Technical Data Sheet

Silquest™ A-Link™ 59

Silquest© A-Link© 597

Description

Silquest A-Link 597 silane functions as an adhesion promoter for a variety of substrate/matrix resin combinations. It is especially useful in high performance hot melt adhesives and other applications where exposure to sustained temperatures might occur.

Key Features and Benefits

- Improved adhesion to difficult substrates such as plastics, glass and metals including aluminum and steel
- Thermal stability at 200°C
- High boiling point, low volatility for better silane retention in hot melt adhesive application conditions
- Compatible with most hotmelt resins

Structural Feature	System Benefit
High concentration of trimethoxy silyl groups	Provides effective adhesion to a variety of substrates
Isocyanurate chemistry	Polar structure provides good solubility in most resins, good wetting of most substrates, imparts thermal resistance and low volatility to the adhesion promoter.

Typical Physical Properties

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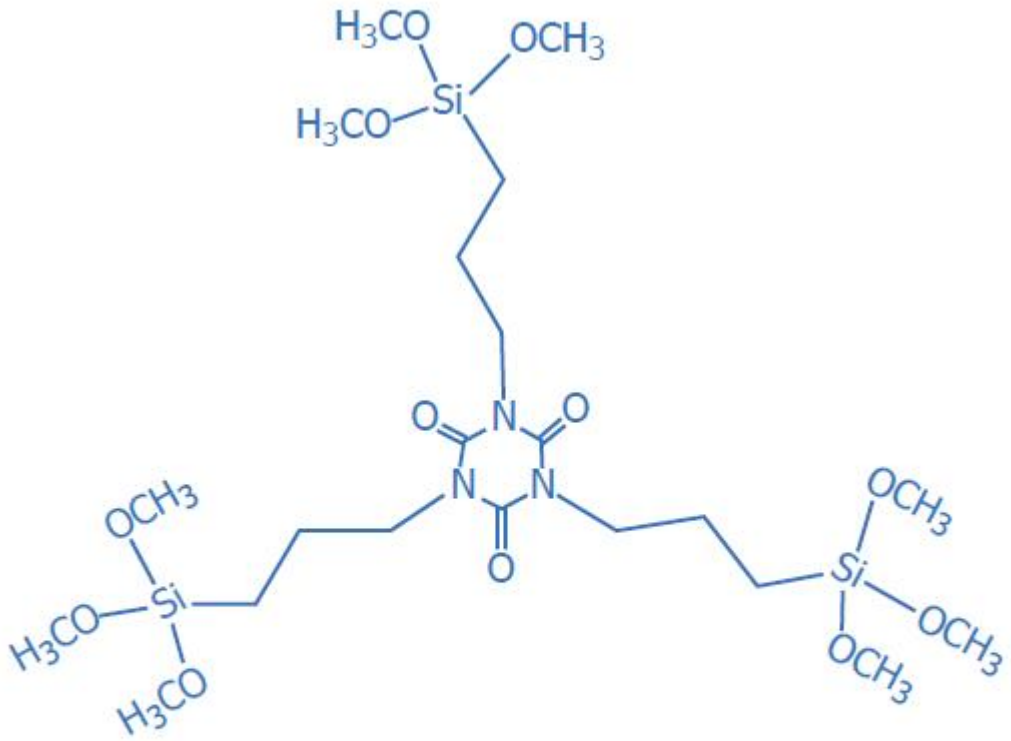
Appearance	Clear liquid
Specific Gravity at 25/25°C	1.170
Viscosity, cSt	95
Flash Point, Pensky-Martens Closed Cup, ASTM D93, °C (°F)	102 (216)
Boiling Point at 0.05mm Hg, °C	230

Chemical Structure



Tris(3-(trimethoxysilyl)propyl)isocyanurate (Mol. Wt. 616)
Silquest A-Link 597 silane

Potential Applications

Silquest A-Link 597 silane demonstrates excellent adhesion promoter properties when evaluated in SPUR+* prepolymer-based sealants and in commercial hot melt adhesives.

