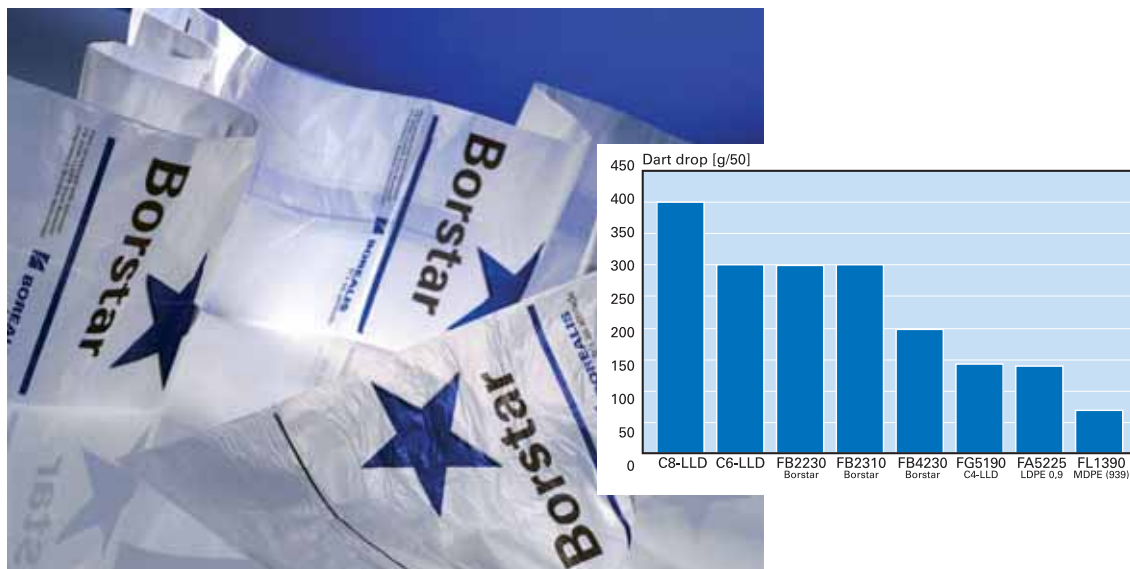


Borstar® FB2230

40 µm mono extruded film



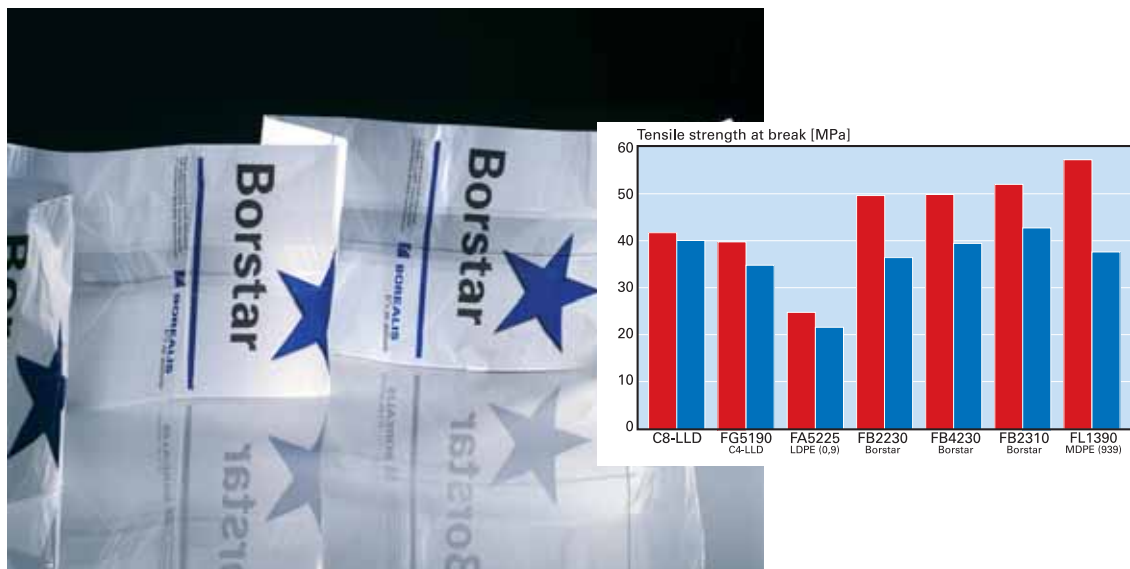
Borstar FB2230 is an enhanced LLDPE film grade, combining good and flexible extrusion behaviour, excellent draw down and superior mechanical properties. Film made from **FB2230** exhibits high dart impact combined with excellent yield and tensile strength and increased stiffness. Its toughness remains also in cold conditions. The film has a high seal strength and hot tack force. **FB2230** contains antioxidant.

Key advantages with Borstar FB2230

• Excellent impact strength	→ Less package breakage
• High tensile strength	→ Improved package performance
• Higher impact than conventional LLDPE	→ Improved package performance
• High penetration resistance	→ Reduced product spoilage
• Excellent performance in frozen conditions	→ Best alternative for packaging of frozen products
• Low migration	→ Compliance to food contact regulations
• Matt surface	→ Frosted surface and exclusive print option Cost saving on colour pigmentation Easy opening and filling Easy to write on
• Very low bubble breaks	→ Enhanced film production regularity
• Easy processing	→ Good quality film production
• Bubble stability	→ Processing of a wide range of film thicknesses
• Well suited for co-extrusion	→ Tailoring the balance of properties
• High ESCR	→ Increased shelf life Reduction in product spoilage

Borstar® FB4230

40 µm mono extruded film



Borstar FB4230 is an enhanced LLDPE film grade combining good and flexible extrusion behaviour, excellent draw down and good mechanical properties.

