lakes” / Croatia
May 15 – 17, 2008

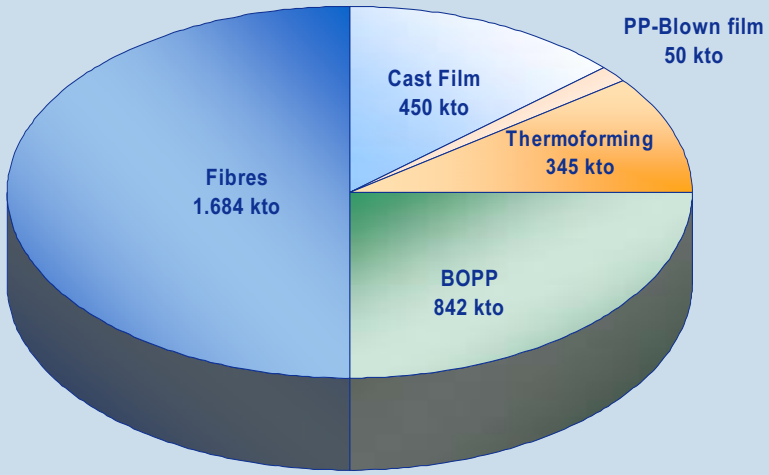
Presented by
Stefan Ortner
Technical Service & Market Development
Business Unit Film & Fibre
Borealis Polyolefine GmbH

BOREALIS
SHAPING the FUTURE with PLASTICS

Copyright © 2005
Borealis A/S

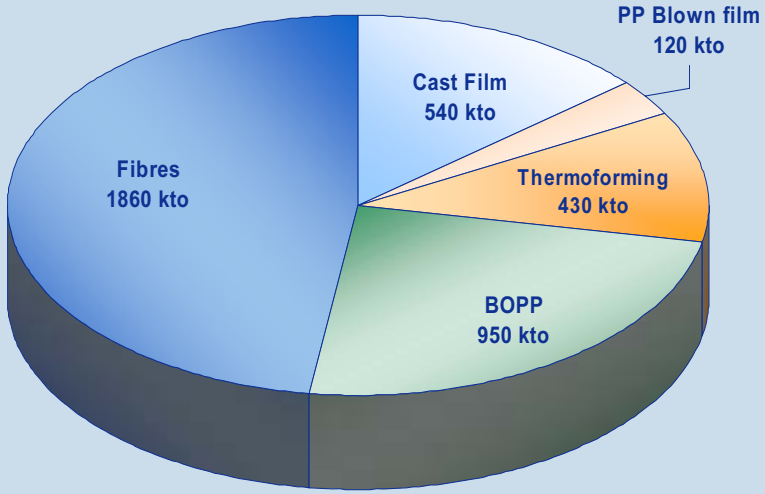
Market Analysis PP Extrusion 2004 – 2009

2004



Total PP Extrusion: 3.371 kto

2009



Total PP Extrusion: 3.900 kto

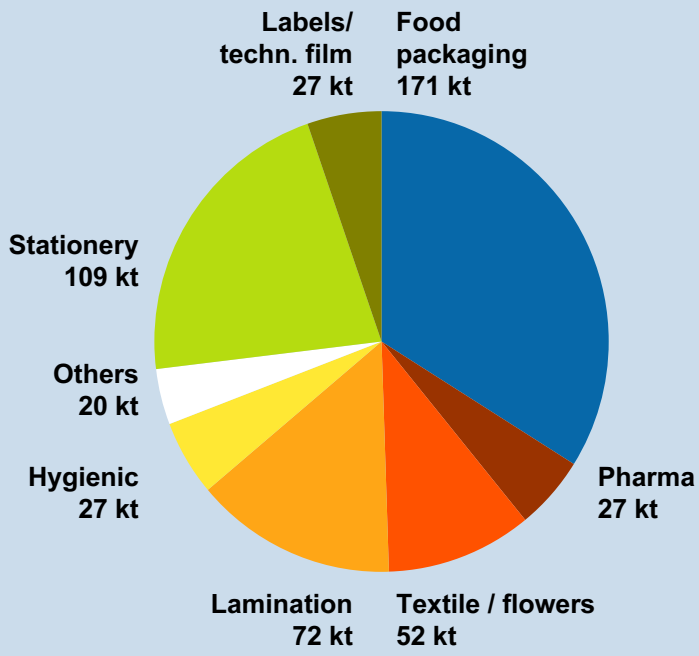
Average Annual Growth Rate Extrusion: +2,87 %

PMRG June 2005

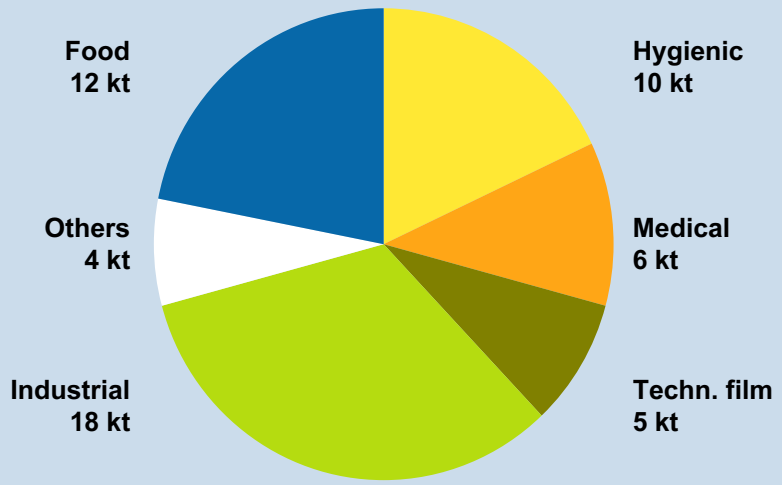
Copyright © 2005
Borealis A/S

PP Blown Film represents today around 10% of the non-oriented PP film market – but is growing extremely fast

Non-oriented PP Film market 2006 (505 kt)



PP Blown Film market 2006 (55 kt)



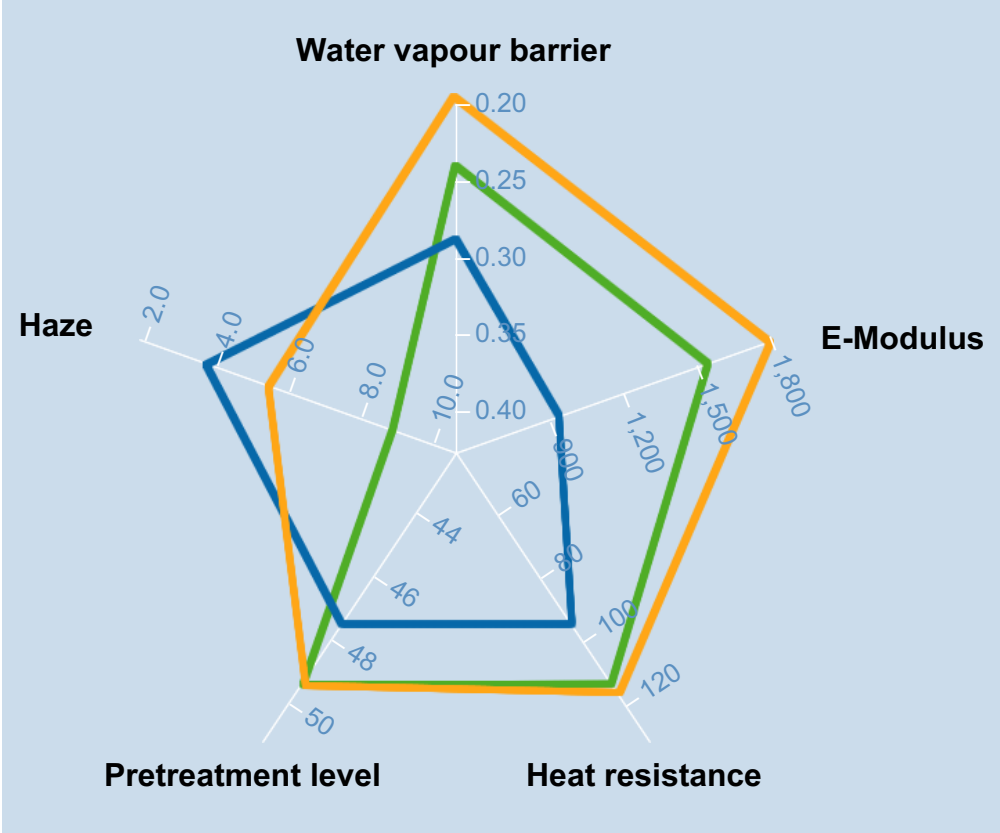
Growth rates: PP Cast Film: ~ 4% / year
Growth rates: PP Blown Film: > 15% / year

Copyright © 2005 Borealis A/S

Benefits of Bormod™ (- high crystalline PP Homo)
Benefits for cast film applications

Main Benefits

- stiffness
- heat resistance
- water vapour barrier
- pre-treatment level



– standard PP

– existing high cristallinity PP

– **Bormod ® HD915CF**
(Borstar technology)

Copyright © 2005
Borealis A/S

Current Application Advances

Bormod ™ HD915CF

- **Food Packaging**

  For cheese packaging: as heat resistant, high stiff layer

  For twist films: as stiff core layer, sometimes as outside coex layer for metallization

