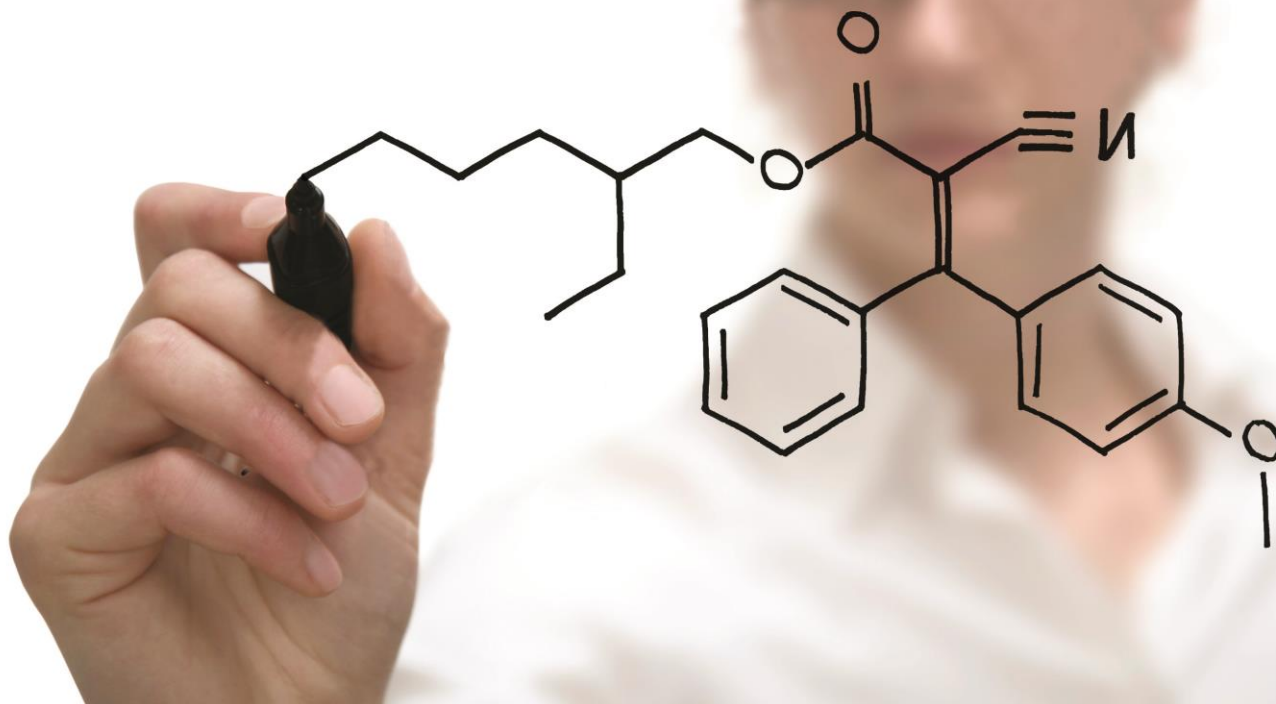


# Hallstar Ester Plasticizers for SMP Sealants



# 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
  - Paraplex A-9000
  - Plasthall 180 S
  - Plasthall PR-A610
  - TegMeR 809