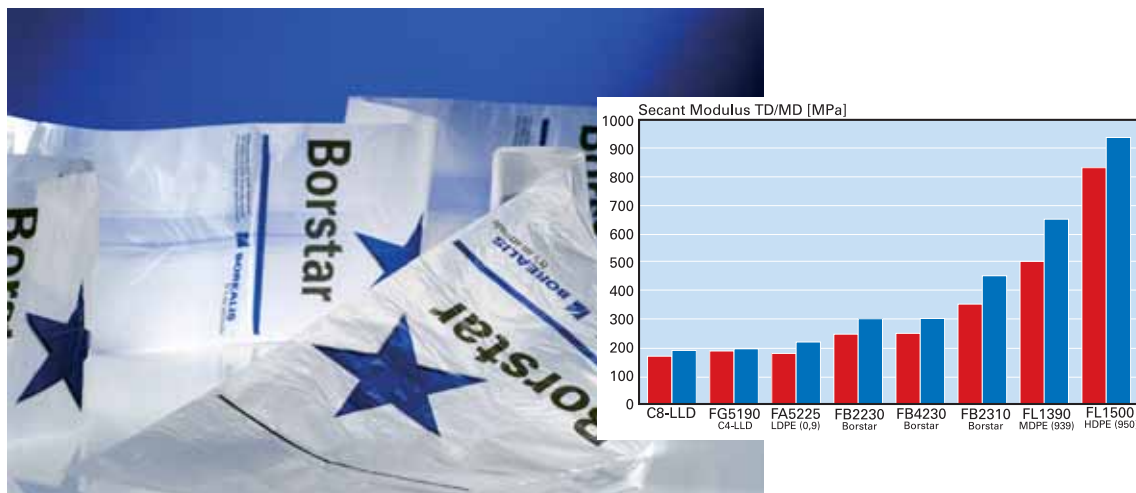
Blown film extrusion with **FB4230** is comparable with LDPE but with better flexibility in film thickness range and draw down. Its toughness remains also in cold conditions. The film has high seal strength and hot tack force. **FB4230** contains antioxidant.

Key advantages with Borstar FB4230

- | | |
|--|--|
| • High tensile strength | → Improved package performance |
| • Higher impact than conventional LLDPE | → Improved package performance |
| • High penetration resistance | → Reduced product spoilage |
| • Excellent performance in frozen conditions | → Best alternative for packaging of frozen products |
| • Low migration | → Compliance to food contact regulations |
| • Matt surface | → Frosted surface and exclusive print option
Cost saving on colour pigmentation
Easy opening and filling
Easy to write on |
| • Very low bubble breaks | → Enhanced film production regularity |
| • Easy processing | → Good quality film production |
| • Bubble stability | → Processing of a wide range of film thicknesses |
| • Improved melt flowability | → Reduced energy consumption |
| • Well suited for co-extrusion | → Tailoring the balance of properties |
| • When used in middle layer | → Improved physical properties with glossy surface |
| • High ESCR | → Increased shelf life
Reduction in product spoilage |

Borstar® FB2310

70 µm mono extruded film



Borstar FB2230 is an enhanced LLDPE film grade combining good and flexible extrusion behaviour, excellent draw down and superior mechanical properties.

Film made from **FB2310** exhibits high dart impact combined with excellent yield and tensile strength and high stiffness. Its toughness remains also in cold conditions. The film has high seal strength and hot tack force. **FB2310** contains antioxidant.

Key advantages with Borstar FB2310

• High impact strength	→ Less package breakage
• High tensile strength	→ Improved package performance
• High creep resistance	→ Downgauging of heavy duty sacks and bags
• Improved stiffness	→ High packaging speed and good handling Good rigidity of stand up pouches
• High penetration resistance	→ Reduced product spoilage
• Excellent performance in frozen conditions	→ Best alternative for packaging of frozen products
• Low migration	→ Compliance to food contact regulations
• Matt surface	→ Frosted surface and exclusive print option Cost saving on colour pigmentation Easy opening and filling Easy to write on
• Very low bubble breaks	→ Enhanced film production regularity
• Easy processing	→ Good quality film production
• Bubble stability	→ Processing of a wide range of film thicknesses
• Improved melt flowability	→ Reduced energy consumption
• Well suited for co-extrusion	→ Tailoring the balance of properties
• When used in middle layer	→ Improved physical properties with glossy surface
• High ESCR	→ Increased shelf life Reduction in product spoilage

Roll Pouches

25 µm mono extruded film of Borstar® FB2310



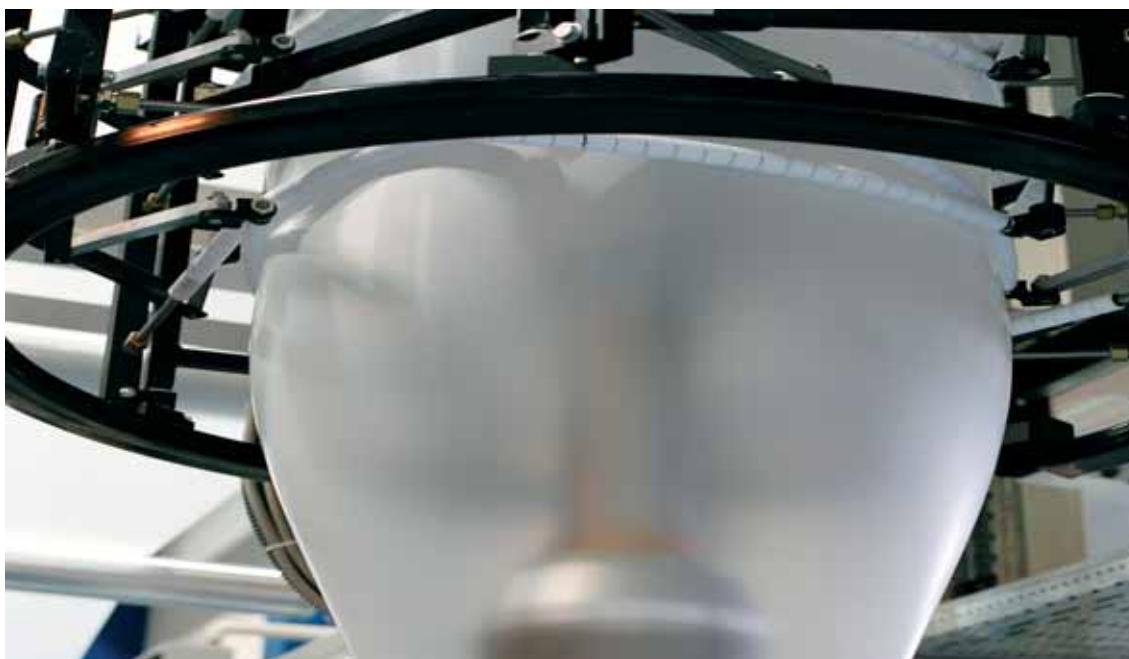
- Deep freeze pouches
- Hospital waste bags
- Other bags and liners with high specification