- **Label films / paper substitution**

  For transparent and opaque labels and paper substitution

- **Stationery film**

  For index / register films and the back side of folders

- **Hygienic films**

  As base for the grip closure films / systems

- **Generally: Downgauging of many different films (up to 30% possible)**

Copyright © 2005
Borealis A/S

New Application can be realized with the new PP-innovations

Bormod™ / Borclear™

Twist Film

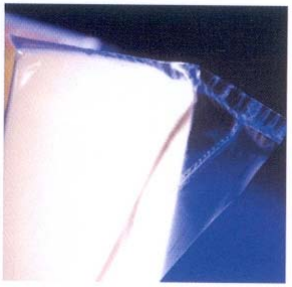
Bormod™

Labels

Bormod™ / Borclear™ / Borseal™

Metallisable BOPP + PP-Cast Film

Bormod™ / Borclear™ / Borseal™

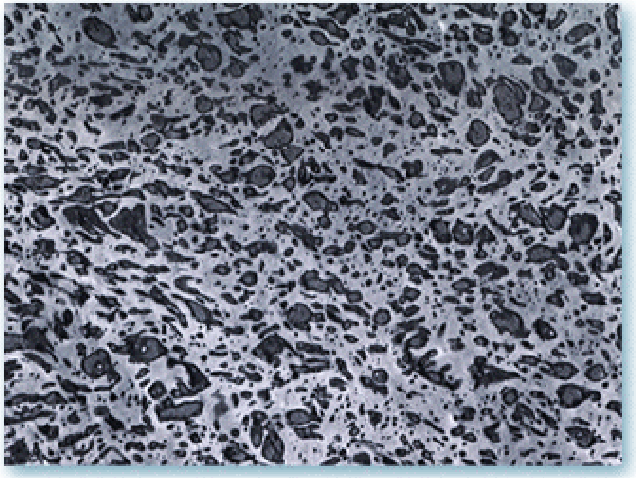


New food + lamination films

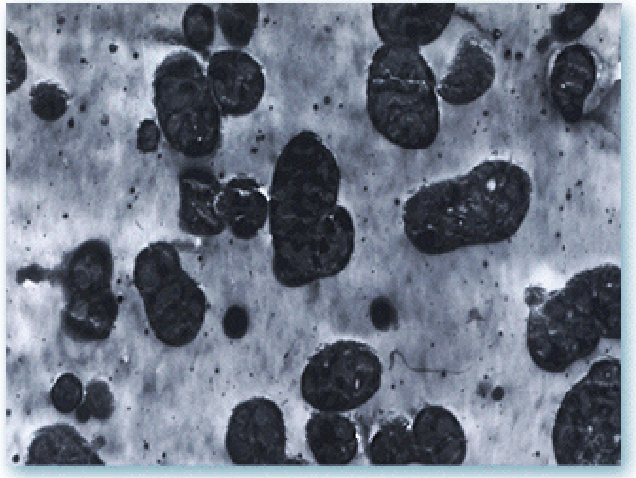
Copyright © 2005
Borealis A/S

Structure Picture: Random-Heterophasic Co-polymers (Borsoft™) & Heterophasic Copolymers

Borsoft™

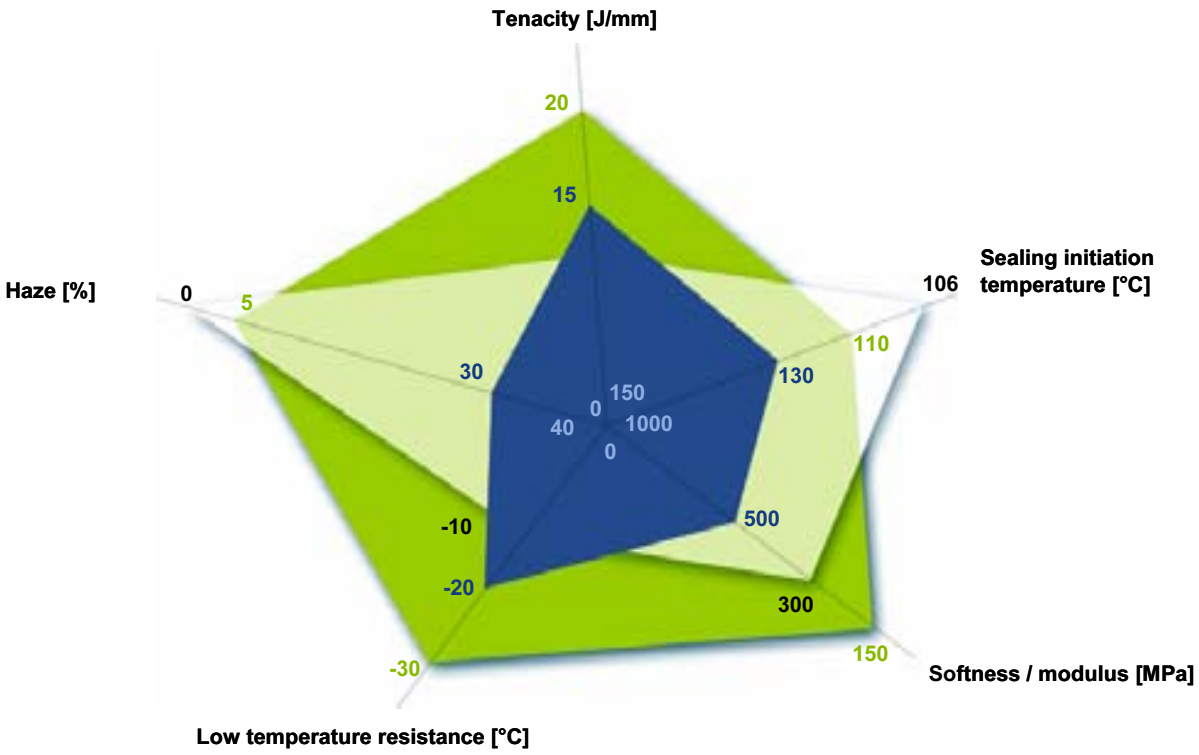


Heterophasic Copolymer



Copyright © 2005
Borealis A/S

Borsoft™ – Soft PP-copolymer



- Film Heco, 12 mol % C_2 (Borealis BD212CF)
- Randomcopo, 8 mol % C_2 (Borealis RD208CF)
- Borsoft™ SD233CF

All values measured at 50 µm films

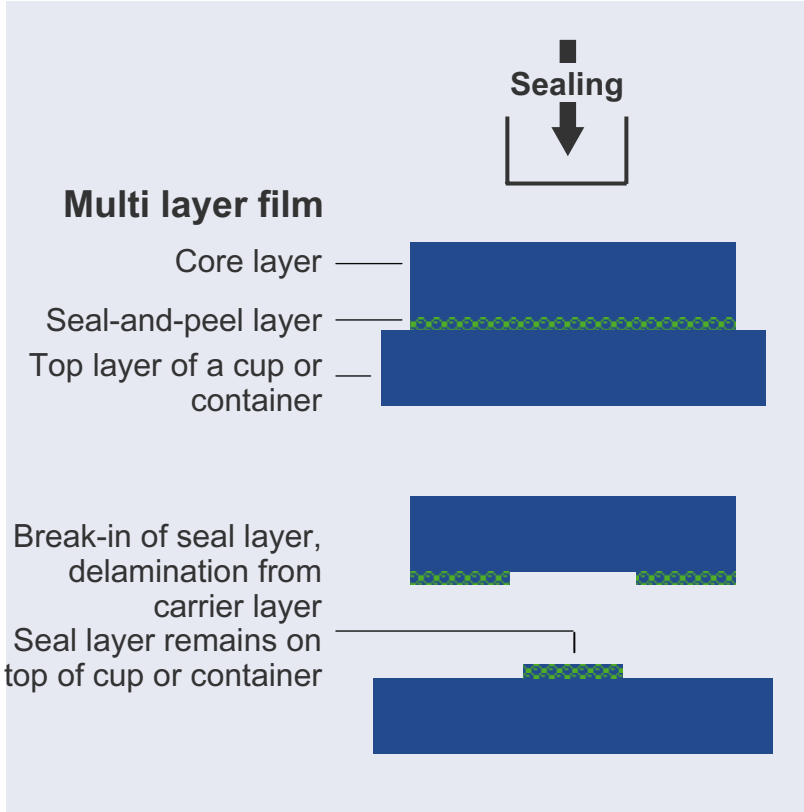
Copyright © 2005 Borealis A/S

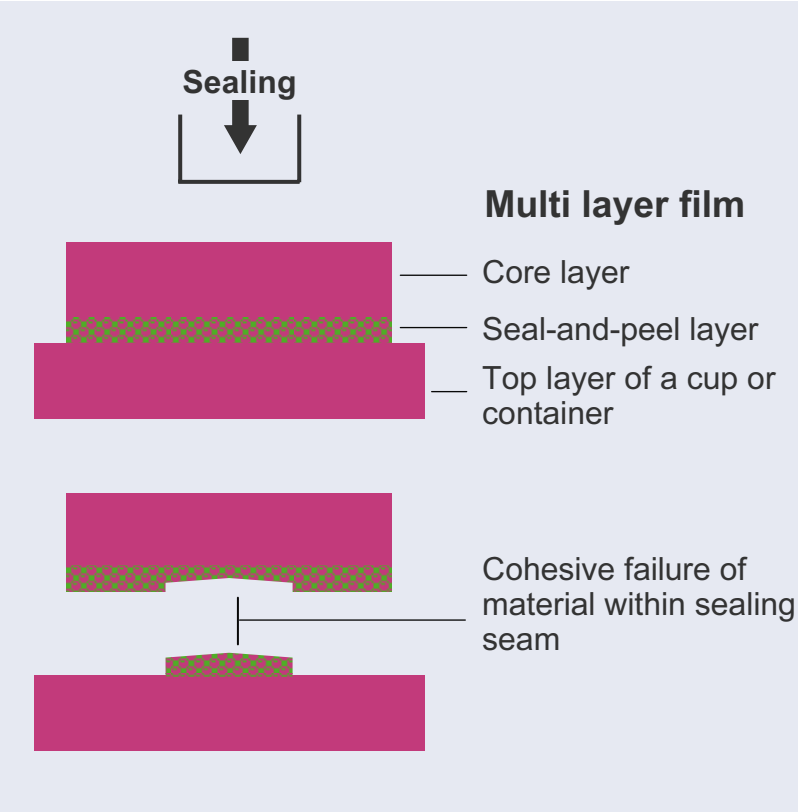
Sterilisable peelable lid/tray packagings