# 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

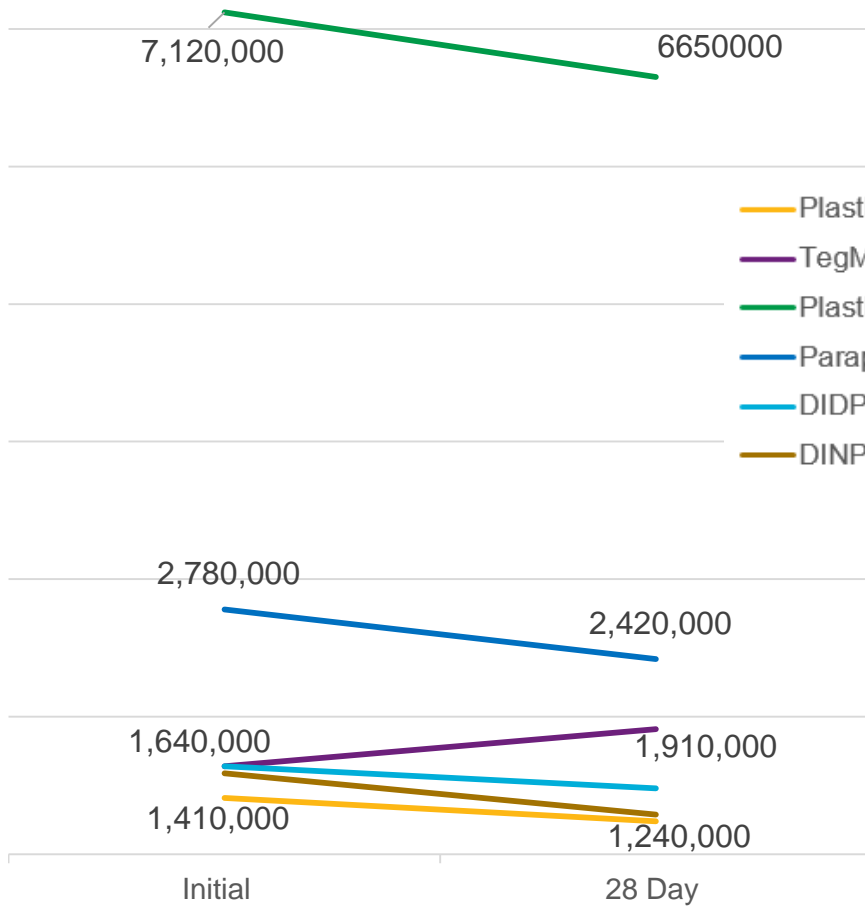
- SMP
  - Kaneka S303H
    - 1K Difunctional MS Polymer\*  
(high modulus)
- **Plasticizers**
  - Plasthall 190 (Aliphatic alkylated ester)
  - TegMeR 809 (Aliphatic PEG ester)
  - Plasthall PR-A610 (Renewable ester)
  - Plasthall 180S (Aliphatic linear ester)
  - Paraplex A-9000 (Aromatic Polymeric Phthalate)
  - DIDP (Aromatic Phthalate)
  - DINP (Aromatic Phthalate)

Base Formulation	
Silane modified polyether	100.0
UV stabilizers	2.0
Precipitated calcium carbonate	160.0
Calcium carbonate	54.0
Titanium oxide	20.0
<b>Plasticizer</b>	<b>90.0</b>
VTMO - dehydrate	3.0
DAMO – adhesion promoter	3.0
Catalyst	2.0