Key advantages with Borstar

• High penetration resistance	→ Low risk of puncture
• Excellent impact strength	→ Less pouch breakage
• High tensile strength	→ Load bearing capability
• Improved stiffness	→ High conversion speed and good handling Good rigidity of stand up pouches
• Excellent performance in frozen conditions	→ Best alternative for packaging of frozen products
• Matt surface	→ Easy opening and filling Good behaviour on converting lines
• Very low bubble breaks	→ Enhanced film production regularity
• Easy processing	→ Good quality film production
• Well suited for co-extrusion	→ Tailoring the balance of properties
• When used in middle layer	→ Improved physical properties with glossy surface

Bread Bags

30 µm mono extruded film of Borstar® FB2230



Bread bags may be produced from either paper or plastics. Different markets and cultures prefer different solutions. Bread bags in PE can be tailored to give good transparency or can be pigmented with the desired colour, and provide a convenient surface to print on. Borstar LLDPE can be used due to its many beneficial properties. Above is an example of the use of **FB2230**. White pigmented film with **FB2310** would give higher stiffness and a more paperlike film.

Key advantages with Borstar

• Excellent impact strength	→ Less package breakage
• High tensile strength	→ Improved package performance
• Improved stiffness	→ High packaging speed and good handling Paper like films
• High penetration resistance	→ Reduced product spoilage
• Low migration	→ Compliance to food contact regulations
• Matt surface	→ Frosted surface and exclusive print option Cost saving on colour pigmentation Easy opening and filling
• Very low bubble breaks	→ Enhanced film production regularity
• Easy processing	→ Good quality film production
• Well suited for co-extrusion	→ Tailoring the balance of properties
• When used in middle layer	→ Improved physical properties with glossy surface

Carriers

70 µm mono extruded film of Borstar® FB2230



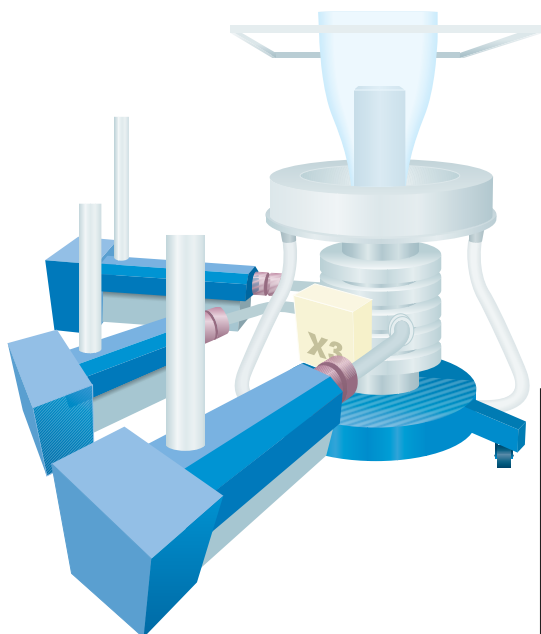
Our **Borstar®** LLDPE products provide an excellent choice of material for heavy duty carry out bags often used by fashion and cosmetic outlets. With **FB2310** a further increase of stiffness and rigidity is achieved. All Borstar products offer a frosted matt surface providing an interesting surface for printing.

Key advantages with Borstar

• Improved stiffness	→ Good bag rigidity High conversion speed and good handling
• Matt surface	→ Frosted surface and exclusive print option Cost saving on colour pigmentation Easy to open
• Excellent impact strength	→ Low risk of bag breakage
• High tensile strength	→ Improved package performance
• Very low bubble breaks	→ Enhanced film production regularity
• Easy processing	→ Good quality film production
• Well suited for co-extrusion	→ Tailoring the balance of properties
• When used in middle layer	→ Improved physical properties with glossy surface

Hygienic and Medical Applications

15 μm white film



Borstar film structure				
	FB2230	4.5 μm	Natural	
	FB2230	6 μm	25%TiO ₂	MB
	FB2230	4.5 μm	Natural	
	Total	15 μm		

Processing parameters	A	B	C	Total
Output [kg/h]	60	93	60	213
Melt temperature [°C]	232	216	228	
Melt pressure [bar]	504	473	397	
Line speed [m/min]				76.5
Thickness distribution [%]				3.8
Die diameter [mm]				316
Die gap [mm]				1.2
Lay flat [mm]				1600

Borstar film properties	
Tensile modulus MD/TD [MPa]	250/300
Tensile strength MD/TD [MPa]	50/40
Strain at break MD/TD [%]	450/700
Dart drop index [g/50]	70
Elmendorf tear strength MD/TD [N]	0.5/6.0

