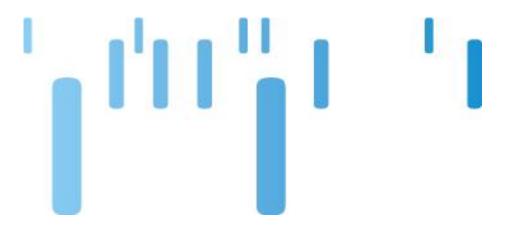


Polybutene-1 in Polyolefin Applications

Tim Schloemer Business Development Manager Polybutene-1 – The Americas



PB-1 Unique Properties

- Polybutene-1 is a Polyolefin like PE and PP, PB-1 is not PIB
- High Miscibility and Compatibility in PP
 - Allows for increased flexibility and impact of PP as well as lower SIT
- Low Miscibility and Compatibility in PE, but Easily Dispersible
 - PB-1 incompatibility with PE realized in peelable sealants
- Unique Solid-State Re-Crystallization
 - Allows for long open and workable times in Hot Melt Adhesives
- Shear Thinning Rheology with Easy Processibility
 - PB-1 can be used to viscosity modify PP to increase MFR without visbreaking
 - PB-1 helps to wet and stabilise filler particles, preventing re-agglomeration
 - Amorphous content of PB-1 Koattro grades >50% allows for high filler loadings
- Low Melting Temperature and Heat of Fusion
 - PB-1 tends to melt first in extruder to allow plenty of time for homogenization
 - Allows for very low setting-temperatures and potential to compound heat and shear sensitive additives
- Excellent Creep, Stress Crack, Chemical, and Wet Abrasion Resistance
- Thermal Expansion and Conductivity lower than PP and PE





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PB-1 Compounding Benefits

- Polybutene-1 (high MFR grade PB0801M) used as part of the carrier in the pigment masterbatch, significantly reduces the presence of pigment agglomerates
- PB0801M as carrier resin for a TiO₂-MB provides the highest color yield with the lowest agglomerates
- Best pigment dispersion of organic red when using a masterbatch with PB-1 as carrier resin
- PB-1 as a migration promoter of additives
 - PB-1 is more apolar compared to PP or PE
 - PB-1 accelerates the migration of fluorochemical surface-modifying additives to the surface of PP fibers
- PB-1 improves the flowability of low MFR polymers, so that the necessity to visbreak (or crack) can be avoided and mechanical properties are maintained
- PB-1 can be used as a property modifier in PP (Increase flexibility, Lower SIT, etc.)
- Good retention of optical properties in BOPP using copolymers
 - no negative effect on clarity and haze by using up to 30 w% PB-1
- Dramatic creep resistance improvement of blown-PE film modified with polybutene-1
- Very limited influence of fillers on flow behavior of PB-1
- PB-1 can be used as an ESCR improver as it does not show any failures after 15,000 hours immersion in 10% Igepal C0630 solution at 50° C (ASTM D1693)

PB-1 Markets and Applications

- Peelable Sealants for Easy Open Packaging
 - Meat and Cheese Flexible Packaging
- Extrusion Blow Molding
 - Hot Water Heater Liners
- Hot Melt Adhesives
- Compounding and Masterbatches
- Fibers
- Low Seal Initiation Temperature Sealants
 - BOPP Film
- Purging Compounds
- Piping Systems
 - Plumbing
 - Underfloor Heating

Main exploitable PB-1 attributes by LYB customers

... or what makes PB-1 different for our customers... :

- Creep resistance.....pipes, pressure tanks, ...
- Env. Stress Crack Resistance......powder coatings, boilers, ...
- Rheological behaviour..... compounds, MBs, fibers, ...
- Slow crystallization.....fibers, hot melt adhesives (HMA), ...
- Dispersability in PE.....easy opening packaging, ...
- Compatible in PP..... compounds, MBs, PP modification, ...
- Good molecular cohesion.....adhesives
- Wet abrasion resistance.....hoses, mining, TPV, ...
- Flexible without a rubber phase

Toppyl & Koattro Polybutene-1 Modifiers

Product type	MFR*	Comonomer	Tm1 (*C)	Flexural Modulus (MPa)	Density (g/cm³)	Typical customer applications	PB-1 Type
Toppy/ PB0110M	0.4	-	128	450	0.915	Easy-open Blown PE film, HDPE retortable blends, Extrusion Coating	Homo Polymer
Koattro PB0300M	4.0	-	128	450	0.915	Easy-open Cast PE film, HDPE retortable blends	
Koattro PB0801M	200	-	128	410	0.915	Compounding & Masterbatch	
<i>Торруі</i> РВ8640М	0.9	Low	114	250	0.906	Easy-open Blown PE film, Extrusion Coating, General use	Copolymer
<i>Торру</i> / РВ8340М	4.0	Low	114	270	0.906	Easy-open Cast PE film General use	
Toppy/ PB8220M	3.0	Med	97	120	0.901	Low SIT for BOPP	
Koattro DP8310M	2.0	High	90	100	0.897	Film Modification (MAP, Breathable)	
Koattro DP8510M	40	High	90	65	0.895	MB Compounding, HMA Modification	
Koattro DP8911ME	200	High	90	60	0.895	Fiber, HMA Modification	
Koattro PBM1000M	1000	Med	100	340	0.908	Fiber, HMA Modification	

* MFR measured at 190° C/2.16 kg

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