Hallstar Ester Plasticizers for
SMP Sealants
Performance Advantages in SMP Sealants

• Esters for modification of SMP: MS & SPUR Sealants
  – Testing performed on a 1K Di-functional MS Polymer*
    • Kaneka S303H (High Modulus)

• Performance Goals
  – Meet/Exceed Phthalate performance
  – Increase Elongation
  – Reduction in Tg
  – Provide stability in Physical Testing after aging

• Compared HallStar Esters with: DIDP, DINP

• HallStar Products:
  – Plasthall 190
  – Plasthall 180 S
  – TegMeR 809
  – Paraplex A-9000
  – Plasthall PR-A610
Ester Evaluations in SMP

- Initial and Aged Ester Performance Evaluations in SMP
  - Viscosity, Brookfield
  - Skin Formation Time
  - Original Physical Properties ASTM D412
    - Modulus, tensile, elongation, hardness
  - Tg, DSC
  - Adhesion – Peel ASTM C794
    - Aluminum, float glass
    - Dry and wet
  - Slump ASTM D2202
- DINP and DIDP as standards
### Variables / Formulation

**SMP**
- Kaneka S303H
  - 1K Difunctional MS Polymer*
    (high modulus)

**Plasticizers**
- Plasthall 190 (Aliphatic alkylated ester)
- TegMeR 809 (Aliphatic PEG ester)
- Plasthall PR-A610 (Renewable ester)
- Plasthall 180S (Aliphatic linear ester)
- Paraplex A-9000 (Aromatic Polymeric Phthalate)
- DIDP (Aromatic Phthalate)
- DINP (Aromatic Phthalate)

### Base Formulation

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Silane modified polyether</td>
<td>100.0</td>
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<tr>
<td>UV stabilizers</td>
<td>2.0</td>
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<tr>
<td>Precipitated calcium carbonate</td>
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<tr>
<td>Calcium carbonate</td>
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<td>Titanium oxide</td>
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<td>Plasticizer</td>
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<tr>
<td>VTMO - dehydrate</td>
<td>3.0</td>
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<tr>
<td>DAMO – adhesion promoter</td>
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<tr>
<td>Catalyst</td>
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*MS Polymer is a registered trademark of Kaneka Corporation*
Viscosity

- Plasthall 180 S high viscosity, with exceptional shear reduction
- Plasthall 190 / TegMeR 809 low viscosity = faster extrusion
Physical testing

- High Elongation
  - Plasthall 180 S
  - TegMeR 809
- High Tensile
  - DIDP
- High Hardness
  - Plasthall 190
Elongation after Aging (ASTM C794)

- Heat Age (21 Day@ 70°C)
  - High Elongation
    - Plasthall 180 S
    - TegMeR 809
Tack Free Time/Skin Formation (ASTM C679 Modified)

- Fast Skin Time
  - Plasthall 190
  - Predicting fast cure through

- Slow Skin Time
  - Plasthall 180 S
    - Use as elongation additive
Tg by DSC (°C)

- **Ultra Low Tg**
  - Plasthall 190
**Adhesion in Peel (ASTM C794)**

- **Stability**
  - Plasthall 190, TegMeR 809
- **Moisture required**
  - Plasthall 180 S (use less dehydrant)
Hallstar Ester Summary in SMP

• **TegMeR 809**
  – Increase Elongation
  – Maintain Tensile, Hardness
  – Stable after aging/weathering

• **Plasthall 190**
  – Ultra Low Tg
  – Fast Skin time/cure through
  – High Hardness
  – Stable after aging/weathering

• **Paraplex A-9000**
  – Good Elongation while maintaining Tensile strength
  – High adhesive strength

• **Plasthall 180 S**
  – Significant Increase in Elongation
  – Potential use as elongation additive
What’s next at Hallstar in SMP?

• Next Round of SMP sealant evaluations to include:
  – SPUR (vs. MS tested)
  – Additional Polymeric Ester Plasticizers
  – Ester Blends (for optimization)
  – Weathering Testing (Xenon Arc/QUV)
  – Recovery/Rebound
Thank you