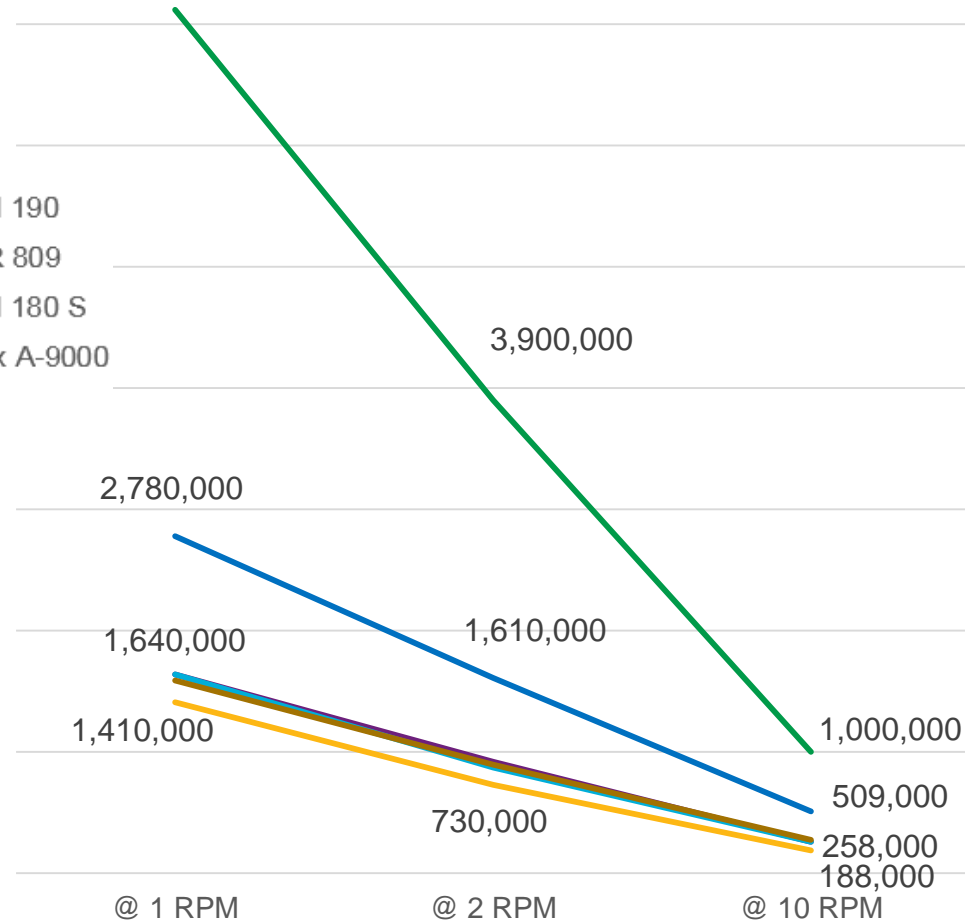
\*MS Polymer is a registered trademark of Kaneka Corporation

# Viscosity

Viscosity Stability(1 RPM)



7,120,000 Shear



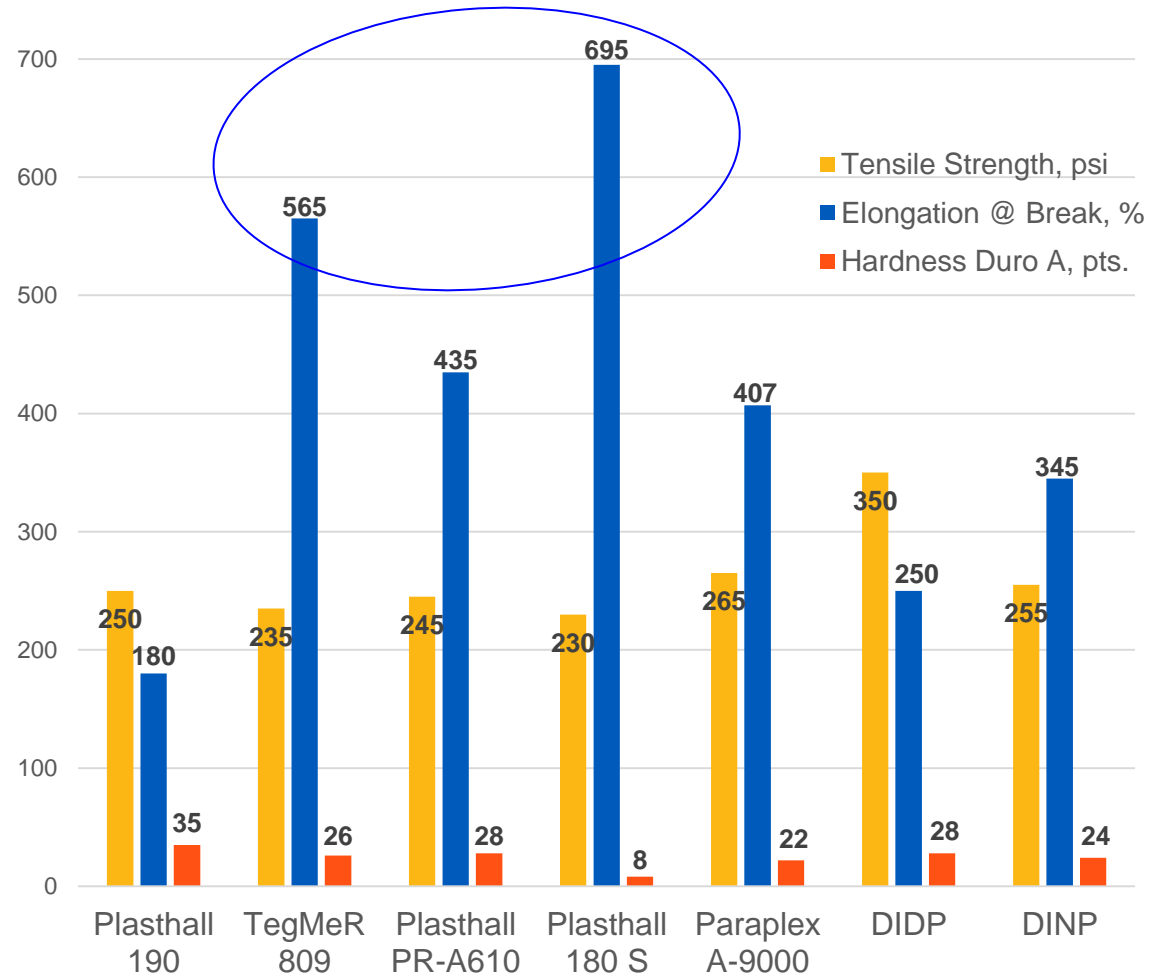
- Plasthall 180 S high viscosity, with exceptional shear reduction
- Plasthall 190 / TegMeR 809 low viscosity= faster extrusion