Silquest A-Link 597 Silane Adhesion Promoter in SPUR+ Prepolymer and

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Sealants:

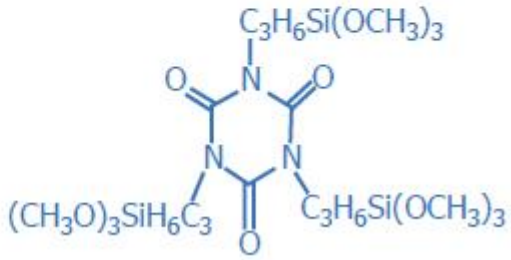
Illustrative of its effectiveness in SPUR+ prepolymer sealants is shown by first the preparation of SPUR+ prepolymers based on either a 4,000 or 8,000 molecular weight, low monol content polypropylene diol using IPDI. The NCO/OH ratio was 1.5 and 15 ppm dibutyltin dilaurate used as catalyst per a previously reported procedure. These prepolymers were capped with Silquest A-Link 15 then formulated into low filler SPUR+ prepolymer sealant formulation:

Sealant Formulation

Ingredients	Weight (g)
SPUR+ prepolymer	250
Plasticizer	100
Moisture Scavenger (Silquest A-171* silane)	3.75
Calcium Carbonate	250
UV Stabilizers	5
Thixotropic Agent	15
TiO2	7.5
Silane Adhesion Promoter	3,75
Catalyst (Fomrez** SUL-4)	0.16

**Formrez is a trademark of Crompton Corporation

For comparison a number of silanes were added as the silane

Commercial Name	Structure
Silquest* A-1170 silane	$HN[\sim Si(OCH_3)_3]_2$
Silquest A-1100* silane	$NH_2\sim Si(OCH_2Ch_3)_3$
Silquest A-Link 597 silane	

The impact of each silane on SPUR* prepolymer-based sealant properties was evaluated using ASTM specifications. Tensile strength, elongation, modulus (ASTM D

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412), shore A (ASTM C 661) and tear resistance (ASTM D 624) data were obtained on samples cured according to the following schedule: 1 week at 50°C (122°F) 85% relative humidity, 1 week at 25°C (73°F) 50% relative humidity, 1 week at 50°C (122°F) 85% relative humidity.

Silquest A-Link 597 has a low basicity and dispersed alkoxy groups relative to other adhesion promoters, which results in sealants displaying excellent elastomeric properties.

Mechanical Properties of Various Adhesion Promoters in SPUR+ Prepolymer Sealants Silane

Silane	Tensile Strength psi (mPa)	Young's Modulus psi (mPa)	Elongation%	Tear lb/in (N/mm)	Shore A
SPUR+ Sealant Based on an 4,000 Molecular Weight, Low Monol Content Polypropylene Diol					
Silquest A-1170 silane	144 (0.99)	342 (2.36)	69	16.8 (2.94)	43
Silquest A-1100* silane	225 (1.55)	300 (2.07)	128	19.5 (3.42)	45
Silquest A-Link 597 silane	191 (1.32)	242 (1.67)	158	22.9 (4.01)	39
SPUR+ Sealant Based on an 8,000 Molecular Weight, Low Monol Content Polypropylene Diol					
Silquest A-1170 silane	198 (1.37)	209 (1.44)	199	23.8 (4.17)	36
Silquest A-1100 silane	214 (1.48)	177 (1.27)	204	28.1 (4.92)	35
Silquest A-Link 597 silane	225 (1.55)	141 (0.97)	365	34.8 (6.09)	30

SPUR+* prepolymer sealant adhesion-in-peel testing from aluminum and glass in accordance with the ASTM C 794 procedure was evaluated. Curing was per above protocol for the physical properties testing followed by water immersion for 1 week then dried by paper towel prior to testing. In Figure 1 (below) Silquest A-Link 597 added to the SPUR+ prepolymer based on an 8,000 molecular weight, low monol content