Key advantages with Borstar

- Matt surface
- Soft and silky feeling
- Toughness and puncture properties
- Bubble stability
- Film production regularity



Possible applications

Medical

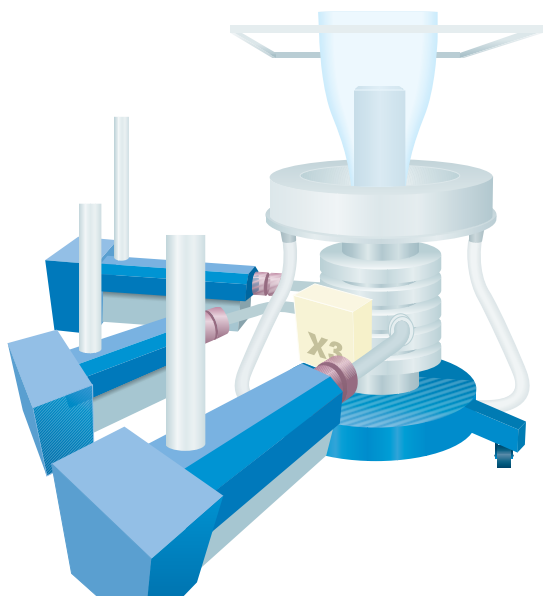
- Lamination to nonwovens




Hygiene

- Gloves
- Diaper backsheet

Collation Shrink Films

50 μm co-extruded film



Borstar film structure				
	FT5270	12.5 μm	Natural	
	FB2310	25 μm	Antistatic	5%MB
	FT5270	12.5 μm	Slip	4%MB
	Total	50 μm		

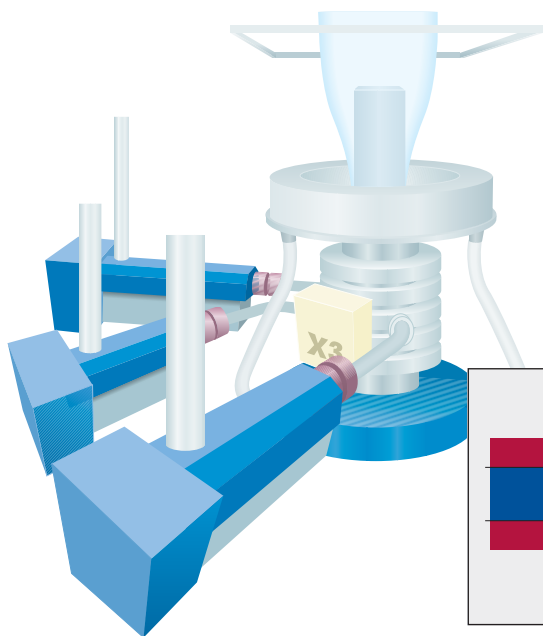
Shrink Film. The shrink film market in WE consumes more than 900 kt per year of PE and is the classic application where LDPE with its good shrinkage behaviour is the dominating material used. Borstar LLDPE exhibits significant benefits over LDPE and its blends with LLDPE or HDPE.

Key advantages with Borstar

- | | |
|---|--|
| • Very low hot shrink forces | → No hole burning |
| • Very high cold shrink forces | → Good collation and holding forces |
| • Beneficial balance of strength, toughness and stiffness | → Good stability during transport and handling
Improved film integrity
Less film puncture with sharp edges
Possibility to downgauge |
| • High gloss and clarity | → Excellent consumer display
High gloss printing |
| • Matt surface characteristics (optional) | → Easy to open film
Easy to apply onto e.g. pallets |

Deep Freeze FFS

40 μm co-extruded natural film



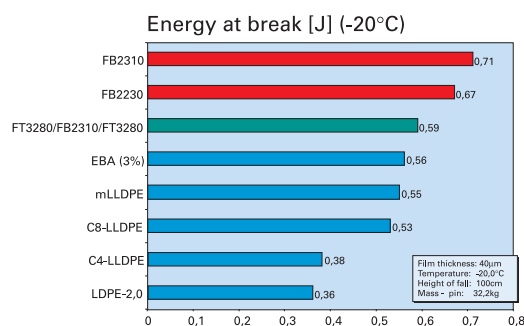
Borstar film structure				
	FT3280	7 μm	Natural	
	FB2310	26 μm	Natural	
	FT3280	7 μm	Natural	20% LLDPE
Total		40 μm		

Processing parameters	A	B	C	Total
Output [kg/h]	36	137	36	209
Melt temperature [$^{\circ}\text{C}$]	186	229	194	
Melt pressure [bar]	372	588	308	
Line speed [m/min]				38.9
Thickness distribution [%]				2.4
Die diameter [mm]				315
Die gap [mm]				1.2
Lay flat [mm]				1200

Borstar film properties	
Tensile modulus MD/TD [MPa]	410/580
Tensile strength MD/TD [MPa]	50/30
Strain at break MD/TD [%]	470/740
Dart drop index [g/50]	120
Elmendorf tear strength MD/TD [N]	0.7/14.0
WVTR (38 $^{\circ}\text{C}$ /90 RH) [g/m ² /24 h]	5.8