# Physical testing

Elongation / Tensile (ASTM D 412)

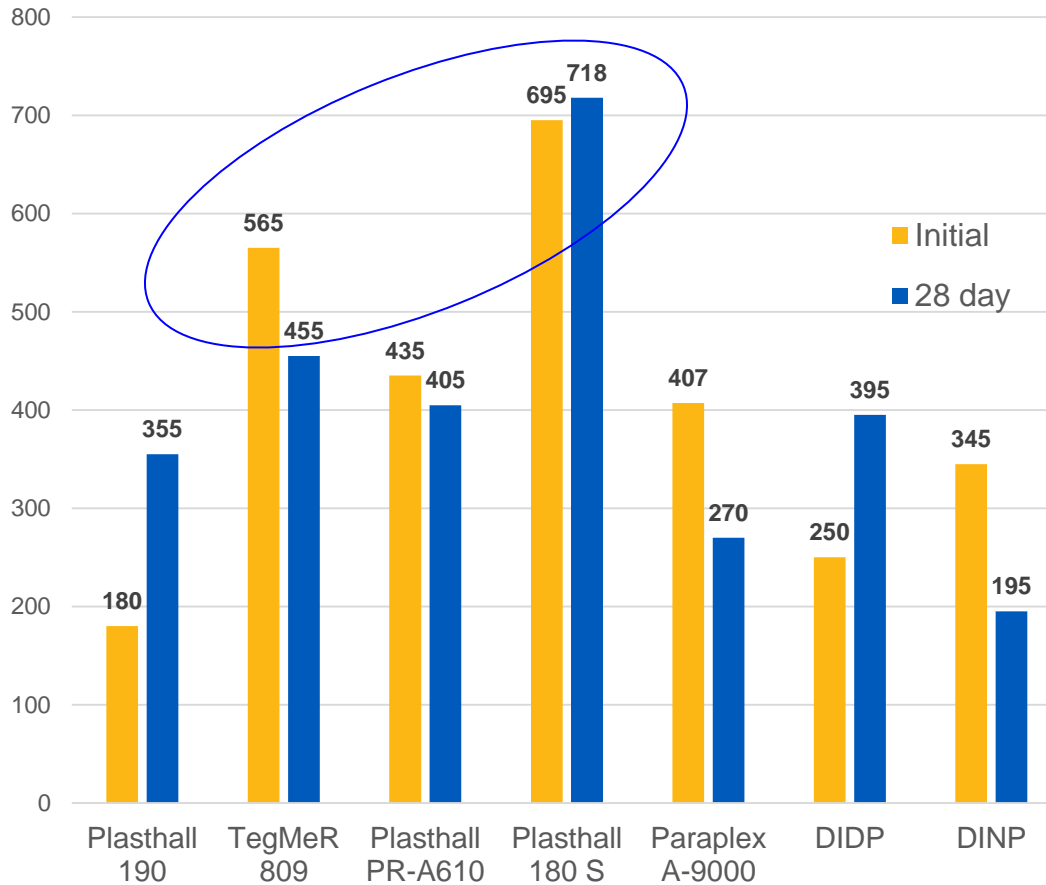
Hardness (ASTM C661)