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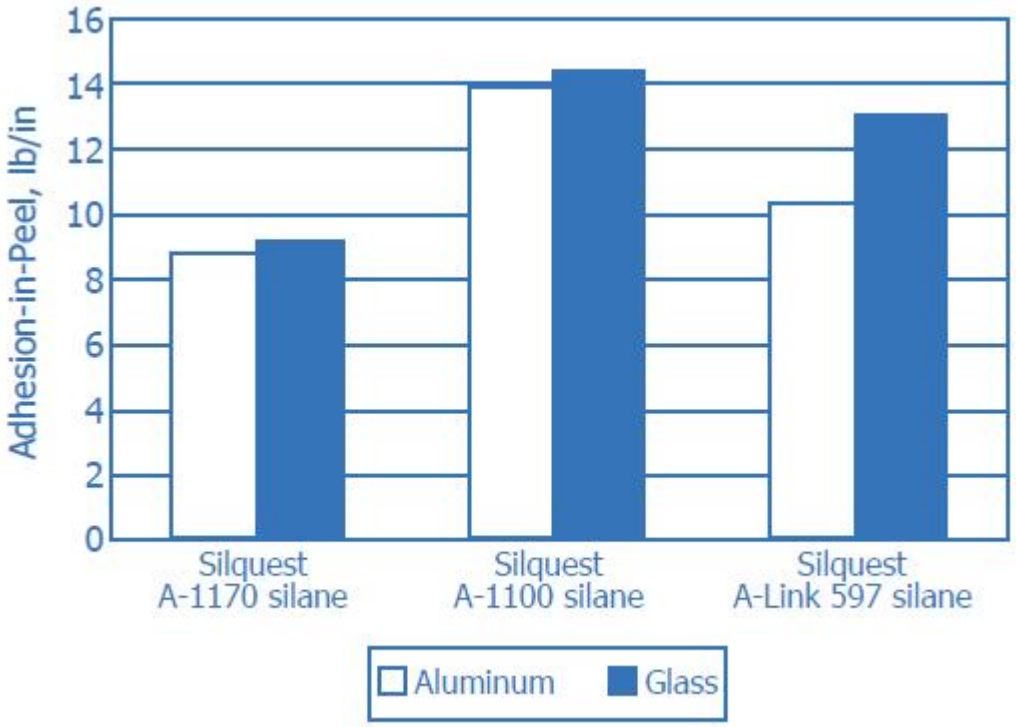
polypropylene diol, clearly exhibits improved adhesion to difficult substrates without sacrificing the flexibility of sealants as do aminosilane adhesion promoters.

Figure 1: Adhesion-in-Peel Test



Silquest A-Link 597 Silane Adhesion Promoter in Commercial Hot Melt Adhesives:

The low volatility and excellent oxidative stability ofSilquest A-Link 597 silane also makes it ideally suited for hot meltadhesive applications where improved adhesion is desired. Todetermine what effect Silquest A-Link 597 silane has on the typicalphysical properties of hot melt adhesives (HMA) blends of severalcommercial HMAs, EVA hot melt adhesive and polyamide adhesiveas shown in the table following. HMA physical properties wereevaluated for the formulations shown in the table below. Thesewere cured by water soaking for two weeks at room temperaturefollowed by conditioning 24 hours at 50°C prior to testing. Physicalproperty results revealed that Silquest A-Link 597 silane mayaffect some physical properties specific to HMA type. For examplethe polyamide adhesive HMA showed increased tensile, modulusand elongation properties while the EVA hot melt adhesive didnot. These findings were typical for the other high temperatureHMAs tested (polyolefins, polyester) and indicated that A-Link597 silane might affect physical properties and this factor shouldconsidered in the specific

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application.

Physical Properties of Commercial Hot Melt Adhesives with Silquest A-Link 597 Silane Adhesion Promoter

	Tensile psi (mPa)	100% Modulus psi (mPa)	Elongation %	Tear lbs/in (N/mm)
EVA Hot Melt Adhesive				
0%	469 (3.23)	468 (3.23)	96	198 (34.7)
0.50%	435 (3.00)	434 (3.00)	93	168 (24.4)
1.00%	597 (4.12)	591 (4.07)	88	204 (35.7)
1.50%	476 (3.28)	476 (3.28)	95	184 (32.2)
Polyamide Adhesive				
0%	473 (3.26)	380 (2.62)	56	240 (42.0)
0.50%	434 (3.00)	434 (3.00)	45	210 (36.8)
1.00%	705 (4.86)	-	62	263 (46.1)
1.50%	679 (4.68)	753 (5.19)	60	269 (47.1)