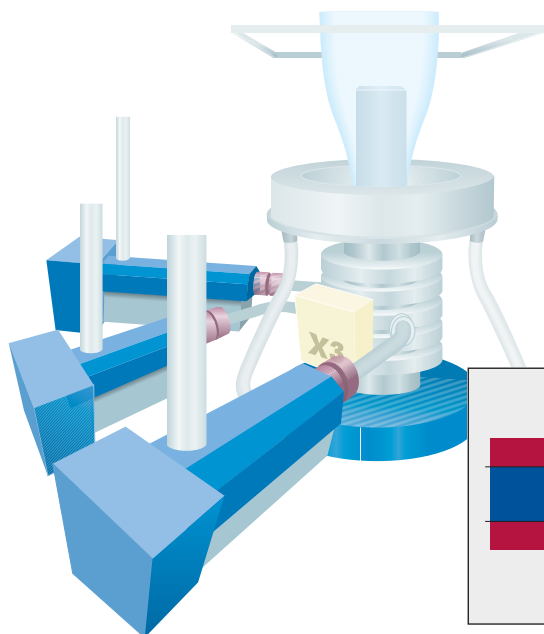
Key advantages with Borstar

- Excellent low temperature properties
- Excellent stiffness/impact balance
- Borstar[®] LLDPE well suited for co-extrusion
- Bubble stability
- Film production regularity
- Downgauging



Deep Freeze FFS

40 μm white co-extruded film



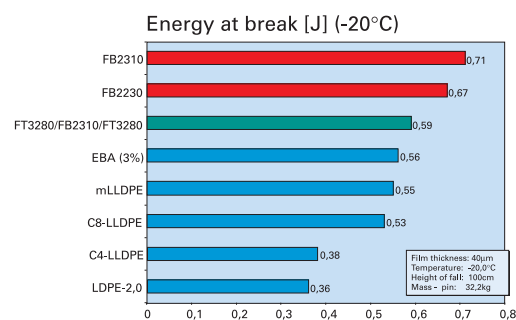
Borstar film structure				
	FT3280	7 μm	Natural	
	FB2310	26 μm	9%TiO ₂	MB
	FT3280	7 μm	Natural	20% LLDPE
	Total	40 μm		

Processing parameters	A	B	C	Total
Output [kg/h]	36	140	36	212
Melt temperature [°C]	186	231	194	
Melt pressure [bar]	370	589	308	
Line speed [m/min]				38.9
Thickness distribution [%]				2.4
Die diameter [mm]				315
Die gap [mm]				1.2
Lay flat [mm]				1200

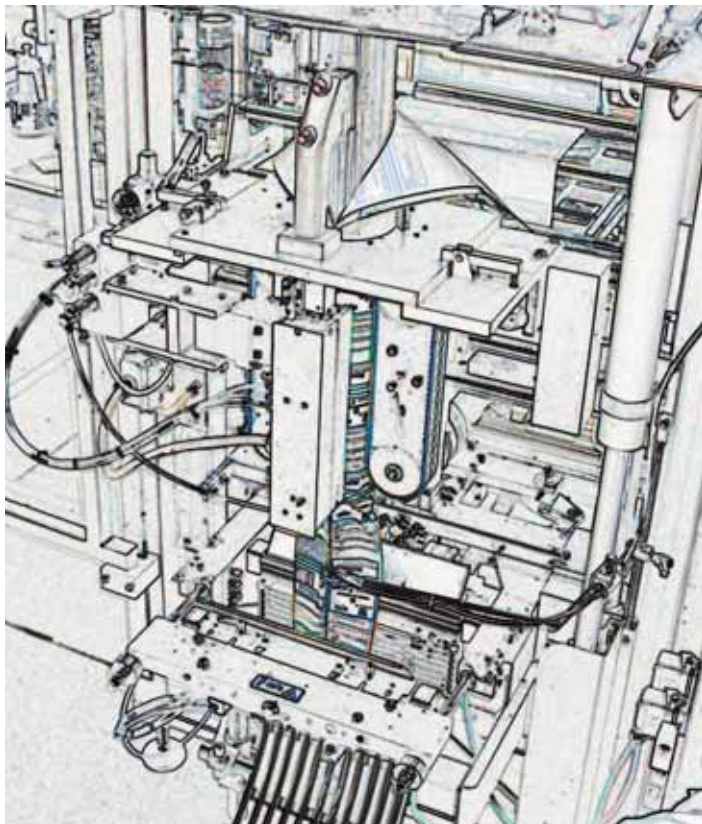
Borstar film properties	
Tensile modulus MD/TD [MPa]	370/530
Tensile strength MD/TD [MPa]	50/35
Strain at break MD/TD [%]	430/850
Dart drop index [g/50]	120
Elmendorf tear strength MD/TD [N]	0.7/14.0
WVTR (38°C/90 RH) [g/m ² /24 h]	5.8

Key advantages with Borstar

- Excellent low temperature properties
- Excellent stiffness/impact balance
- Borstar® LLDPE well suited for co-extrusion
- Bubble stability
- Film production regularity
- Downgauging



FFS Packaging with Borstar®



Below are the results of packaging tests at a food company with Borstar® based co-extruded film:

- A FT3280
- B FB2310
- C FT3280 + 20% LLDPE

Processing on Bosch SVK 3000L	Standard	Borealis
Film thickness	70 µm	40 µm
Film structure	Laminate	Coex
Output [c/min]	60	60
Sealing temperature [°C]	170	150

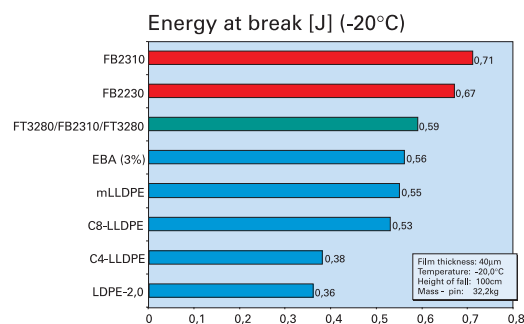
Comment from packer:

The Borstar® co-extruded film was very easy to handle on the machine. The relatively high stiffness provided easy handling in the bag forming part of the machine including sealing.