- High Elongation
  - Plasthall 180 S
  - TegMeR 809
- High Tensile
  - DIDP
- High Hardness
  - Plasthall 190



# Elongation after Aging (ASTM C794)

Elongation @ Break, %

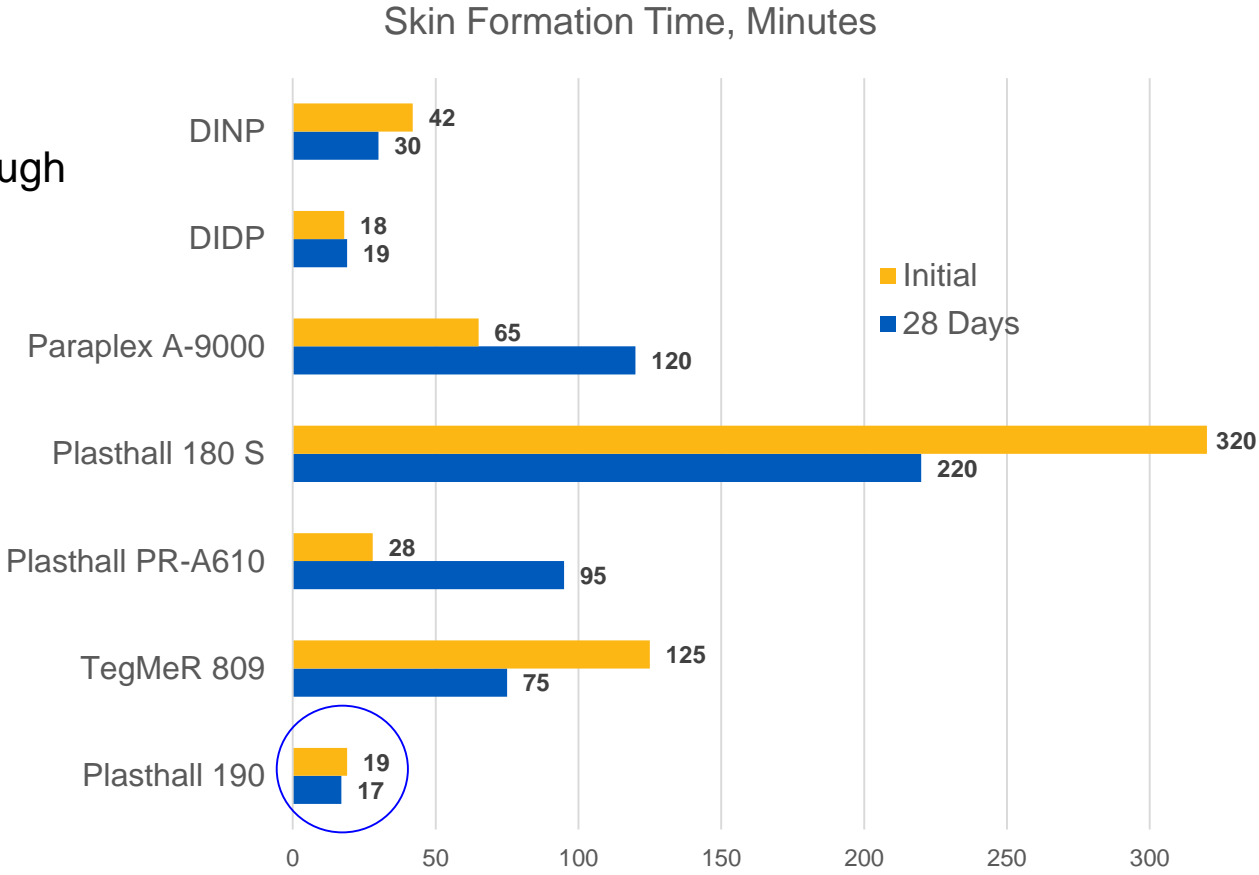


- Heat Age (21 Day @ 70°C)
  - High Elongation
