New hydrophobically modified acrylic technology to create cellulosics coatings rheology

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European Coatings WEB CONFERENCE
Novel additive developments
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AGENDA

- Overview of rheology modifiers for emulsion paints
- Thickening mechanisms
- New HASE as cellulose ether alternative
- Conclusions
# COMMON RHEOLOGY MODIFIERS FOR EMULSION PAINT

<table>
<thead>
<tr>
<th>CONVENTIONAL</th>
<th>SYNTHEtIC</th>
<th>NATURAL DERIVATIVES</th>
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</thead>
<tbody>
<tr>
<td>• Alkali Soluble Emulsion</td>
<td></td>
<td></td>
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<tr>
<td>-ASE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Acrylic type</td>
<td></td>
<td>• Cellulose ethers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Other polysaccharides</td>
</tr>
<tr>
<td>THIXOTROPIC ASSOCIATIVE</td>
<td></td>
<td></td>
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<tr>
<td>• Hydrophobically modified Alkali Soluble Emulsion (HASE)</td>
<td></td>
<td></td>
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<tr>
<td>• Non-Ionic Synthetic Associative Thickeners</td>
<td></td>
<td></td>
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<tr>
<td>• Incl. Hydrophobically modified Ethylene oxide Urethane (HEUR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Titanium, Zirconium chelates</td>
<td></td>
<td>• Hydrophobically modified cellulose ethers (HM cellulose ethers)</td>
</tr>
<tr>
<td></td>
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<td>• Clays</td>
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</tbody>
</table>
Overview of DCM Rheology Modifiers
According to chemistry

• Acrylic thickeners - ACRYSOL™ range
  - Alkali-soluble emulsions (ASE)
  - Hydrophobe modified alkali-soluble emulsions (HASE)

• Urethane thickeners - ACRYSOL™ range
  - Hydrophobically modified Ethylene oxide Urethane (HEUR)

• Cellulosic thickeners
  - Hydroxyethyl cellulose (HEC) – CELLOSIZE™ range
  - Hydroxyethyl Methyl cellulose (HEMC) – WALOCEL™ M range
  - Carboxymethyl cellulose (CMC) - WALOCEL™ C range
Thickener Chemistry of focus

Cellulosic chemistry

Acrylic chemistry
**Thickening mechanisms**

**Associative thickening**
- Latex
- Acrylic chemistry:
  - HASE
- Cellulosic chemistry:
  - HM cellulose ethers

**Non-associative thickening**
- Latex or Pigments
- Thickener
- Acrylic chemistry:
  - ASE
- Cellulosic chemistry:
  - Cellulose ethers (HEC)
Need for cellulosics replacement by a HASE

- Ease of addition via liquid delivery
- Increasing speed of paint production avoiding a powder swelling step
- Avoid viscosity loss via enzyme resistance
- Reduce roller spatter with standard cellulosics
- Formulation cost benefits possible
- Improve supply and availability situation
Development Concept
New HASE as cellulosic ether alternative

• HASE and ASE can each match some cellulosic ether properties

• New HASE technology delivers many of the positive attributes of both HASE and ASE

• Result: Viable alternative to cellulosic ethers
Technical Requirements for cellulosics replacement

- Rheology
  - High sag resistance
  - High efficiency in flat-satin formulations
  - Resistance to viscosity loss with colorant
  - Resistance to viscosity loss on water dilution
  - Roller pattern
  - “application feel”

- Color
  - Good color acceptance/color float
  - Resistance to viscosity loss with colorant

- Dry-film properties
  - Excellent water resistance
  - Good scrub resistance
New HASE : ACRYSOL™ DR-110 ER

Hydrophobically modified, alkali-soluble, emulsion-form thickener (HASE) designed as an alternative to cellulose ethers for latex based paint thickening.