Copyright © 2005
Borealis A/S

Comparison of peel principles

Cohesive and adhesive peel systems





Copyright © 2005
Borealis A/S

BorPure - the new PP-Randoms for Cast Film applications

„GLASS ALIKE FILMS EVEN WITH HIGH SOFTNESS“

Economics and Aesthetics

- Orange peel free at highest output rates
- Excellent clarity and gloss on multilayer films

Processability

- Improved sealability due to broadening of the sealing range and lowering of the sealing initiation temperature

Target markets

- Medical films, soft technical films for automotive and lamination, special food packaging, used as sealing layer

Copyright © 2005
Borealis A/S

BorPure™ RE906CF & RE936CF

Features

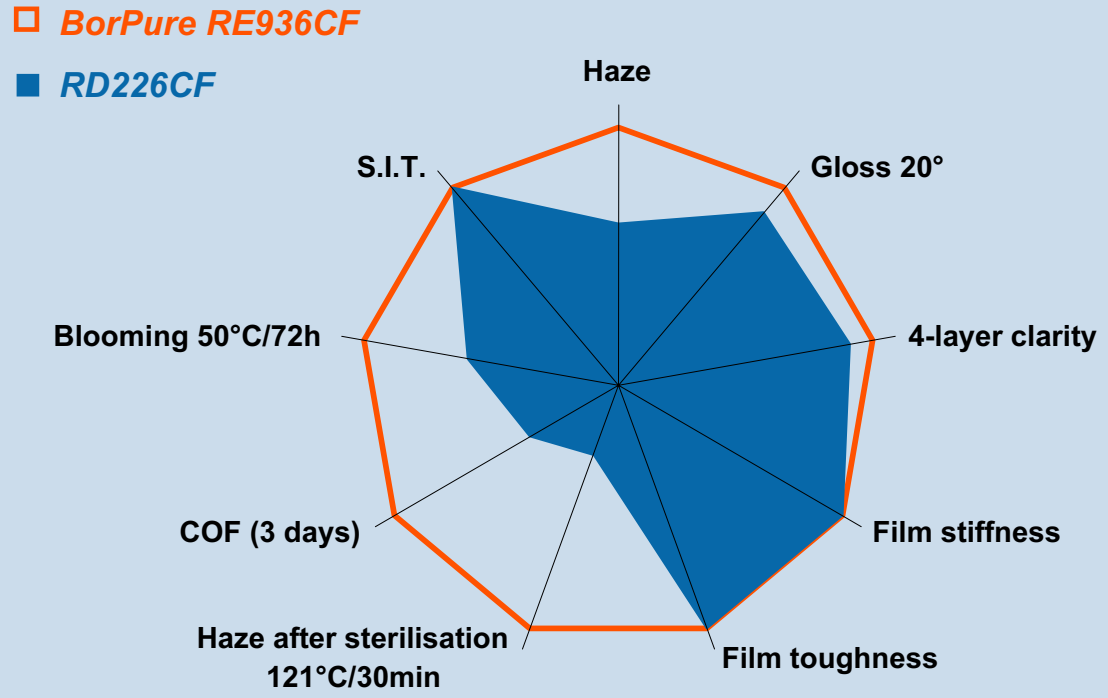
- Excellent organoleptics and purity
- Improved optical properties
- Lowe haze after sterilisation
- Fast slip agent migration – excellent winding behaviour
- Low / No orange peel effect even at high output rates

Target markets

- Medical film
- Food packaging
- Lamination film
- Advanced stationery
- DVD packaging

Copyright © 2005
Borealis A/S

New BorPure™ – Innovation boosts optical properties and processing speed



Film thickness 50µm

Copyright © 2005 Borealis A/S

BorPure™ RE909CF & RE939CF

Features

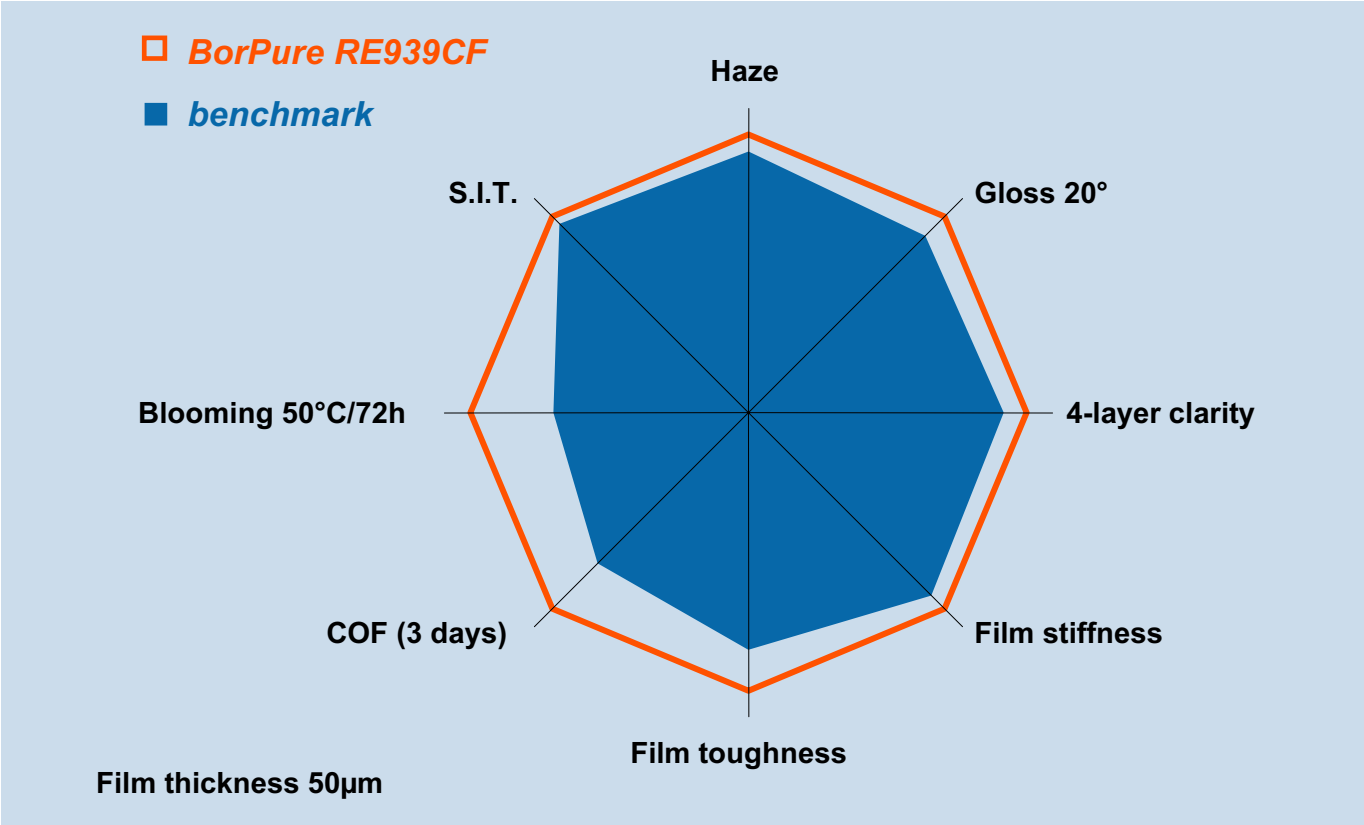
- Excellent organoleptics and purity
- Very low seal initial temperature (SIT)
- Broad sealing window
- Excellent optical properties
- High softness and toughness

Target markets

- Medical film
- Food packaging
- Lamination film
- High quality stationery film
- Sealing layer

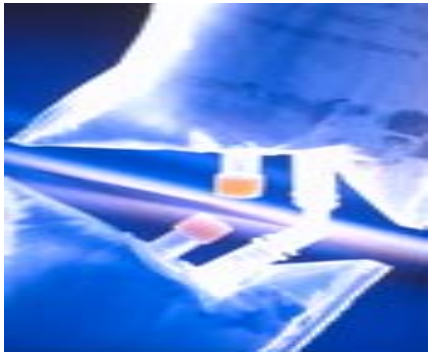
Copyright © 2005
Borealis A/S

New BorPure™ – Innovation boosts optical properties, sealing performance and toughness

