Milliken®

Hyperform® HPN-20E
Nucleating Agent for Polypropylene

Hyperform HPN-20E Attributes

- Excellent stiffness/impact balance
- Unique shrinkage for dimensional control
- Superior CLTE and HDT performance
- Excellent nucleation performance to maximize processing speed

Typical Applications

- Automotive
- Appliances
- Pipe extrusion
- Closures

Physical Property Enhancements

Hyperform HPN-20E offers unique polypropylene physical properties that combine balanced bidirectional stiffness and excellent impact performance, to meet strict application requirements.

Bidirectional Stiffness

<table>
<thead>
<tr>
<th></th>
<th>MD</th>
<th>TD</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPN-20E</td>
<td>2000</td>
<td>1900</td>
</tr>
<tr>
<td>Non-nucleated Control</td>
<td>1800</td>
<td>1700</td>
</tr>
<tr>
<td>Adv. Nucleator</td>
<td>1600</td>
<td>1500</td>
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</table>

Charpy Notched Impact

<table>
<thead>
<tr>
<th></th>
<th>Charpy Notched Impact (kJ/m²) @ Room Temperature</th>
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</thead>
<tbody>
<tr>
<td>HPN-20E</td>
<td>3.4</td>
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<tr>
<td>Talcum</td>
<td>3.0</td>
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<tr>
<td>NaBz</td>
<td>2.6</td>
</tr>
<tr>
<td>Adv. Nucleator</td>
<td>2.2</td>
</tr>
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Transportation / Injection molding

HPN-20E provides the perfect balance of physical properties and nucleation speed for zero gap bumper applications.

Case Study: Automotive Exterior

Process: Injection Molding

- Isotropic shrinkage for tight tolerances
- Very good HDT performance
- Balanced stiffness / impact performance
- Very low CLTE for demanding exterior applications
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Bottles/Closures-ECM

HPN-20E can improve the production of ECM and IM closures with improved nucleation and consistent shrinkage performance.

Case Study: Closures
Process: ECM

• Pigment leveling - Hyperform overriding process inconsistencies associated with various pigments
• Consistent Processing
• Cycle time reduction (more caps/minute)
• Improved quality - Less defects such as sink marks

Industrial/Other

HPN-20E improves the extrusion processing of PP pipe, and can be used to optimize shrinkage and production performance.

Case Study: Pipes
Process: Other

• Improved processing and throughput
• Better dimensional stability
• Optimized stiffness impact performance
• Very low shrinkage
• Excellent HDT performance

Balanced Shrinkage Performance

Hyperform HPN-20E offers unique polypropylene shrinkage characteristics that allow for highly tuned resin systems that meet high shrinkage and thermal performance tolerances.

Shrinkage Characteristics

Coefficient of Thermal Expansion

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