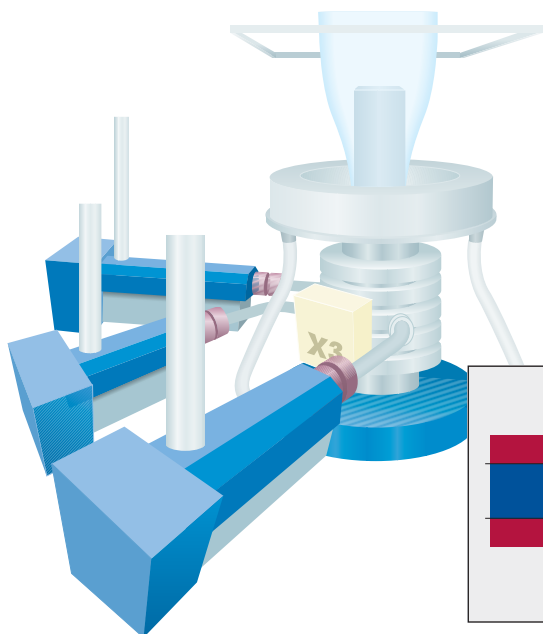
Key advantages with Borstar




- Excellent low temperature properties
- Excellent stiffness/impact balance
- Well suited for co-extrusion
- Bubble stability
- Film production regularity
- Packaging integrity



Compost FFS Bags

70 µm yellow/black co-extruded film



Borstar film structure				
	FB2230	21 µm	5% Yellow	MB
	FB2310	35 µm	19% TiO ₂	MB
	FB2230	14 µm	6% Black	MB
Total		70 µm		

Processing parameters	A	B	C	Total
Output [kg/h]	70	110	45	225
Melt temperature [°C]	241	323	224	
Melt pressure [bar]	541	548	389	
Line speed [m/min]				26
Thickness distribution [%]				2.1
Die diameter [mm]				315
Die gap [mm]				1.2
Lay flat [mm]				1200

Borstar film properties	
Tensile modulus MD/TD [MPa]	330/420
Tensile strength MD/TD [MPa]	50/40
Strain at break MD/TD [%]	660/880
Dart drop index [g/50]	400
Elmendorf tear strength MD/TD [N]	5/19

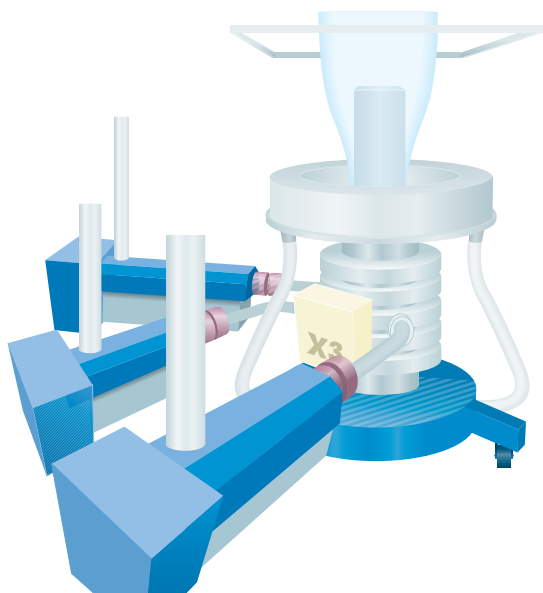





Key advantages with Borstar

- Bubble stability
- Film production regularity
- Good behaviour on packaging machine
- Easy opening/filling
- Package integrity
- Excellent stiffness/impact balance
- Downgauging

Security Envelopes

60 µm black/white co-extruded film



Borstar film structure				
	FB2230	15 µm	White	MB
	FB2310	30 µm	White	MB
	FT5270	15 µm	Black	MB
	Total	60 µm		

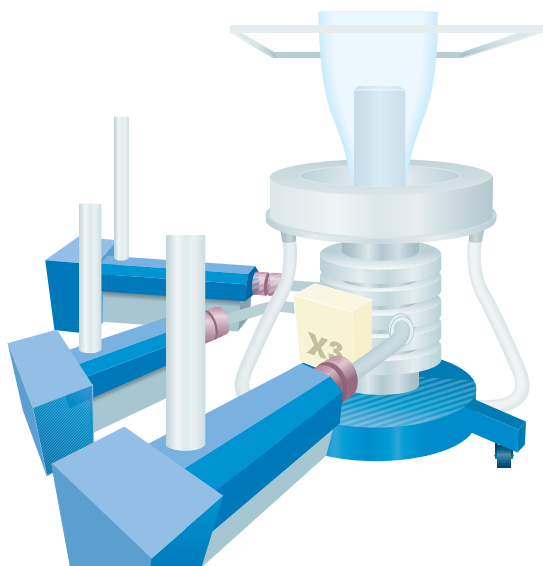
Plastic envelopes and pouches have been successfully implemented for courier shipments, direct mail and money bags. This is due to the beneficial properties of plastics like water repellence, toughness, security aspects, efficient production etc, providing high performance at a beneficial cost.

Key advantages with Borstar

- | | |
|-----------------------|--|
| • Increased stiffness | → Pouch rigidity and handling
Potential for downgauging |
| • High toughness | → High protection/security |
| • High seal strength | → Less risk of breakage |
| • Matt surface | → Ease of conversion and opening
Facilitates write-on
Reduced transparency |
| • Processability | → Cost efficient film production |

Co-extrusion with HDPE

14 μm co-extruded T-shirt bag



Borstar film structure				
	FB2230	2.8 μm	Natural	
	HDPE	9.1 μm	White	MB
	MDPE	2.1 μm	Natural	
	Total	14 μm		

HDPE co-extrusion

The installation of 3-layer ABC co-extrusion lines for high neck HDPE film extrusion has become an important trend in the industry.

