Aqueous Dispersions of Polyolefins
Breaking the Extrusion Barrier

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Session 6.2, Paper 7633
What comes to mind when you think of polyolefins?

- Films
- Plastic Pellets
- Molded Articles & Containers
Traditional Polyolefin Converting Processes

Blown / Cast Film

Injection, Compression, Blow - Molding

Extrusion Coating / Lamination

Profile & Sheet Foam Extrusion
Waterborne Polyolefin Dispersions
40-55 % Solids, < 500 cps Viscosity
Converting Options for Polyolefin Dispersions

Printing/Coating Processes (Rotogravure)

- Spray Application
- Dipping
- Frothed Foams
Waterborne Application Vs Extrusion for Coating of Polyolefins

- Thinner coatings
- Use existing waterborne application equipment
- Higher line speeds
- Penetrate porous / fibrous webs
- Coat at low temperature
- Coat complex geometry
- Coat in pattern
Polyolefin Dispersion Characteristics

- Avg. Particle Size ~ 1 µ
- Solids Content (by wt) 40 to 55% solids
- pH – 8.0-10.5
- Viscosity (Brookfield @ 25°C) < 500 cps
# Example Polyolefin Dispersions

<table>
<thead>
<tr>
<th>Product Designation</th>
<th>Polymer Composition</th>
<th>Carboxylic Acid Content</th>
<th>Polymer Melting Point (deg C)</th>
<th>Polymer Tg (deg C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersion A</td>
<td>Ethylene Copolymer</td>
<td>Yes</td>
<td>60</td>
<td>-55</td>
</tr>
<tr>
<td>Dispersion B</td>
<td>Ethylene Copolymer</td>
<td>Yes</td>
<td>116</td>
<td>-55</td>
</tr>
<tr>
<td>Dispersion C</td>
<td><em>Propylene Copolymer</em></td>
<td>Yes</td>
<td>85</td>
<td>-25</td>
</tr>
<tr>
<td>Dispersion D</td>
<td>Ethylene Copolymer</td>
<td>No</td>
<td>60</td>
<td>-55</td>
</tr>
<tr>
<td>Dispersion E</td>
<td><em>Propylene Copolymer</em></td>
<td>No</td>
<td>85</td>
<td>-25</td>
</tr>
</tbody>
</table>
Film Formation – Hot Stage Microscopy

Polyolefin Particles

Homogeneous Film
Mechanical Properties of 250 µ Films Cast from Dispersion D

Paper 7633, Ronald Wevers
Properties of Polyolefin Dispersions

- Water resistance
- Oil & grease resistance
- Heat sealability
- Elasticity / flexibility

- Adhesion to polyolefins
- Adhesion to polar substrates
Carpet Backing

Benefits

- Interlayer adhesion with Polypropylene Tuft & Fabrics
- Thermoformability (Automotive)
- Moisture resistance
- Ability to recycle
- Application via conventional latex coating processes
Frothed Polyolefin Foam Coatings

- Foam directly onto various substrates
- Open cell structure
- High elasticity & soft, luxuriant feel
- Biocompatibility
- High filler acceptance
- Embossable
PO Dispersions as Paper Coatings

- Polyolefins have been widely used to modify paper
- Limitations exist for extruded polyolefins
  - Thickness (> 10 microns)
  - Adhesion to paper
- Beneficial properties provided to paper and board
  - Oil and grease barrier
  - Moisture resistance
  - COF modification
  - Adhesion promoter / tie layer
  - Heat sealability
PODs in Flexible Packaging

**Tie Layer / Laminating Adhesive**
- Alternative to extrusion lamination
  - Adhesion to polyolefins
  - Adhesion to polar substrates (paper, glass, foil, polar polymers)

**Heat Sealable Layer**
- Apply at low temperatures and high speeds
- Low HSIT (<70°C)
- Use existing printing equipment
Grease Resistance (OGR) - 24hrs in 60 deg C Oven

<table>
<thead>
<tr>
<th></th>
<th>Corn</th>
<th>Sesame</th>
<th>Vegetable</th>
<th>Olive</th>
<th>Peanut</th>
<th>Canola</th>
<th>Oleic Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyolefin Dispersion A</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>HS</td>
</tr>
<tr>
<td>Styrene/Butyl Acrylate Latex</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
</tr>
</tbody>
</table>

**HS = Highly Saturated**

Polyolefin Dispersions provide excellent OGR which is maintained after creasing.
# Moisture Resistance of Polyolefin Dispersion Coatings

<table>
<thead>
<tr>
<th>Dispersion</th>
<th>% Solids</th>
<th>Brookfield Visc (cP)</th>
<th>pH</th>
<th>Cobb 120 (g/sqm/120 sec)</th>
<th>MVTR (g/sqm/24hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyolefin Dispersion E</td>
<td>50%</td>
<td>56</td>
<td>12</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Polyolefin Dispersion B</td>
<td>44%</td>
<td>510</td>
<td>11</td>
<td>7</td>
<td>420</td>
</tr>
<tr>
<td>None</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>28</td>
<td>950</td>
</tr>
</tbody>
</table>
Summary

• Attributes of polyolefins are available in a water-borne dispersion
• PODs provide unique properties
  • Adhesion to polyolefins
  • Heat sealability
  • Barrier properties
• PODs create opportunities for innovations in building existing and novel structures
  • Paper and Board
  • Films
  • Foams
  • Textiles
  • Many Others
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THANK YOU

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