Improved adhesion of these commercial HMAs with Silquest A-Link 597 was further evaluated by lap shear testing using various substrates. Samples were prepared with 0.5 inch x 1 inch overlap and 0.125 inch of adhesive thickness. Typical results are shown below. As in the SPUR+* prepolymer-based sealant case, Silquest A-Link 597 demonstrated effective adhesion promoter results. Optimum level was found to be dependent on the hot melt adhesive type, i.e. polyester, polyamide, EVA etc and should be evaluated on the specific HMA to be used.

Figure 2: Polyamide HMA

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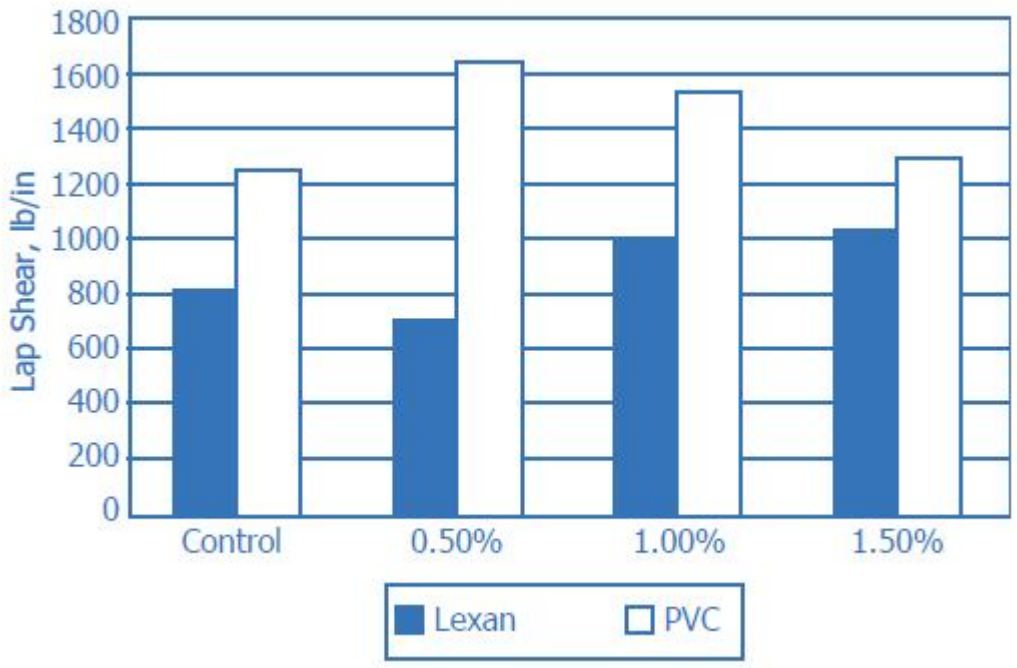
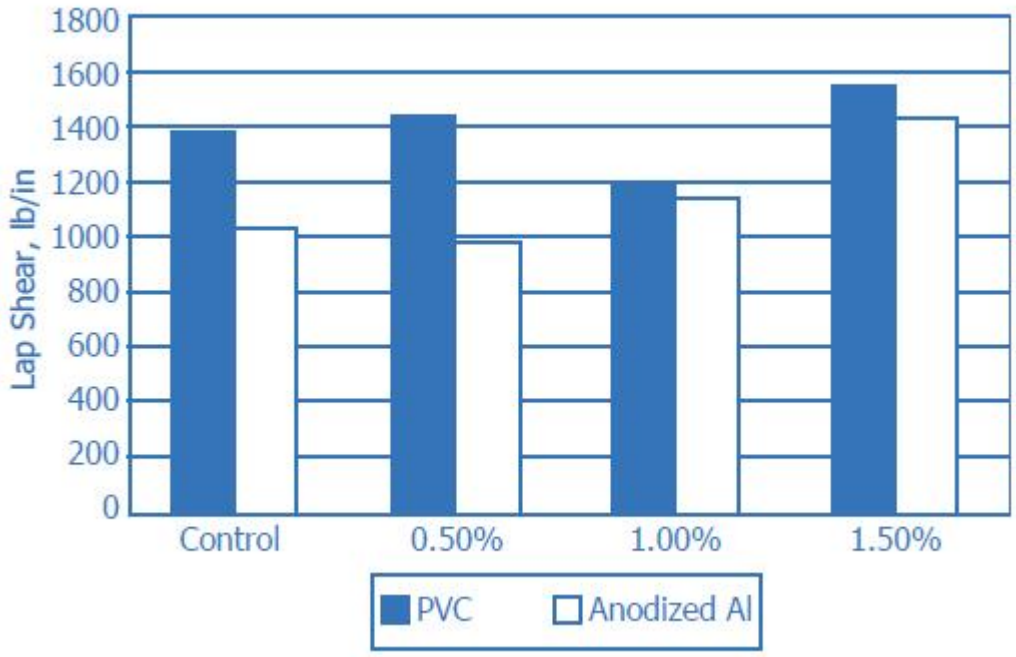


