

POLY bd[®] Resins in Insulating Glass Window Sealants

Poly bd[®] Resin based sealants are used worldwide as preferred engineering materials in marine, automotive, building construction and, especially, *insulating glass window* applications.

Sealants for insulating glass window must meet the highest standards of performance. Urethane cured Poly bd[®] Resin based formulations are capable of providing excellence in adhesion, UV exposure resistance and physical properties over a wide temperature range. These advantages are due to the ability of Poly bd[®] Resins to impart:

- Excellent adhesion to metals and glass
- Excellent low temperature flexibility
- Excellent water resistance
- Excellent property retention with age
- Excellent dispersion of fillers

Results from a study to develop an improved Poly bd[®] Resin based insulating glass window sealant starting formulation are presented here. Comparisons of the initial and UV weatherometer aged elastomer properties with those of a typical commercial polysulfide based sealant are provided. The results from this study clearly demonstrate the advantages for the Poly bd[®] Resin based formulation.

A starting Point Formulation using Poly bd[®] Resin R-45HTLO as the base resin for an Insulating Glass Window Sealant is shown below:

Ingredients^(a)	Parts by Weight	
	Base	Cure Agent
1. Poly bd [®] Resin R-45HTLO (OH Value = 0.85 meq/g)	100.0	
2. 2-Ethyl-1,3-Hexanediol (Equivalent Weight = 73.12)	2.11	
3. Super-Pflex 200 (calcium carbonate)	85.0	
4. Ultra-Pflex (calcium carbonate)	40.0	
5. Sterling R (carbon black)	2.0	
6. Santicizer 278	75	
7. Cab-O-Sil TS-720 fumed silica	7.5	
8. Vanox NBC antioxidant	2.0	
9. Silquest A-187 Silane	2.0	
10. Dibutyltin Dilaurate (DBDTL)	0.045	
11. Isonate 143L (Equivalent Weight = 143.5)		
(NCO/OH = 0.95)		15.49
(NCO/OH = 0.926)		15.10

(a) See Materials Suppliers listed below.

Elastomer Physical Properties

Property	Units	0.95 NCO/OH Ratio	0.926 NCO/OH Ratio
Tensile	psi	237	256
Elongation	%	383	473
Tensile Set	%	6	9
Tear Strength	pli	57	52
Hardness	Shore A	43	39
Modulus, 100%	psi	131	105
300%	psi	211	179
Water Vapor Transmission	g/m ² /24 hr	8.29	-
Water Permeance	g/m ² /24 hr/mmHg	0.20	-

Application Properties at NCO/OH = 0.95

Mixing ratio (weight 100 parts base/4.74 parts accelerator). This ratio can be varied by putting part or all of the Santicizer 278 plasticizer on the isocyanate cure agent side.

Work Life – adjustable ^(b)	20-45 min. max.
Tack Free Time – adjustable ^(b)	3-8 hours
Sag, Channel at 70°F ^(c)	0.05 in. max.
T-Peel, A1/Glass ^(d)	12-14 pli
Lap Shear (glass to glass) ^(e)	>130 psi (glass failure)

^(b) can be adjusted by changing DBTDL catalyst content

^(c) aluminum channel, ¾" wide, ¼" deep x 6" long, 1/6 inch wall max., SIGMA Test A.3.B.

^(d) SIGMA Test P.7.A

^(e) SIGMA Test P.6.A

Elastomer Formulation/Effects of Accelerated Aging on Physical Properties

Test	Poly bd [®] Resin Based Starting Formulation (NCO/OH = 0.95)			Typical Commercial Polysulfide Based Sealant		
	0	10	30	0	10	30
Days in Weatherometer ^(f)	0	10	30	0	10	30
Tensile, psi	237	276	288	164	178	160
Elongation, %	383	432	476	431	105	95
Tensile set, %	6	8	9	32	4	2
Hardness, Shore A	43	43	39	50	60	61
Modulus, 100% psi	131	114	111	119	177	-
300% psi	211	230	225	145	-	-
T-Peel, A1/Glass, pli	14 ^(g)	38.3	39.2	8.0	10.5	10.3
Water Permeance, Metric Perms	0.20	-	-	0.30	-	-

^(f) Weatherometer utilizes 6500 watt xenon arc, borosilicate glass filtered, with a cycle of 102 minutes dry, 18 minutes water spray at 50% relative humidity and a black body temperature of 140°F.

^(g) At zero starting time, the Poly bd[®] Resin elastomer is not fully cured, which provides a longer pot life for laboratory testing. A higher catalyst concentration is expected to increase the initial T-Peel value.

FORMULA INGREDIENT	SUPPLIER
1. Poly bd [®] Resin R-45HT	Cray Valley Company, Inc.
2. 2-Ethyl-1,3-Hexanediol	Kyowa Hakko Chemical Americas, Inc.
3. Calcium Carbonate, coated (0.5 microns)	Specialty Mineral Incorporated
4. Calcium Carbonate, coated (0.07 microns)	Specialty Mineral Incorporated
5. Carbon Black	Cabot Corp.
6. Benzyl Phthalate	Ferro Corp.
7. Fumed Silica	Cabot Corp.
8. Antioxidant	R. T. Vanderbilt Company, Inc.
9. Adhesion Promoter	Momentive
10. Dibutyltin Dilaurate	Arkema
11. Isonate 143L	Dow Chemical

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