<table>
<thead>
<tr>
<th>Property</th>
<th>Typical Values</th>
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<tbody>
<tr>
<td>Appearance</td>
<td>Milky white emulsion</td>
</tr>
<tr>
<td>Solids, by weight, %</td>
<td>30.0</td>
</tr>
<tr>
<td>Density (g/ml), wet</td>
<td>1.06</td>
</tr>
<tr>
<td>pH</td>
<td>4.3</td>
</tr>
<tr>
<td>Viscosity (Brookfield #2, 60 rpm), cps</td>
<td>&lt; 50</td>
</tr>
<tr>
<td>Stabilization</td>
<td>Anionic</td>
</tr>
<tr>
<td>Storage precautions</td>
<td>Protect from freezing</td>
</tr>
</tbody>
</table>

Properties are typical but do not constitute specifications
**ACRYSOL™ DR-110 ER**

- Shows the typical HASE advantages over cellulosics:
  - Liquid delivery, low viscosity emulsion – easy of handling
  - Enzyme resistant – good paint storage stability
  - Good spatter resistance – Ease of application
  - Possibility of post-addition as well addition in the grind for ease of formulation

- Good alternative to cellulose ethers based on:
  - Matching rheology profile
  - Good retention of viscosity upon water dilution
  - Good performance upon tinting: good colour acceptance, reduced colour float

- Can lower the total formulation cost
  - As first estimate, recommended to replace HEC with 2 parts of this new HASE
Use Level Across Binders/Formulations

New HASE Use Level versus cellulosics

- PVA-blend flat
- Acrylic eggshell
- Acrylic semigloss
- Acrylic exterior flat
- PVA flat

Legend:
- HASE 110 (dry)
- HEC (dry)
**Rheology of the New HASE**

Brookfield rheology at constant Stormer Viscosity (121 – 124 KU) in S/A based flat paint at 70 PVC.

In this formulation, the New HASE Acrysol™ DR-110 ER show a more comparable rheology to cellulosics than standard HASE.
Excellent viscosity retention after water dilution

20% water dilution KU viscosity loss, acryl-vinyl binder 64% PVC Flat

- Standard HASE
- HEC
- New HASE
Excellent viscosity retention after water dilution

Water dilution of paints based on styrene-acrylic binder at various PVC levels (flat and semi-gloss)

The New HASE shows a better viscosity retention after dilution versus other HASE thickeners
Excellent Colour Compatibility – Colour Float

HASE

HEC

New HASE

Acryl-vinyl based flat paint tinted with 3% colorant, 1 week at 60°C

Excellent Color Compatibility
Effect of PVC on Scrub Resistance

Scrub Resistance

- New HASE
- HEC
- HMHEC

Cut Thru Cycles

PVC

0 500 1000 1500 2000

49 57

vinyl acrylic flat
PJ9-25
Can Thicken the Grind

New HASE in Grind

<table>
<thead>
<tr>
<th></th>
<th>100% in Letdown</th>
<th>40% in Grind 15 min</th>
<th>40% in Grind 30 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brookfield Visc, Spindle #4, cPs, 25C</td>
<td>46590</td>
<td>45990</td>
<td>42791</td>
</tr>
<tr>
<td>3RPM</td>
<td>16546</td>
<td>16147</td>
<td>15197</td>
</tr>
<tr>
<td>12RPM</td>
<td>5479</td>
<td>5399</td>
<td>5129</td>
</tr>
<tr>
<td>Sag resistance (mils)</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Leneta Flow</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Vinyl-acrylic flat paint
Conclusions

- The New HASE Acrysol™ DR-110 ER can be used as a close alternative to cellulosics
  - Matching rheology profile
  - Good retention of viscosity upon water dilution
  - Good performance upon tinting: good colour acceptance, reduced colour float
  - Can lead to lower formulation costs

- Additional advantages versus cellulosics
  - Liquid delivery, low viscosity emulsion – ease of handling
  - Enzyme resistant – good paint storage stability
  - Good spatter resistance – Ease of application
  - Possibility of post-addition as well addition in the grind for ease of formulation
THANK YOU FOR YOUR ATTENTION

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