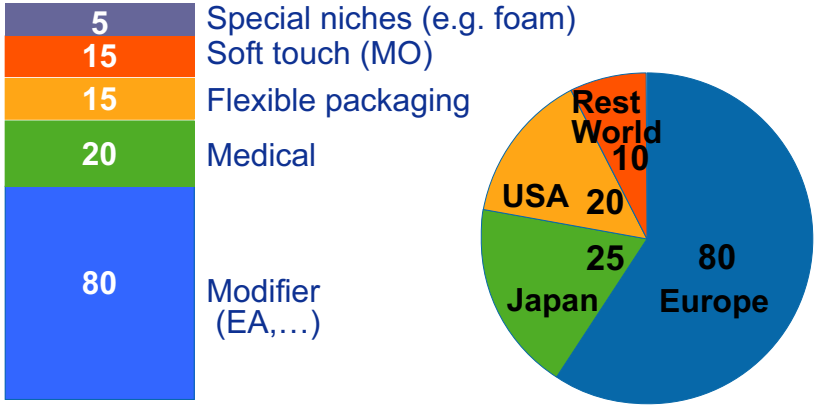


Copyright © 2005
Borealis A/S

Soft PP is a global speciality business

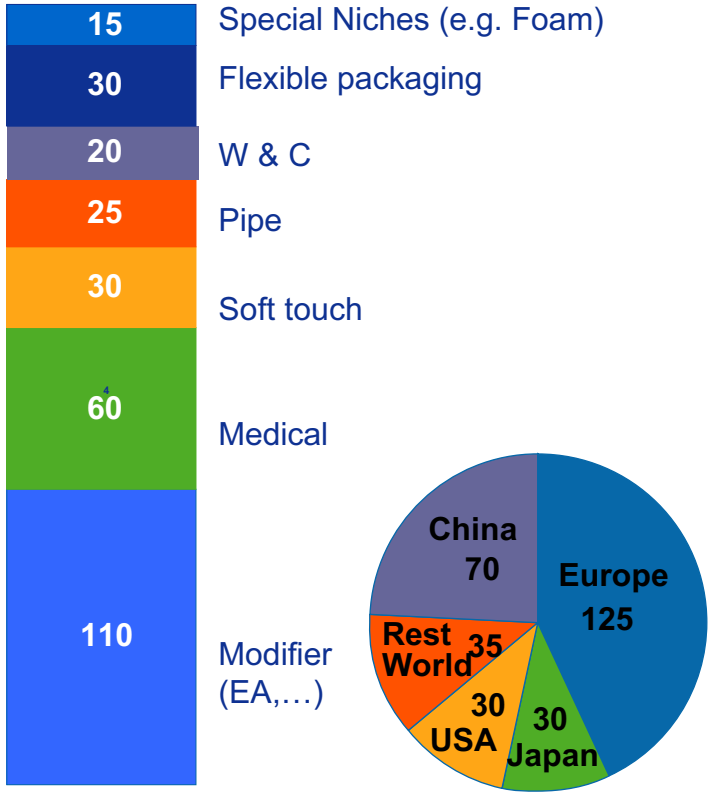


135 ktons



Global consumption 2005

290 ktons



Global consumption 2015

Copyright © 2005 Borealis A/S

Next Borsoft™ generation delivers a new dimension in softness and high transparency PP

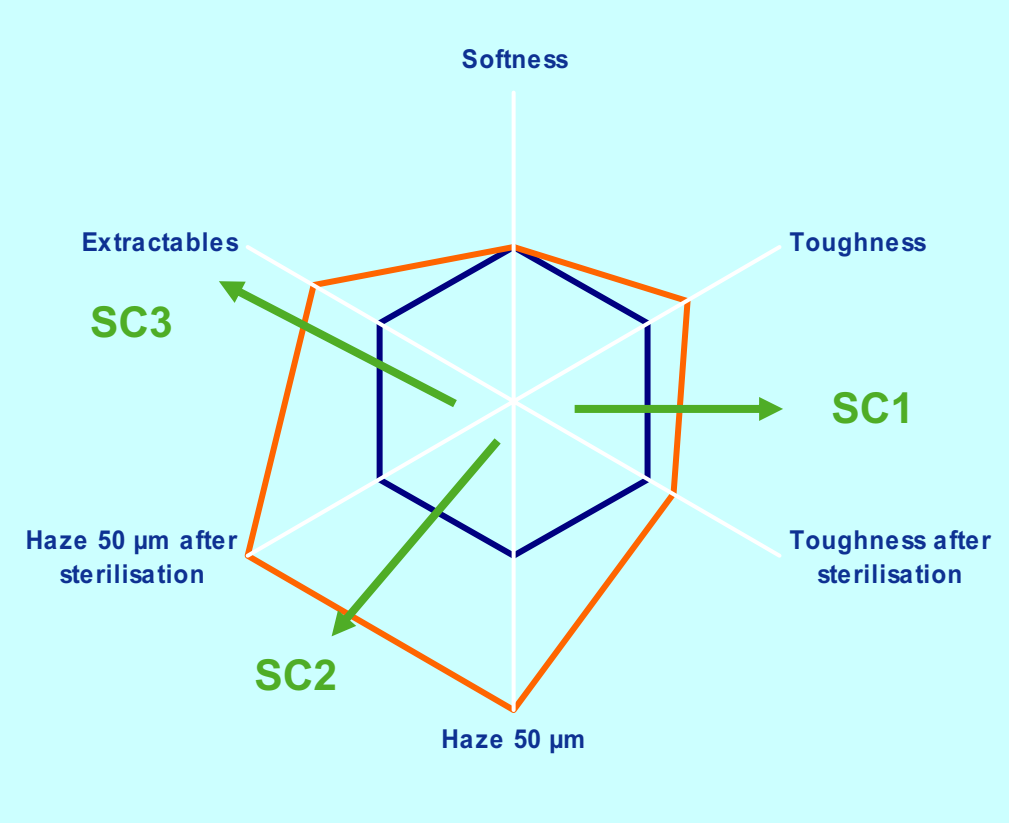
New Borsoft™ Raheco generation

For combining softness
with highest toughness -
before and after sterilisation
e.g. for medical pouches,
sterilisable food packaging, …

…and superior optics!!!

Copyright © 2005
Borealis A/S

A new class of highly transparent, sterilisable and soft materials will enable new application step changes



- *Current PP plastomers*
- *New Borsoft™ , Bormed*

Step change 1 (SC1)

High toughness after sterilisation

Step change 2 (SC2)

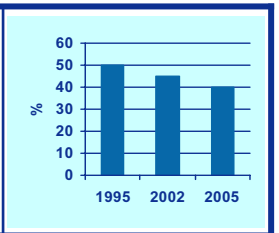
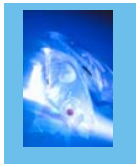
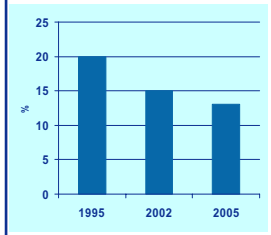
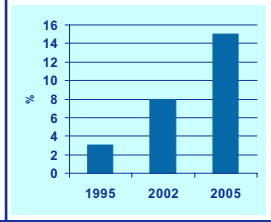
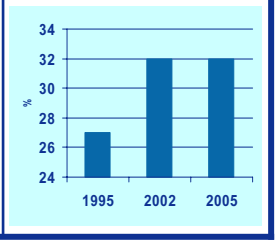
Excellent optical properties before and after sterilisation

Step change 3 (SC3)

Combination of softness, toughness and optics with low extractables & high purity
=> new Borstar® PP6 plant and new, proprietary catalyst

Copyright © 2005 Borealis A/S

Market is looking for alternatives to glass and PVC

	Main Players	Trends	Global Market Trend
Glass Bottle		In the process of being substituted. No development.	
PVC Pouch 	Solvin Ineos Norsk Hydro	Reduction of the product range for medical applications (pharmacopeia approved). Healthcare is not target market. Environmental pressure.	
PP-Pouch	Basell Borealis	Small, but highest growth rates 3 layer and 5 layer films	
EBM PO	Basell Borealis	Mature market, no further development anticipated. Technological limits reached. Expected to be defensive, e.g. by reducing price. In the US, LDPE is no longer material of choice.	

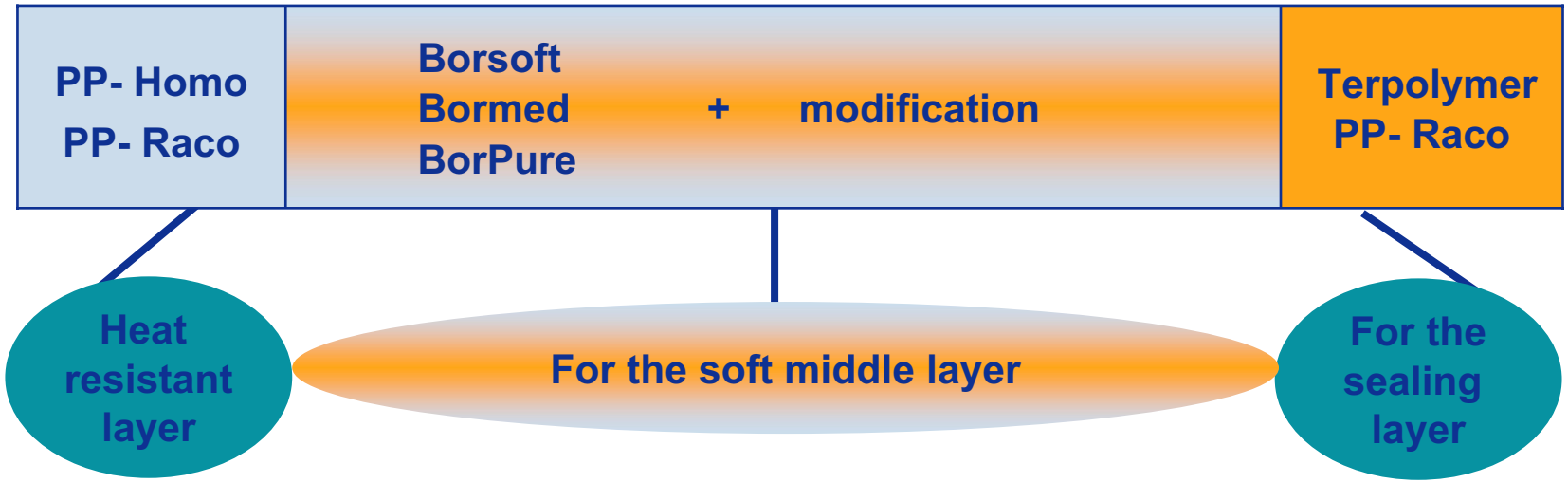
BNT ISBM for Health Care

Copyright © 2005 Borealis A/S

Our solutions approach:
New soft polymer innovation & dedicated medical grades

For the primary & secondary pouch & tubings

Coextruded film solutions:



Copyright © 2005
Borealis A/S

Borpact BC918CF – the versatile grade fulfills unmet market needs

Cast Film

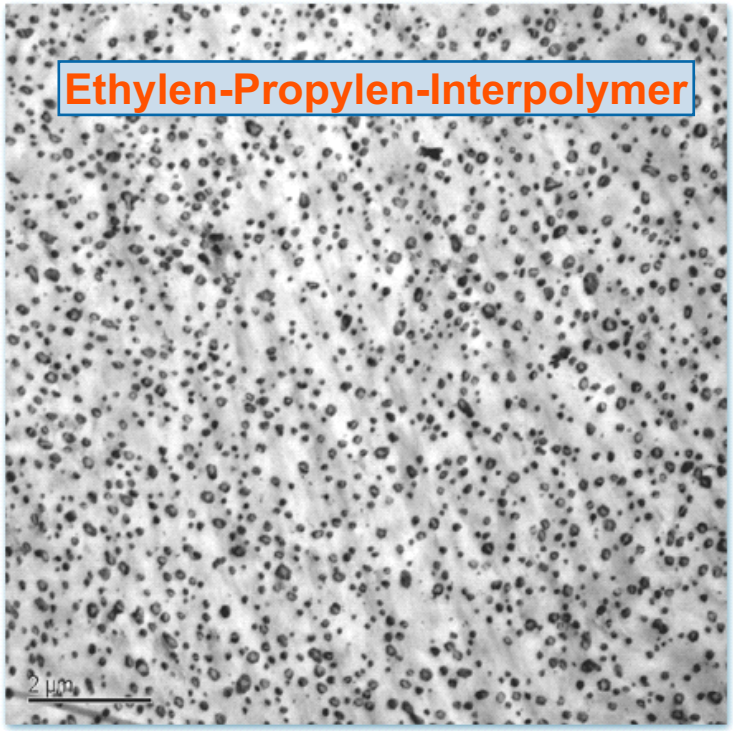
Blown Film

Thermo forming

- Stiff as a PP Homo
- Impact as a PP HECO
- Transparency as a PP Random
- Processability as e.g. PS, PE

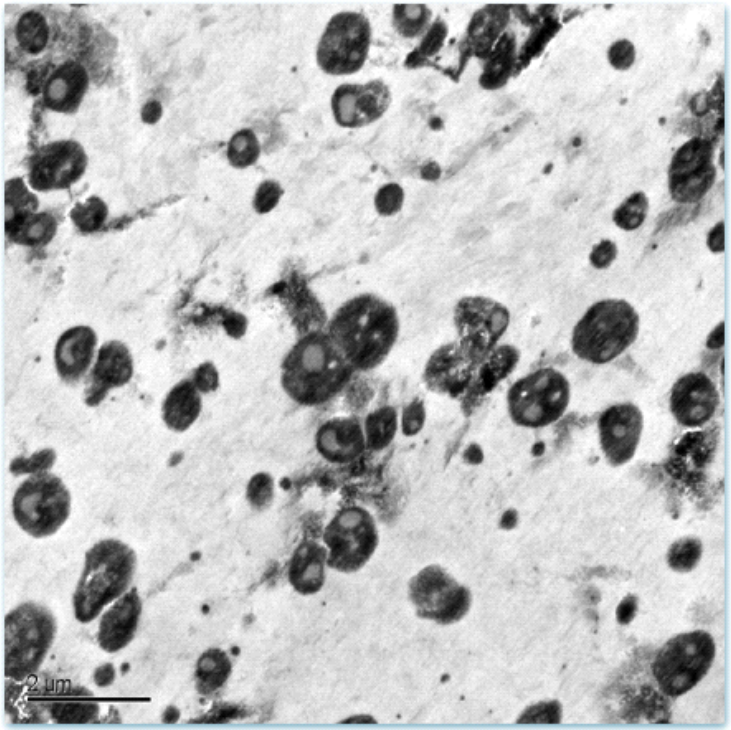
Copyright © 2005
Borealis A/S

The key to high transparency in impact PP
Design of the microstructure



x 10,000

Transparent



x 10,000

Mat

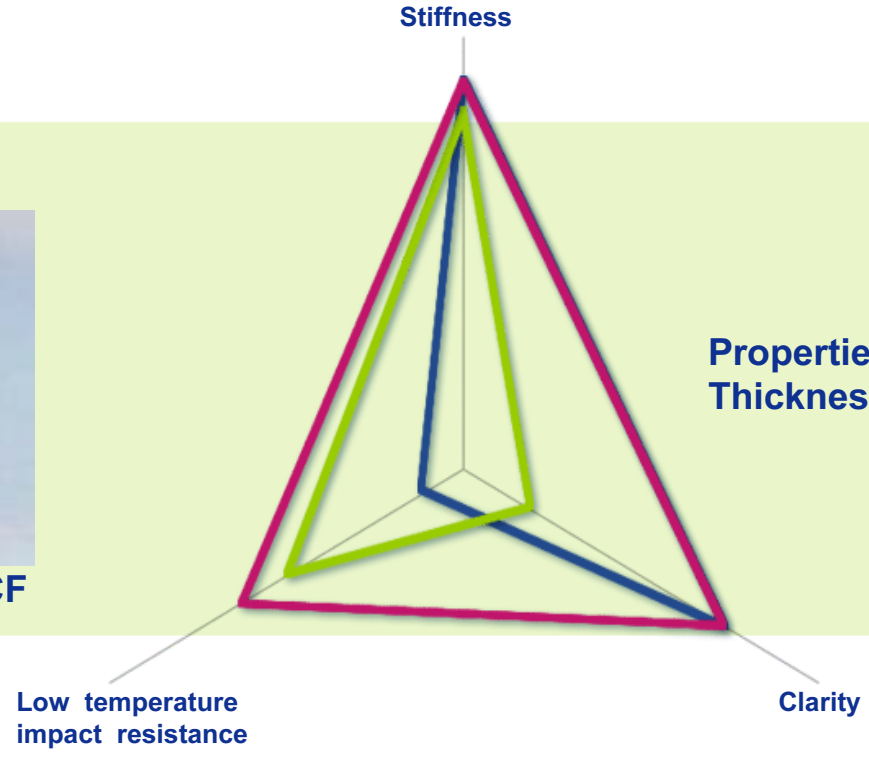
Copyright © 2005
Borealis A/S

Borstar® PP - Borpact™ BC918CF

Transparent HECO

New HECO

Borpact™ BC918CF



Properties TF films
Thickness: 300 µm

Borpact™ BC918CF Stiff HECO PP HOMO

Copyright © 2005
Borealis A/S

SHAPING the FUTURE with PLASTICS

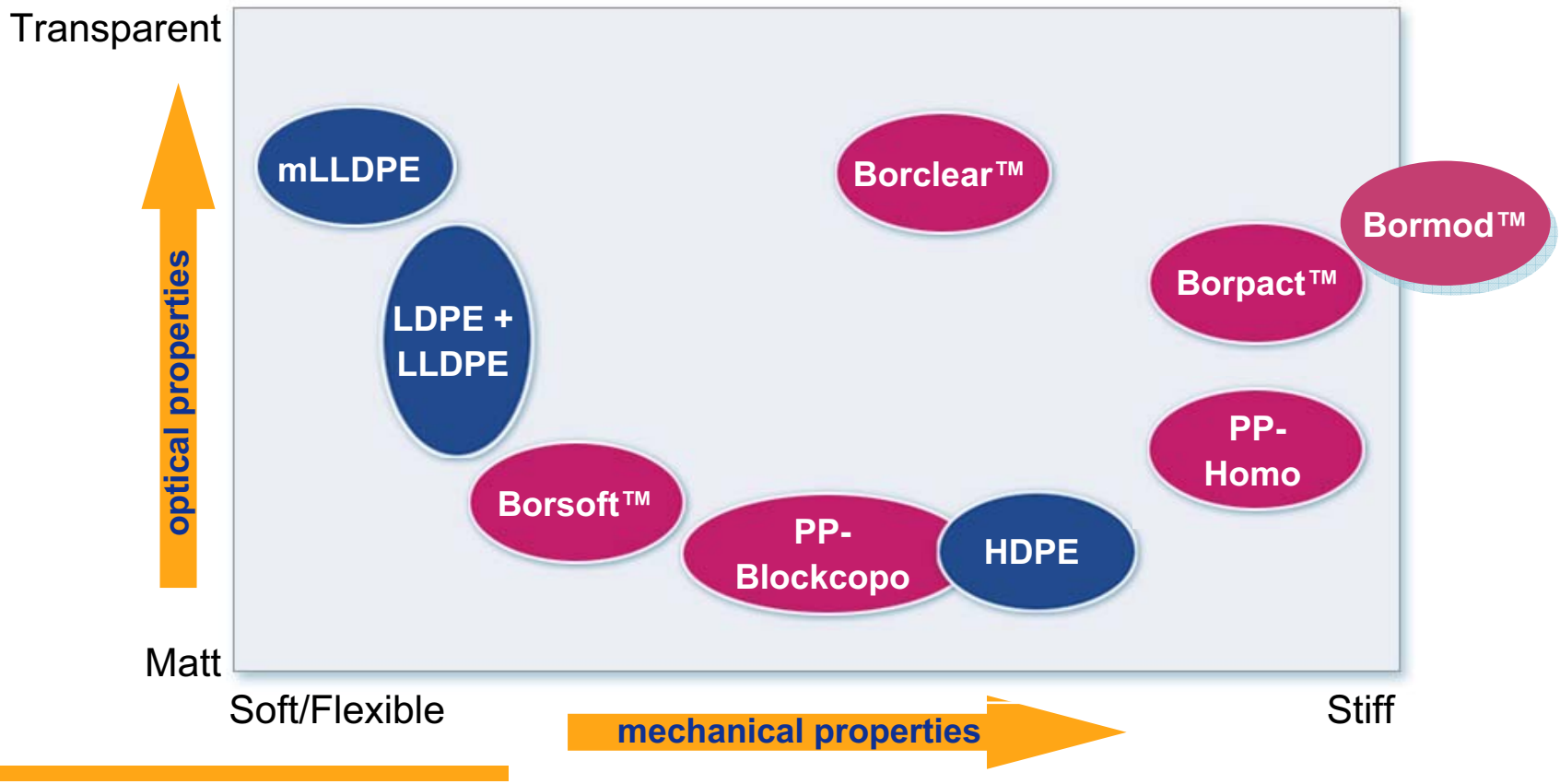
PO's are used in SUP-concepts due to many reasons and for a broad application scope