Figure 3: Polyester HMA



Silquest A-Link 597 demonstrates enhanced adhesion as demonstrated for the EVA hot melt shown below. Further evaluation using a blended A-Link 597 with A-1100* at a 4/1-weight ratio blend enhanced lap shear adhesion. Such a blend can affect both

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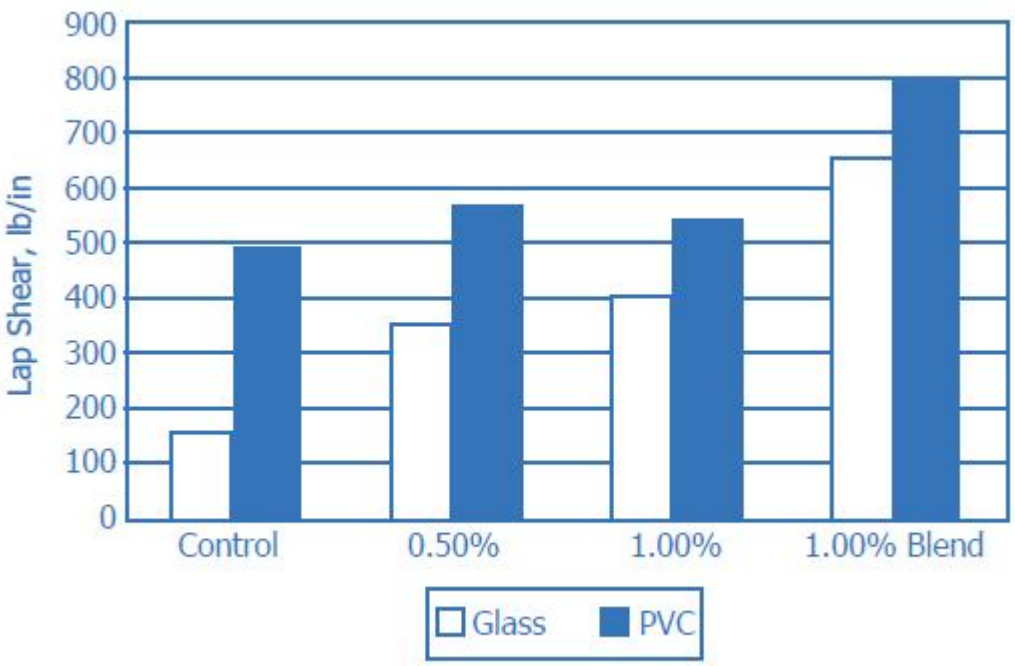
mechanical and hot melt properties (viscosity, color, open time) therefore a thorough evaluation should be done prior to use.

Figure 4: EVA HMA



Silquest A-Link 597 silane has a characteristic low volatility and oxidative stability that makes it well suited as an adhesion promoter in both SPUR+* prepolymer-based sealants and higher temperature applications such as hot melt adhesives.

Patent Status

Standard copy to come

Product Safety, Handling and Storage

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Limitations

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