Olefin Block Copolymers in Health and Hygiene

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Olefin block copolymers deliver...

- Elasticity competitive to styrenic block copolymers (SBCs)
- Adhesive formulation performance comparable to styrene-isoprene-styrene (SIS)
- Compression set similar to thermoplastic vulcanizates (TPVs)
- All at improved cost-in-use
**Uniqueness of Olefin Block Copolymers**

**Random† vs. Block Copolymer Structures**

**Ethylene/Alpha Olefin Random† Copolymers**
- Adding more co-monomer lowers the polymer’s density and crystallinity while increasing flexibility.
- However the melt temperature, crystallization temperature and heat resistance also drop as density is lowered.

**Proprietary Chain Shuttling technology**
- OBC’s use the same raw materials arranged into alternating “soft” and “hard” blocks
- The “soft” blocks deliver flexibility and the “hard” blocks deliver heat resistance

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**Random† Copolymers**

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Less co-monomer and higher density

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More co-monomer and lower density

**Block Copolymers**

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Soft blocks

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Hard blocks

Note: †denotes “substantially” random
Higher Heat Resistance

• OBCs exhibit 50°C - 60°C higher melting temperatures versus random† ethylene copolymers of similar density and modulus

• This results in higher upper service temperatures for OBCs

Note: †denotes "substantially" random
• OBC polymers show less stress-relaxation compared to SBC.
• Improved stress-relaxation performance translates to improved fit (less sag) in end-use.
Higher Crystallization Temperature

- OBCs exhibit 50°C - 60°C higher recrystallization temperatures versus random† ethylene copolymers of similar density and modulus.
- The result is improved processing, such as increased throughput, higher spinning speeds and broader bonding window.
- Faster Set Up during extrusion, lamination, fiber spinning, etc.
- Random† propylene-copolymers are difficult to crystallize hence have a negative impact on processing.

Note: †denotes “substantially” random.
• OBCs offer elastic recovery comparable to SBCs at high strain
• The result is olefin elastic films that can be stretched further with excellent recovery
Permanent Set Performance

Random†
Ethylene-based

Random†
propylene-based

Olefin Block Copolymer

OBC closes the performance gap between random† copolymers and SBCs.

Note: †denotes “substantially” random
Positioning of OBC in H&H

Health and Hygiene

Diapers, Fem Hy & Adult Incontinence

Extensible and Elastic Components
- Ears
- Side Panel
- Back- & Top-sheet
- Waist Band
- Leg Cuffs
- Closure Systems

Adhesive Components
- Low Temperature Hot Melt Adhesives
- Pressure Sensitive Adhesives
Positioning of Olefin Block Copolymers

Heat Resistance vs. Processability

- **Excellent**
  - Polypropylene
  - OBCs (Ethylene-based Elastomers)

- **Poor**
  - Propylene-based Plastomers
  - Ethylene-based Elastomers

Materials:
- SIS
- SEBS
- SBS
- Polyethylene
- OBCs
  - Propylene-based Elastomers
  - Ethylene-based Elastomers
Positioning of Olefin Block Copolymers

Extensibility vs. Processability

- SIS
- SEBS
- SBS

- Ethylene-based Elastomers
  - Propylene-based Elastomers

- Propylene-based Plastomers
  - Polyethylene
  - Polypropylene

Health and Hygiene
Positioning of Olefin Block Copolymers

Elasticity vs. Processability

OBCs

SIS
SEBS
SBS

Propylene-based Elastomers

Ethylene-based Elastomers

Propylene-based Plastomers

Polyethylene

Polypropylene
• Grade of olefin block copolymer
  – Melt Index (2.16 kg @ 190°C) = 15 g/10 min, Density = 0.866 g/cm³
• Successful trials (Reicofil 3 & 4 technology)
  – Mono-component
    • Spinning excellent
    • Touch Rubbery
  – Bicomponent trials
    • Spinning excellent
    • Broad bonding window (70 °C to 125 °C)
    • Core sheath ratios varied from 90/10 to 70/30
  – Bonding Window
    • Broad bonding window (70 °C to 125 °C) in both Mono and Bico
• OBC nonwovens can be produced at competitive rates compared to conventional Bicomponent (PP/PE) and Mono-component (PP or PE) nonwovens.
• Rates are **significantly improved** over current random† propylene-ethylene copolymers.
• OBC nonwovens exhibit elasticity necessary to meet current market needs.
• Elasticity can be optimized based on core sheath ratios
Tensile Properties

Nonwovens made with OBC vs Conventional Polymers

- Elongation is significantly improved over PP/PE bi-component nonwovens.
- Tensile strength/Elongation properties can be designed

Can be engineered based on OBC and Fiber design
Olefin Block Copolymer Grades

- Nine grades have been recently launched in multiple markets for a variety of products and applications.
- OBCs are marketed with the best-in-class cost-performance position, competitive with incumbent solutions and expanding the possibilities for further innovation in comfort-fitting applications.

<table>
<thead>
<tr>
<th>Density (g / cc)</th>
<th>Melt Index (g / 10 min)</th>
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<tbody>
<tr>
<td>0.877</td>
<td>0.5</td>
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<tr>
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<td>15</td>
</tr>
<tr>
<td><strong>0.866</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>
Conclusions

• Olefin block copolymers in *Spunbond*:
  – Total Polyolefin approach for Elastic/Extensible applications in Health & Hygiene Applications
  – Polyolefin processing conditions on standard spunbond technology
  – Similar throughput comparable to hPP, however significant higher than other Elastomeric resins
  – Can manipulate Elastic/Extensible properties to desired end use requirements

• Olefin block copolymers in *Films and Laminates*:
  – High line-speed without draw resonance
  – Fast crystallization kinetics / fast development of elasticity
  – Lower permanent set
  – Reduced stress-relaxation at body temperature
  – Formulation flexibility

• Our Health and Hygiene group specializes in several areas of expertise which can be leveraged to customers to improve current and to develop future products:
  – Material selection and blend design
  – Processing optimization
  – Strong IP Portfolio
  – Mechanical characterization
Thank You!

Contact: Ron Weeks, rjweeks@dow.com
All data in this presentation were internally generated.