Key advantages with Borstar

• Excellent impact strength	→ Less bag breakage
• High penetration resistance	→ Reduced product spoilage
• Matt surface	→ Easy to open and no blocking Good handling on converting lines
• Better sealing than HDPE	→ Converting speed
• Easy processing	→ Good quality film production
• Bubble stability	→ Supports high neck processing
• Well suited for co-extrusion	→ Tailoring the balance of properties

Monoaxially oriented Borstar® LLDPE

90 µm co-extruded OPE film



Oriented PE films

Biaxially Oriented PE films have traditionally been serving packaging markets like high transparency shrink films, barrier films and candy twist wrap. Other technologies are emerging in the market like monoaxial orientation of PE blown films suitable for producing oriented films beyond 100 µm. This allows penetration of OPE into new applications.

Key advantages with Borstar

• Bubble stability	→ Film production output
• Flexible orientation	→ Tailoring of properties
• Very high mechanical	→ Significant downgauging
• Impact/tear resistance	→ Package integrity
• High creep resistance	→ Downgauging of heavy duty sacks and bags
• Improved stiffness	→ High packaging speed and good handling Good rigidity of shipping sacks
• High penetration resistance	→ Reduced product spoilage

Monoaxially oriented Borstar® LLDPE

25 µm co-extruded OPE film



Oriented PE films.

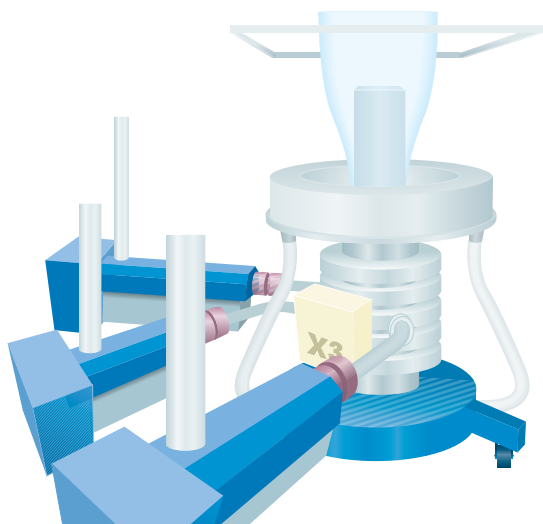
Biaxially Oriented PE films have traditionally been serving packaging markets like high transparency shrink films, barrier films and candy twist wrap. Other technologies are emerging in the market like monoaxial orientation of PE blown films suitable for producing oriented films beyond 100 µm. This allows penetration of OPE into new applications. The attached film is a co-extruded film where **Borstar FB2310** is embedded in two layers of a lamination grade LLDPE. The result is high stiffness, toughness and excellent optical properties.

Key advantages with Borstar

• Bubble stability	→ Film production output
• Flexible orientation	→ Tailoring of properties
• Excellent optical properties	→ Good display and promotion of product
• Very high mechanical properties	→ Significant downgauging
• High stiffness	→ Good behaviour on packaging machine
• Impact/tear resistance	→ Package integrity
• High tensile strength	→ Improved package performance

Diaper Compact Bags

50 μm white co-extruded film



Borstar film structure				
	FB2230	12 μm	Natural	
	FB2310	26 μm	White	10%MB
	FT5270	12 μm		
	Total	50 μm		



Hygienic products packaging

The packaging of hygienic products, like diapers/napkins, typically requires a high specification for mechanical strength and stiffness of the used film. Additionally a high gloss surface for decorative printing is required for the display function. The films need to be easy to fill and seal in the fast packaging operation and have a positive environmental profile.

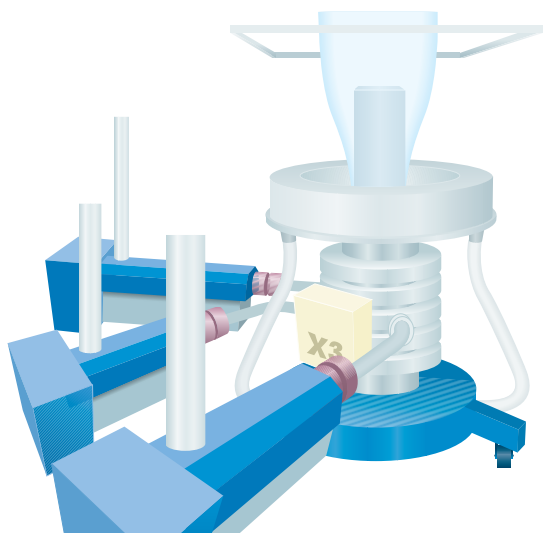
By co-extrusion of Borstar® LLDPE with Himod LDPE, films with high toughness and high gloss can most successfully be produced.




Key advantages with Borstar LLDPE

• Film processability	→ Production efficiency
• Increased stiffness	→ Conversion and packaging speed
• Toughness	→ Material reduction/cost saving
• Matt surface	→ Differentiated print appearance Conversion speed Easy to open and fast filling

Lamination Films

70 µm natural co-extruded film



Borstar film structure			
	FT5270	17.5 µm	Natural
	FB2310	35 µm	Natural
	FB2230	17.5 µm	Natural
	Total	70 µm	

Lamination films

PE films are extensively used in laminates for a wide range of packaging films. Normally the PE film forms the body of the laminate and provides an easy to seal inner layer of the package. Due to the high number of products being packed in laminates the requirements to barrier, mechanical, optical and sealing performance will vary significantly. The usage of Borstar® LLDPE products as mono or co-extruded films in laminates brings numerous advantages. Due to the high amount of extractable components used the emphasis is on good taste and freshness which is very important for the packaging of food. By co-extrusion of Borstar LLDPE with other products it is easy to achieve specific performance profiles depending on the final product to pack.