    - Plasthall 180 S
    - TegMeR 809

# Tack Free Time/Skin Formation (ASTM C679 Modified)

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

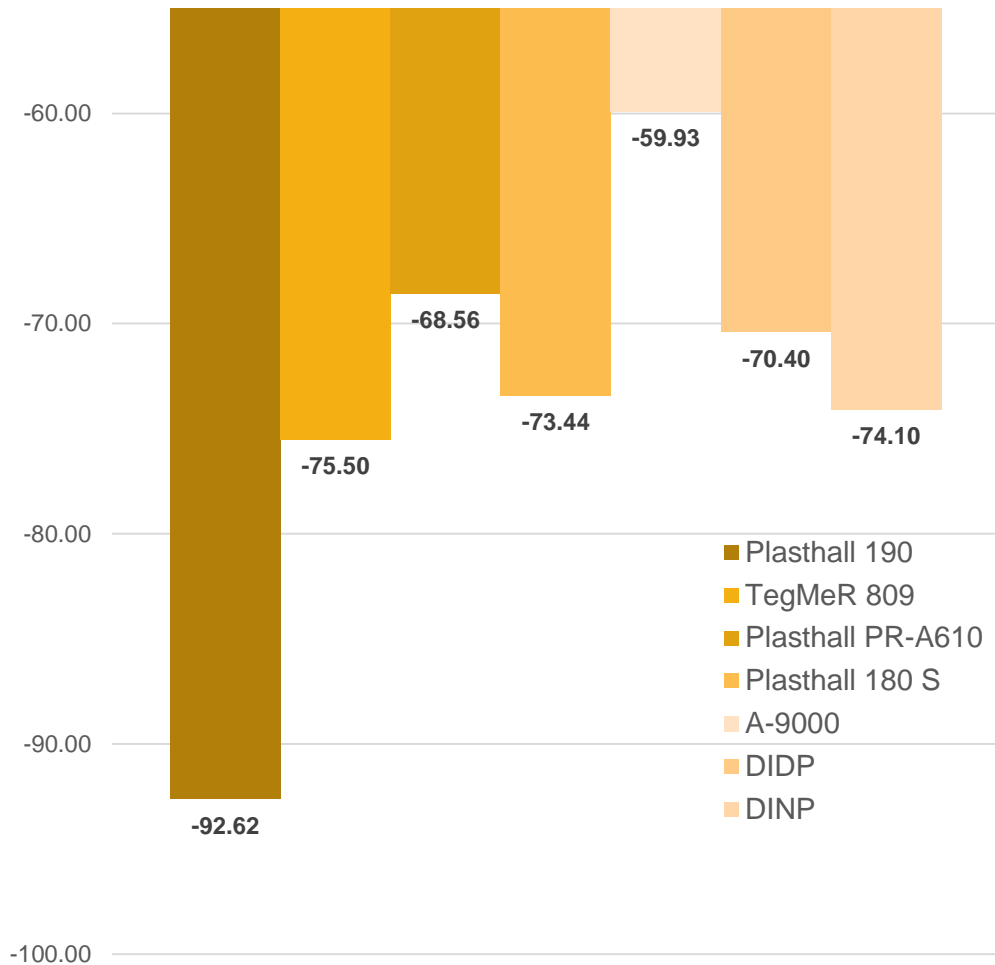
- Slow Skin Time
  - Plasthall 180 S
    - Use as elongation additive