Stand-Up Pouch structures with PO's:

- Sealing layer
- Improved impact of laminate
- Stiffness of film
- Converting & printing features
- Lower costs → Down gauging or reduction of layers
- Organoleptics / Reduced migration
- Low package breakage rates

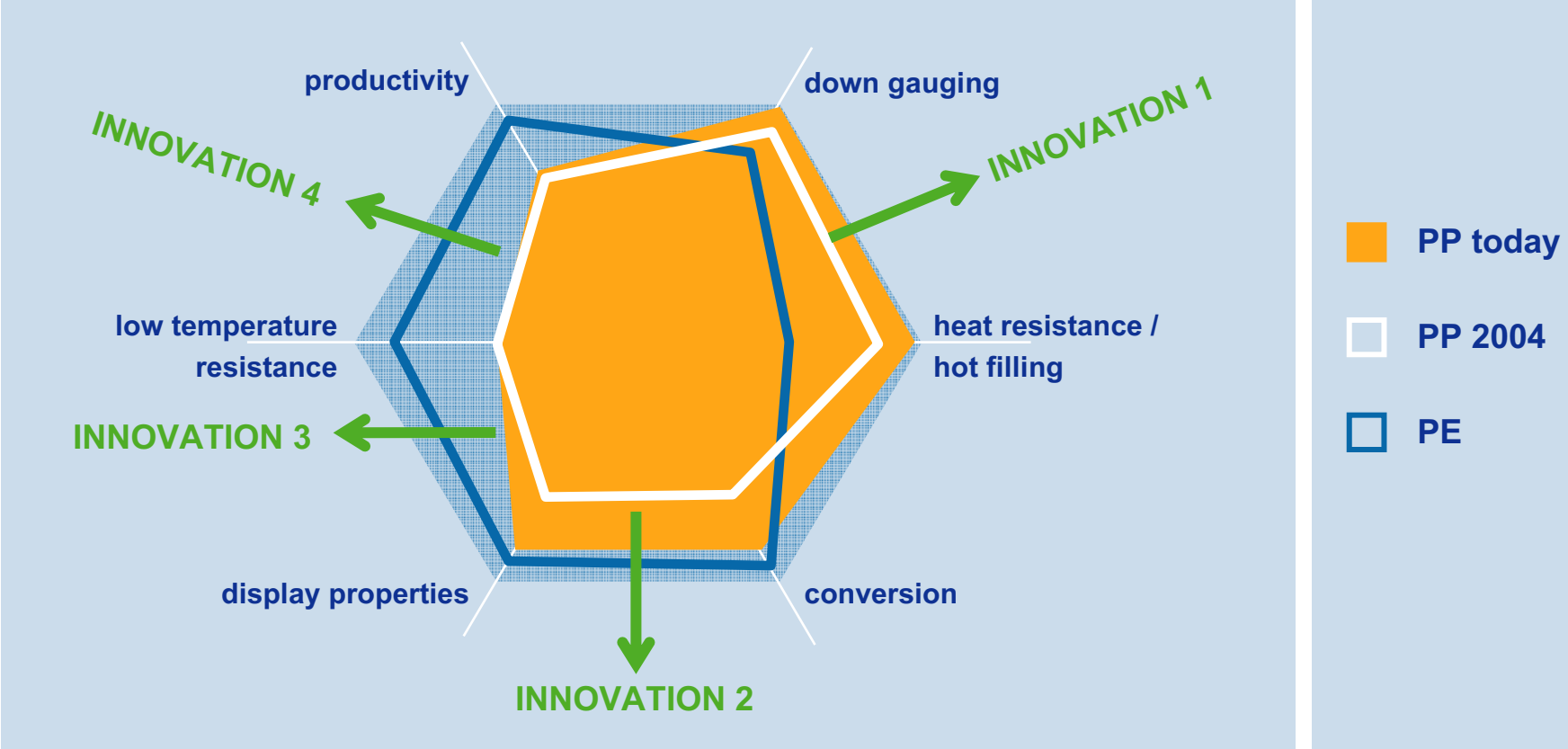
Copyright © 2005
Borealis A/S

Property balance optics - mechanics of PO-blown films with air cooling



Copyright © 2005 Borealis A/S

Mapping the Blown Film properties of PP compared to PE



Copyright © 2005 Borealis A/S

Latest and future developments in PP Blown Film

	Innovations	Timing
Innov. 1	Transparent and stiff Ethylene Propylene Interpolymer **Borpact™ BC918CF**	Q1/07
Innov. 2	High brilliant PP sealing grade **Borclear™ RB709CF**	Q4/06
Innov. 3	Tough and sterilisable PP-Raheco **next generation Borsoft™**	2008
Innov. 4	Long chain branched PP for improved processability **Daploy™ HMS**	Q4/07

Copyright © 2005
Borealis A/S

Innovation 1: Borpact™ Ethylene-Propylene-Interpolymer (EPI) structure

New Borpact™ Ethylene-Propylene Interpolymer generation

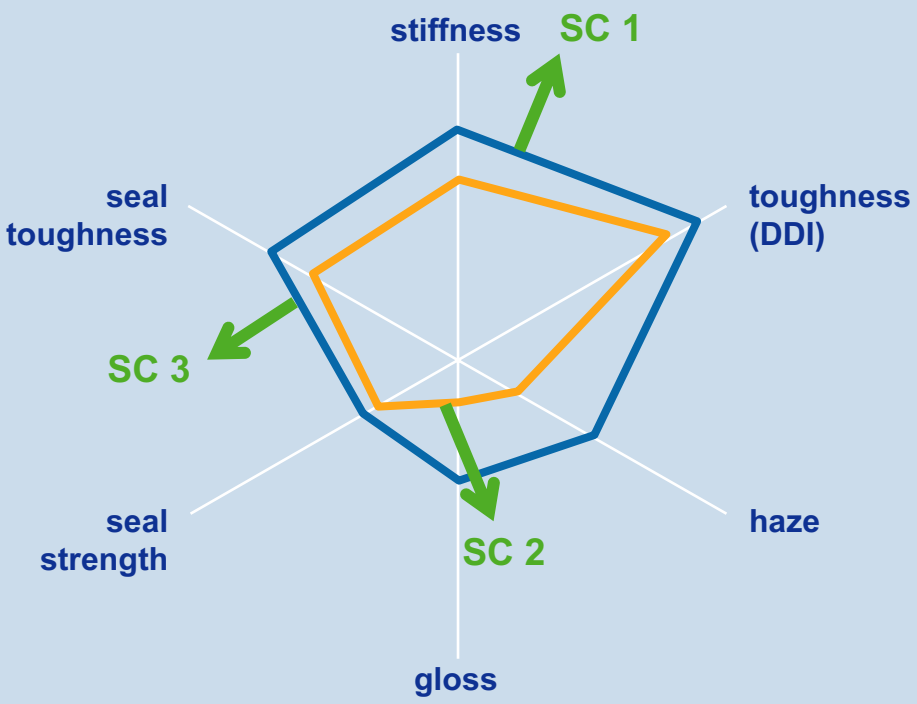
Outstanding property combination:

- superior mechanical properties
- high transparency
- easy tear, linear tear

Main applications: stand up pouches, labels, …

Copyright © 2005
Borealis A/S

Borpact™ Ethylene-Propylene-Interpolymers lift mechanical and optical properties of blockcopolymers to a new level