Key advantages with Borstar

• Increased stiffness	→ Rigidity and handling Packaging speed and handling
• Toughness/seal strength	→ Less product spoilage
• Impact/puncture	→ Package integrity
• High ESCR	→ Shelf life and no breakage
• Low temp. resistance	→ High integrity at frozen conditions
• Matt surface	→ Ease of conversion and filling
• Low migration	→ Low taste and odour
• Low additive level	→ Compliance to food packaging

Bags and Pouches

20 μm natural film



Borstar film structure			
	FA6224	4 μm	Natural
	FB2310	12 μm	Natural
	FA6224	4 μm	Natural
	Total	20 μm	

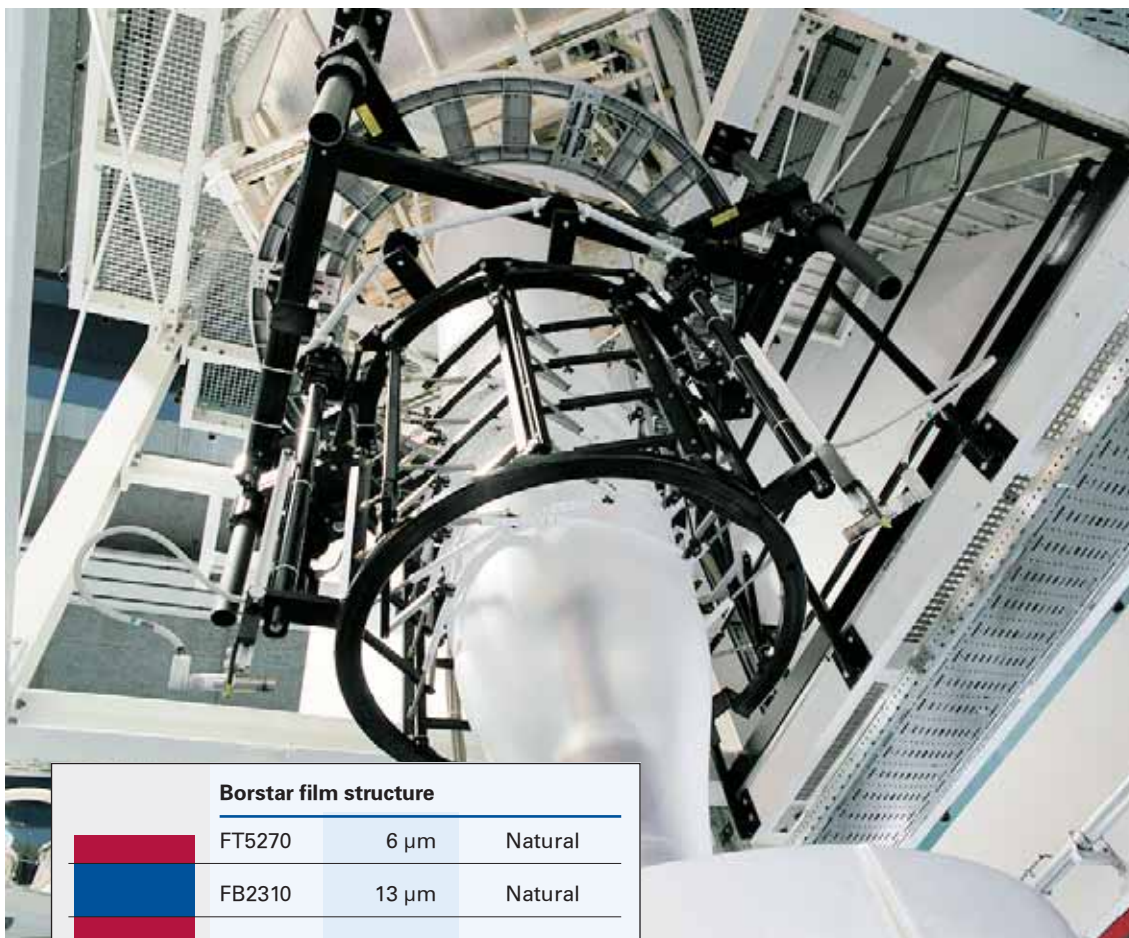
Bags and pouches are used as packaging and containment in many different formats for consumer goods. These films create various demands on the mechanical and optical properties depending on their use and packaging process conditions. Thin films can most successfully be produced by extrusion of Borstar® LLDPE products pure, in blends or coex with LDPE. Their processing properties in terms of drawdown, bubble stability and regularity is outstanding.

Key advantages with Borstar

• Stiffness	→ Packaging speed and handling Rigidity and handling
• Impact/puncture	→ Package integrity
• Penetration resistance	→ Suited for hospital waste bags
• Matt surface	→ Ease of conversion and filling
• Low migration	→ Low taste and odour
• Low additive level	→ Compliance to food packaging
• High toughness	→ Improved protection/security
• High seal strength	→ Less breakage
• Processability	→ Cost efficient

Protection and Cover Films

25 μm natural co-extruded film



Borstar film structure			
	FT5270	6 μm	Natural
	FB2310	13 μm	Natural
	FT2230	6 μm	Natural
	Total	25 μm	

PE Films are frequently used as protection, for example, car seat covers in repair shops, laundry covers for garments or masking films in paint shops. Such films need to meet the mechanical performances required, which will depend strongly on the preferences of the end user. Borstar® LLDPE products, used pure or in blends, will contribute positively to the processing and to the properties of such covering films.

Key advantages with Borstar LLDPE

- | | |
|--------------------------|--|
| • Processability | → Cost efficient and high regularity |
| • Penetration resistance | → Best protection to leakage of dust or paint |
| • Stiffness | → Rigidity and handling |
| • Matt surface | → Easy to open and apply
Good draping behaviour |