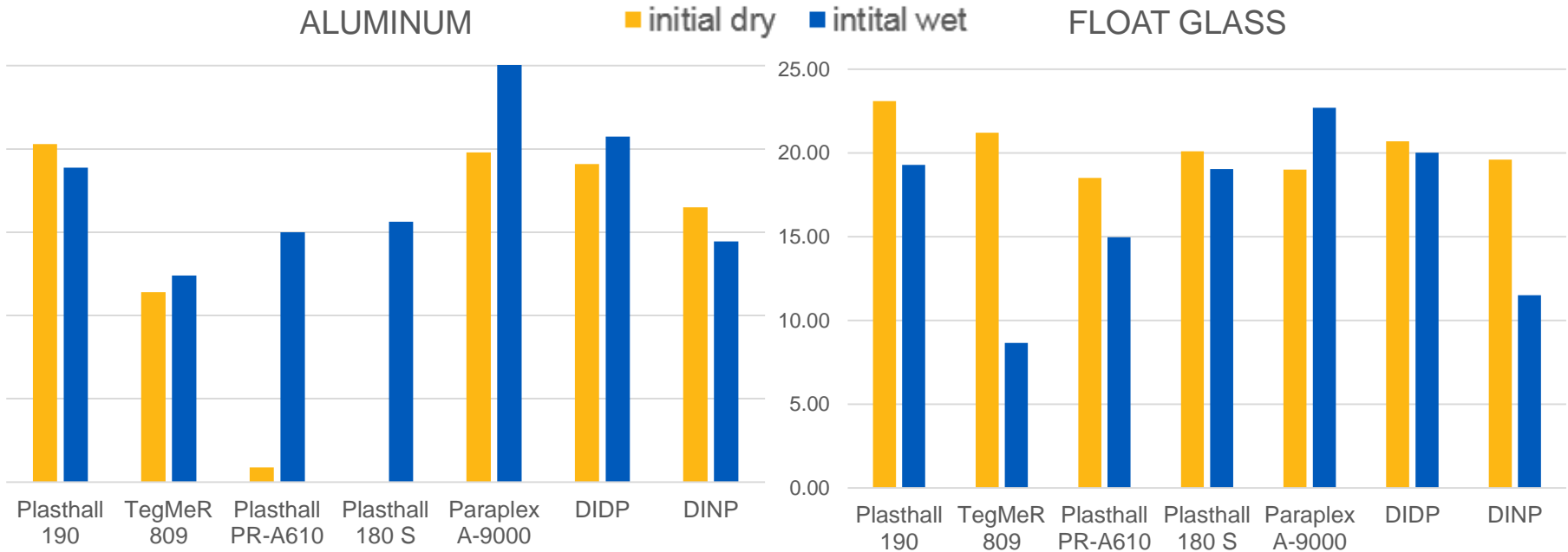


# Tg by DSC (°C)

- Ultra Low Tg
  - Plasthall 190



# Adhesion in Peel (ASTM C794)



- Stability
  - Plasthall 190, TegMeR 809
- Moisture required
  - Plasthall 180 S (use less dehydrant)

- Stability
  - Plasthall 190, Plasthall 180S
  - Paraplex A-9000

# 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