Borpact™ BC918CF

Conv. blockcopolymer

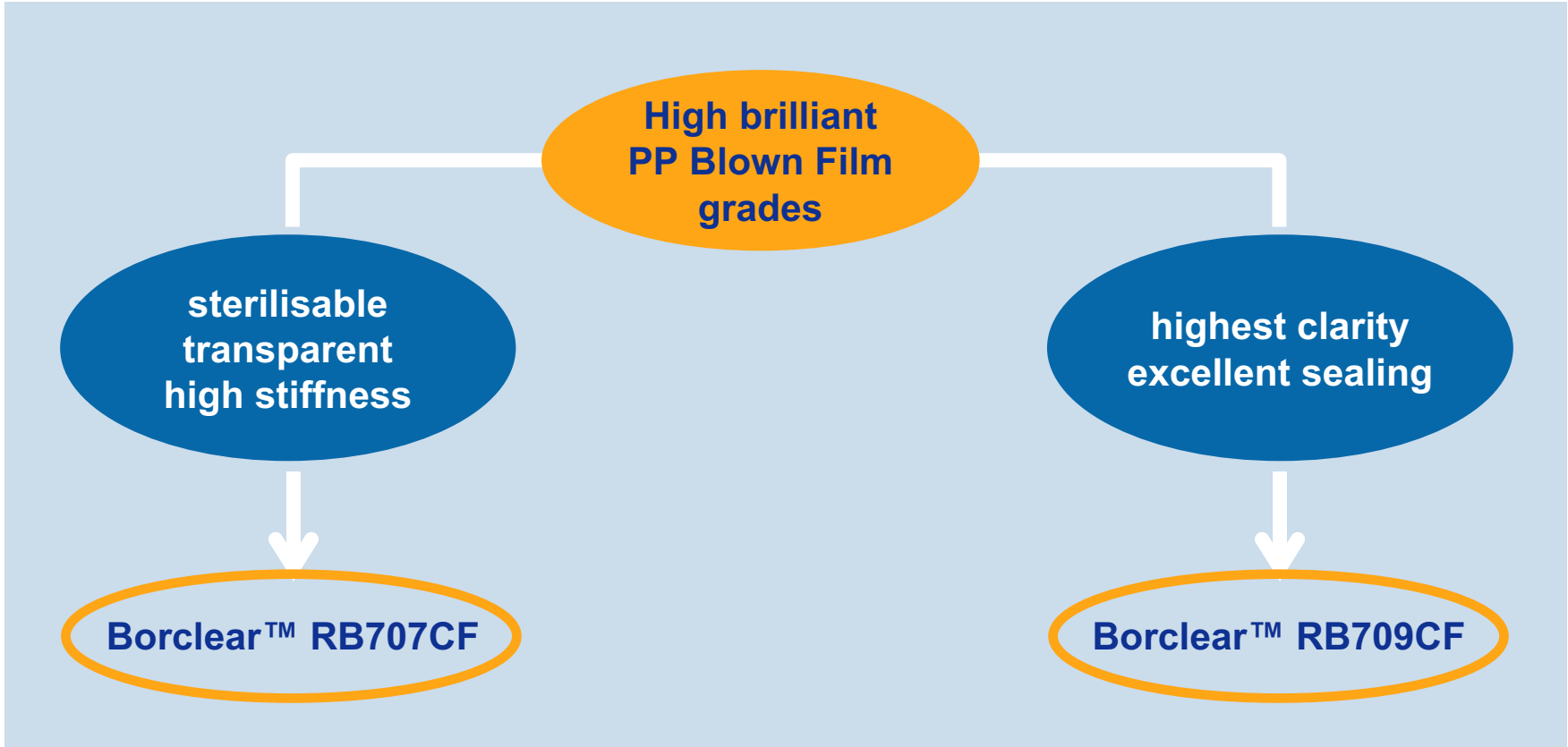
Step change (SC 1)
30% higher stiffness and toughness at the same time

Step change (SC 2)
Superior optics / clarity compared to translucent blockcopolymer

Step change (SC 3)
Higher seal strength

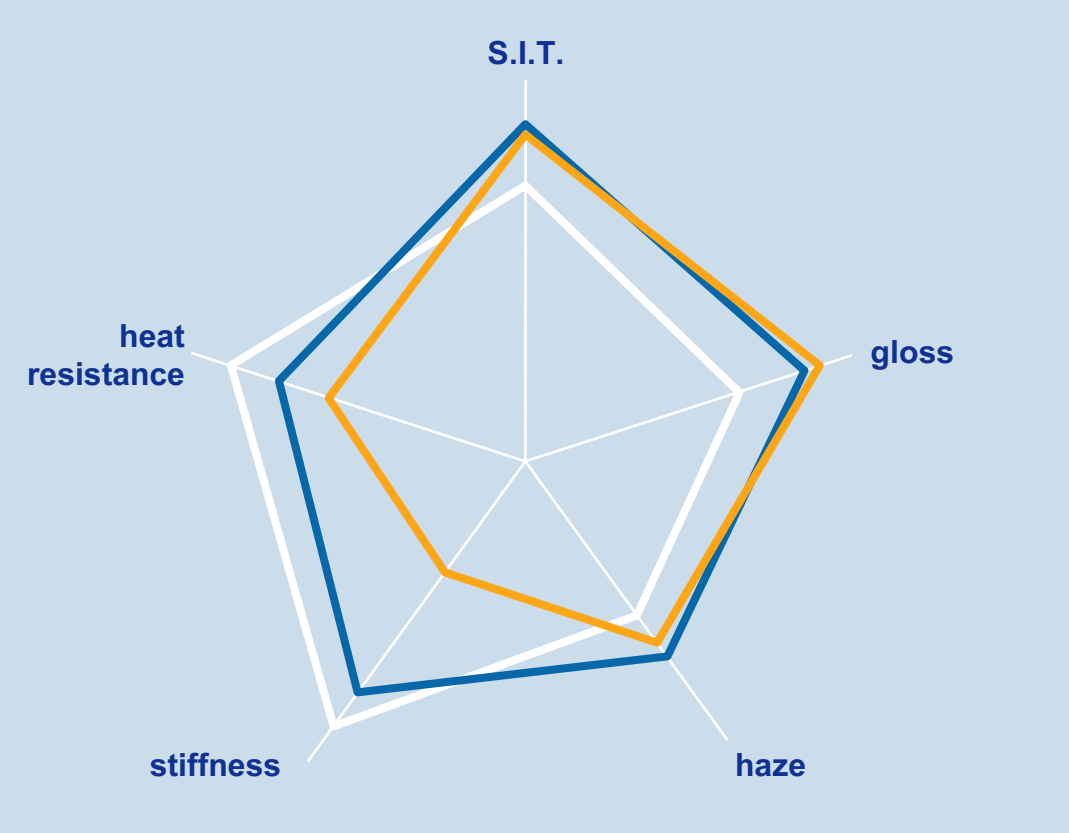
Copyright © 2005 Borealis A/S

Innovation 2:
Borclear™ products offer a new dimension in optical brilliance to Blown Film converters



Copyright © 2005 Borealis A/S

High transparent and stiff PP sealing materials



- Borclear™ RB707CF
- Borclear™ RB709CF
- Blend mLLDPE/LDPE

Key advantages step change

- Excellent optical properties
- Broad sealing window
- High stiffness
- Good printability
- Very low extractables (n-hexane)
- Good conversion

Copyright © 2005 Borealis A/S

Innovation 3: Next Borsoft™ generation delivers a new dimension in softness and toughness in PP Blown Film

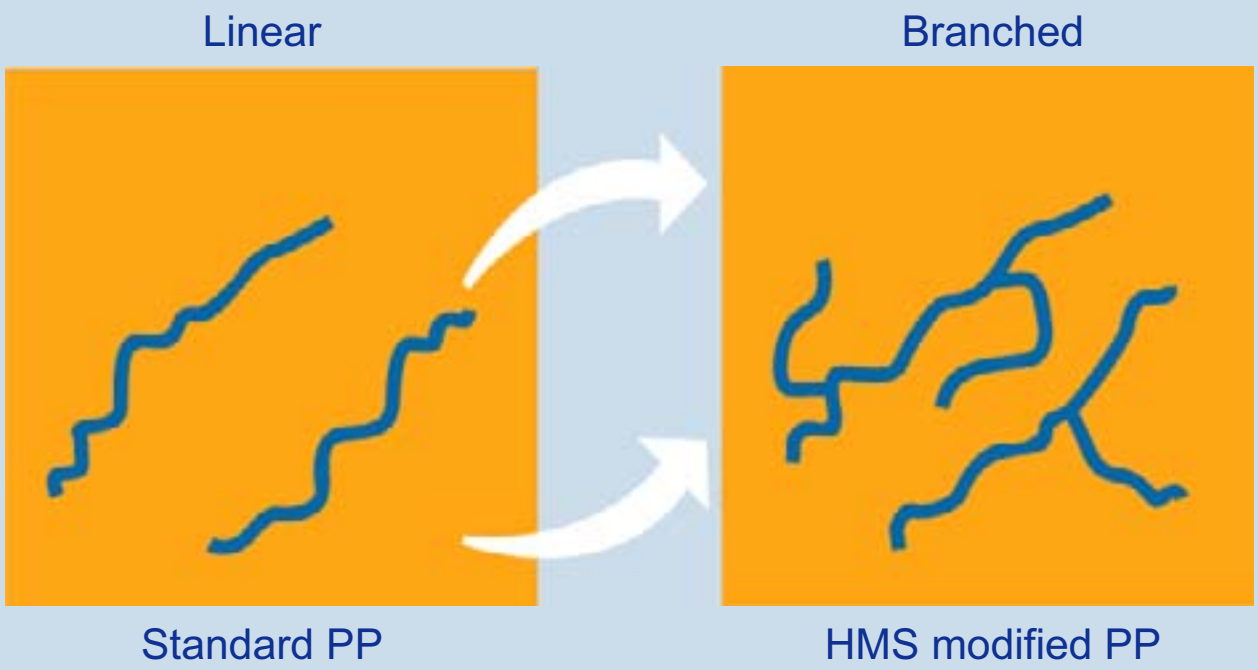
New Borsoft™ Raheco properties:

- Softness and highest toughness before and after sterilisation
- low extractables & high purity

Typical applications:
high quality sterilisable food packaging, bigger pouches, hygiene films, …

