Novel propylene based performance polymers for hotmelt adhesives

Energy lives here™

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Agenda

ExxonMobil’s Chemical adhesive market commitment

Market trends

New Vistamaxx™ performance polymers

Hot melt adhesives (HMA) using Vistamaxx polymers
  • Example adhesives and data

Summary
ExxonMobil Chemical is committed to the adhesive industry

- Introduction of new family of performance polymers to market
- World largest tackifier plant on track for start up in 2017
  - Global manufacturing presence with enhanced supply reliability
  - Delivering of consistent, high quality Escorez™ tackifying resins
- Leverage on our expertise in tackifiers and polymers to innovate
Hot melt adhesives market and trends
HMA market evolution

Demand growing at 5% (2014 – 2020)

Conventional HMA steady growth
- Wide market appeal
- Proven fit for use

Metalloocene polymers (MCN-PO) drive

value growth
- “Trouble-free” attributes
- Improved stability
- Supply security
- Reduced usage

Hot melt industry growth
(Adhesive volumes)

Source: ExxonMobil estimates and publicly available data
New possibilities, expanding product portfolio

Semi-crystalline copolymers of propylene and ethylene with

- >80 wt% polypropylene with isotactic stereochemistry

Current commercial offerings in HMA

- *High-viscosity* typically as minor component

New Vistamaxx™ performance polymer grades developed

- *Low-viscosity* commercialized grades designed for packaging, hygiene, and assembly adhesion
- *Low-viscosity* polymers become majority component of adhesive formulation
Low viscosity Vistamaxx™ performance polymers 8380, 8780, and 8880

Properties

- Enabling low odor formulations
- Low density for higher mileage
- Clean polymer / clean formulations
- Robust application
- Consistent tack, excellent adhesion to low energy substrates

Supply

- Readily available feedstocks

Pellets

- Provided in pellet form
Novel low viscosity grades enable high polymer loading for hygiene HMAs
Novel low viscosity grades enable high polymer loading

Hygiene HMA sample formulations

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<th>Weight % of adhesive</th>
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<th>20%</th>
<th>40%</th>
<th>60%</th>
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Vistamaxx™ performance polymers
High polymer loading benefits

**Performance**
- Lower density / higher mileage
- Lower add-ons in-use

**Properties**
- Low odor and minimal color
- Stable viscosity
- Improved adhesion

**Processing (robust window)**
- Broad processing window & application temperature range
- High consistent tack, with adjustable open/set times
- Excellent low surface energy adhesion

**Procurement stability**
- Readily available feedstocks

### HMA melt density: volume of 100g HMA at 190°C

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<tr>
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<th>ml/100g</th>
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<tr>
<td>MCN-PE</td>
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<tr>
<td>SBS</td>
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<tr>
<td>50% Vistamaxx</td>
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<td>66.5% Vistamaxx</td>
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Hot melt adhesives for hygiene

Tackifiers and process oils

• Compatible with a broad range of typical HMA components
• Enables higher polymer loading formulations
• Can be manufactured in standard hot melt adhesive mixing equipment
• Vistamaxx polymer-based adhesives using hydrogenated tackifiers enable low odor
Vistammaxx 8380 and 8780 based HMA viscosity profiles

- Viscosity curves of Vistammaxx polymer-based adhesives indicative of broad temperature application window
- Example Vistammaxx polymer-based HMA viscosities are within typical commercial hot melt adhesive viscosity ranges
- High polymer loading example Vistammaxx polymer-based adhesives provide stable thermal viscosity
Vistamaxx 8380 and 8780 based HMA coating performance

- Vistamaxx polymer-based HMA can be coated using both slot and spray applicators
- Broad application temperature window ranges from 130 to 160°C
- Slot coating delivers uniform appearance: straight edges, perfect control

<table>
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<tr>
<th>Polymer</th>
<th>Typical HMA Spray Application Temperature</th>
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<tr>
<td>Vistamaxx</td>
<td>140°C</td>
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<tr>
<td>MCN-PE</td>
<td>150°C</td>
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<tr>
<td>SBC</td>
<td>140/150°C</td>
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Vistamaxx 8380 and 8780 vs next best alternatives

- Vistamaxx polymer-based HMA peel adhesion performance compared to commercial adhesives
- Bond adhesion more stable over time vs. commercial HMAs
- Peel adhesion comparable at 3 gsm, favorable at lower add-on

- Excellent adhesion performance with example Vistamaxx polymer-based adhesives
- Clear potential to optimize further for hygiene applications
Blending of Vistamaxx based HMA

Vistamaxx™ based HMA at 70wt% load can be blended:
  • Using traditional commercial blending unit
  • Within normal T/A times

Blends have been made by:
  • pre-melting wax, than tackifier
  • adding polymer at increasing increments
  • After each increment wait until temperature back at target

Test performed using:
  • Typical 3-shaft pilot blending unit with blade @ 30 rpm
  • Test performed at constant mass (4kg)

Vistamaxx™ based adhesive can be produced using traditional HMA mixing tools.
Summary
Less

Density
Odor
Trouble

More

Mileage
Stability
Performance

Vistamaxx™ performance polymers
Thank you