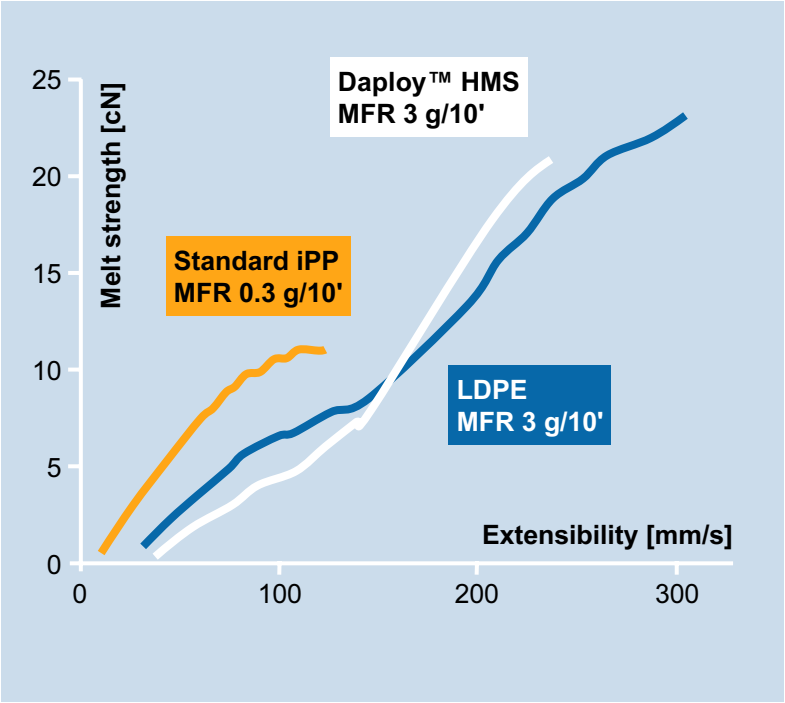
Copyright © 2005
Borealis A/S

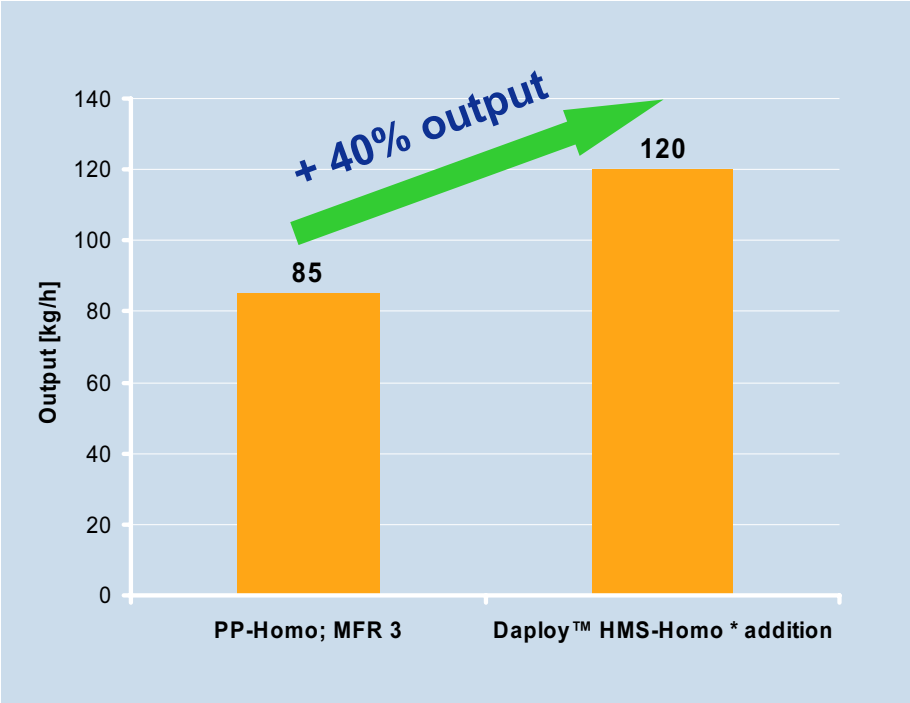
Innovation 4: Daploy™ HMS – a new PP modifier for boosting PP Blown Film processability



Copyright © 2005
Borealis A/S

Long chain branched Daploy™ HMS as modifier improves processability of PP distinctively





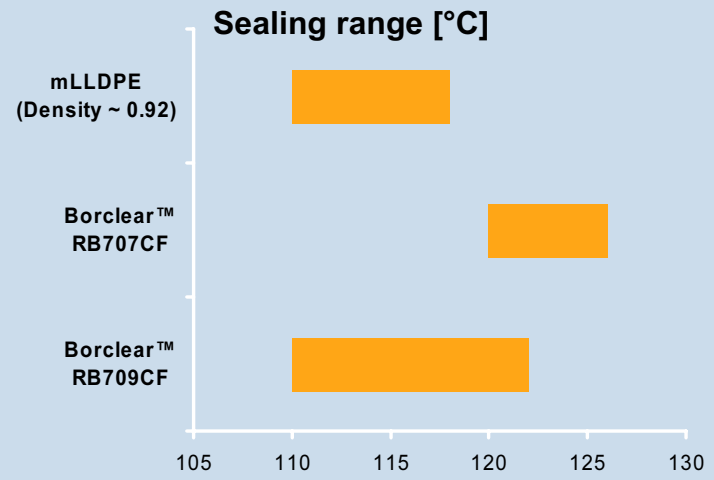
*** Daploy™ HMS addition: between 10 to 25% (depending on base polymer & extrusion line)**

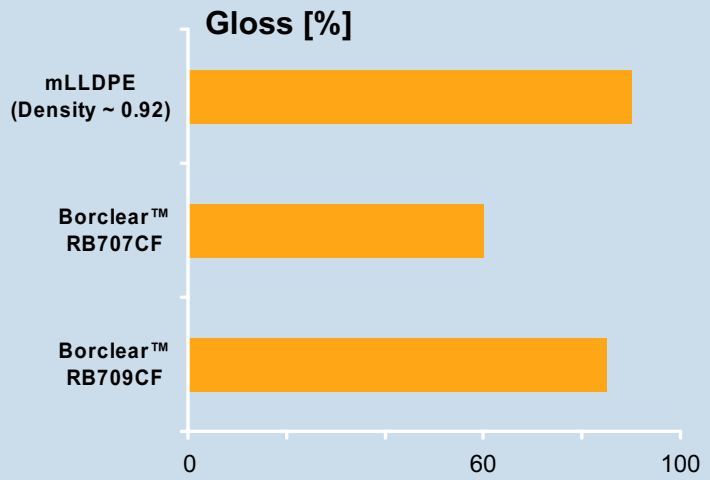
Copyright © 2005
Borealis A/S

PP Blown Films are increasingly used in food packaging due to superior clarity, stiffness & sealing

- High heat resistance
- High stiffness
- Excellent clarity
- Good sealing
- Good printability

Possible example: bread film





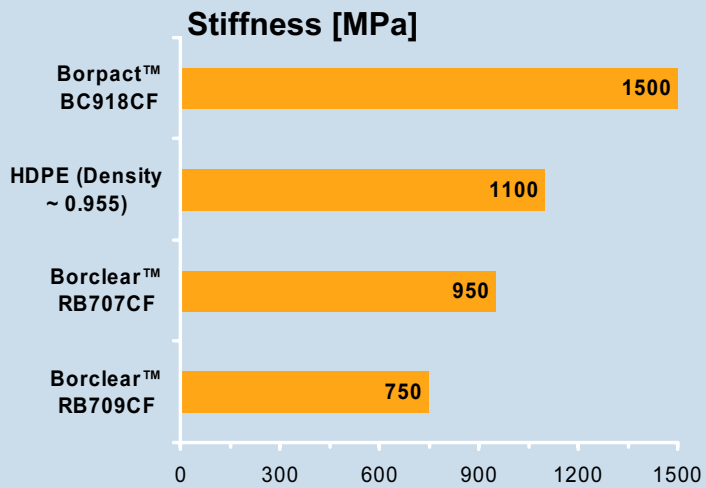
Copyright © 2005 Borealis A/S

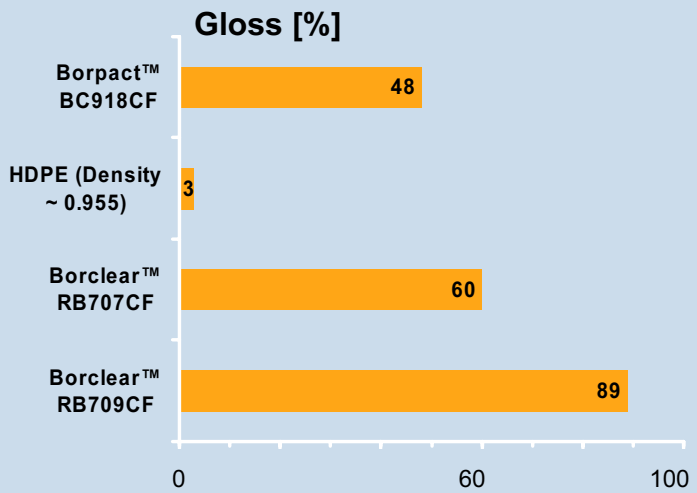
PP Blown Films are used increasingly in label films due to high stiffness, optics & easy punching

PP delivers

- Stiffness
  → 20-30% thickness reduction vs. PE
- Cost reduction
- Good punching
- High gloss

Possible example: label film





Measured on 50 µm Blown Film according Borealis standard

Copyright © 2005 Borealis A/S

Borealis very broad PP Blown Film product mix allows converters to cover a broad value-added application range

Market need / Property	Grade family	Applications
Highest stiffness, heat resistant & good transparency	High stiff Homo "BNT" HC205TF, HB300TF, HC904CF	Barrier film, label film, technical film (siliconisation)
	Homo standard	Stiffness modifier
Good impact, transparency & stiffness	Borpact™ BC918CF	Retortable PET food pouch, label film, freezer film
Good impact, low temperature resistance	Conventional blockcopolymers BA110CF, BB213CF	Hygienic film, retort. PET food pouch, lamination film, freezer film
Soft & high impact	Borsoft™ SA233CF New Borsoft™ ex Borstar PP	Medical pouch, large size pouches (food), hygienic film
Superior optics & sealing at reasonable stiffness	High transparent C_2/C_3 Randomcopolymers; Borclear™ RB707CF, RB709CF	Food packaging, lamination film, label film
Processability and stiffness	Daploy™ WB180HMS	Processing & stiffness modifier

Copyright © 2005 Borealis A/S

SHAPING *the* FUTURE *with* PLASTICS

Copyright © 2005
Borealis A/S