CHEMICAL BONDING TECHNOLOGY

DOW CORNING CORPORATION

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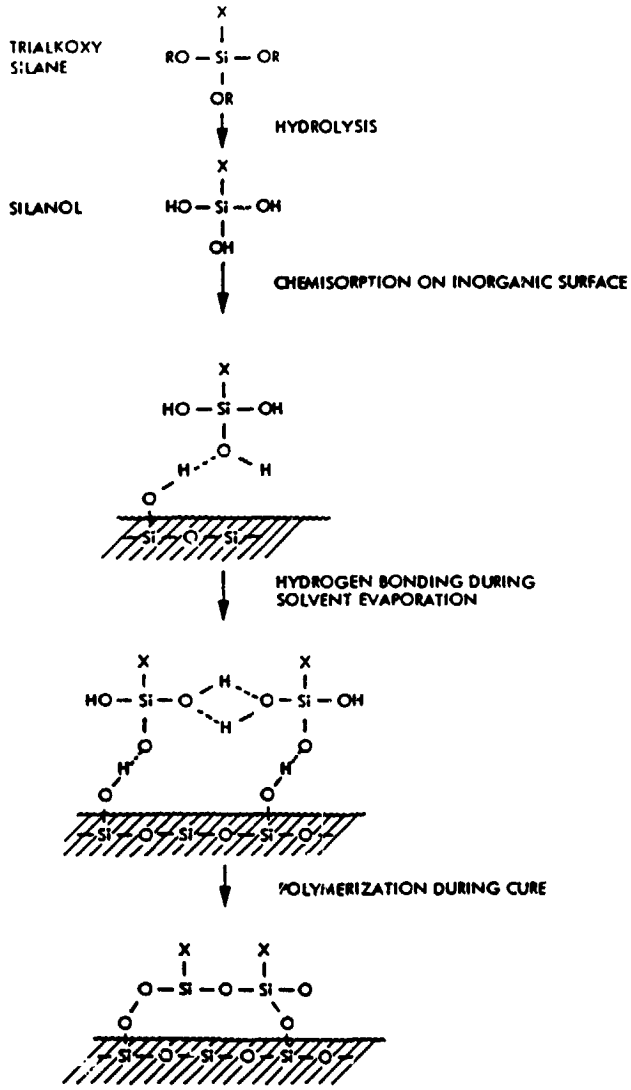
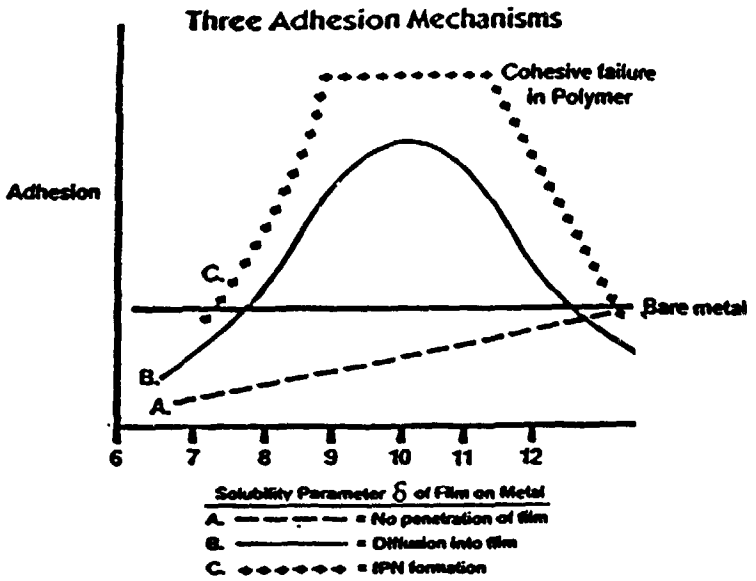
Formation of Polysiloxane on Glass Surface (Bonding of Trialkoxysilanes to Glass and Metals)



Bonding with the Polymer



How Much Should Primer be Pre-Cured? (PVC Plastisol on Glass with Aminosilane Primer) Plastisol Fused 20 min at 150°C

Drv Primer 15 min. at Temperature (°C)	Peel Adhesion of PVC Film (N/cm)	
	Dry	1 day in 50°C water
100°C	(c)	1.08
125	(c)	1.27
150	(c)	15.8
150 (30 min.)	(c)	13.1
175	4.35	–
200	2.50	2.5_0
No primer	0.3	–

(c) = cohesive failure in film at about 25 N/cm

Bonding EVA Copolymers to Glass Through the Use of Commercial Silanes

Commercial designation	Functional group of primer (on Si, Cr, etc.)	Thermoplastic CXA 2202	X-linkable A-9918
A-1100	Aminopropyl	-	+
Z-6020	Diamine	-	+
Z-6030	Methacrylate	++	++
Z-6032	Vinylbenzyl cationic	-	+
Z-6040	Epoxy	-	-
Z-6062	Mercaptan	+	-
Z-6076	Cloropropyl	+	-
Q9-6300	Vinyl	+	+
Q1-6106	Epoxy-melamine resin	++	-
" + Z-6030		+	++
Z-6020 + 2 Mal. Anhyd.		-	++
X1-6100	Mixed Ph/Z-6020 90/10	-	+
Z-6020 + IEMA	Methacrylate-urea	++	+++

+++ = best
++ = good
+ = fair
- = not recommended

Peroxides in Z-6030 Primer for EVA 9918 Peel Strength (Pounds/Inch)

Add 0.5% peroxide to	C.R. Steel		Stainless steel		Aluminum	
Z-6030 + 1% BDMA	Dry	2 hr. boil	Dry	2 hr. boil	Dry	2 hr. boil
None	6.6	9.5	c	c	c	3.3
t-Bu perbenzoate	11.0	c	c	3.3	c	1.8
Lupersol 101	13.2	c	c	c	6.2	-
Lupersol TBEC	c	c	c	c	c	c
Dicumyl peroxide	5.5	9.0	c	c	c	c
Luazo-85 (azo compd.)	c	9.0	c	c	c	c

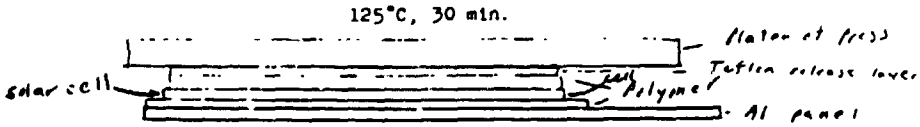
101 = 2,5-Dimethyl-2,5-bis(t-butylperoxy)hexane
TBEC = t-Butyl-2-ethylhexyl monoperoxycarbonate
c = cohesive failure in film at over 15 lb/linear inch

Forced Drying of Primers for EVA on Steel

Primer on C.R. Steel	Drying T°C 15 min.	Adhesion after 2 hour water boil (pli) A-9918
Z-6030 + 1% BDMA	r.t.	11.0
	80	8.1
	120	4.4
" " + Lupersol 101	r.t.	c
	80	11.7
	120	4.4
1% Z-6030 in 1205	r.t.	15.4
	80	7.2
	120	2.4
" " + $ZnCrO_4$	r.t.	c
	80	c
	120	5.5

c = cohesive failure in polymer at over 15 pli

Adhesion Testing of Formulated EVA and EMA (from Springborn Labs, Inc.) on Solar Cells



This configuration also gave me an opportunity to check the adhesion of polymers to aluminum. Observations :

Peel strengthe of cured polymers on solar cells and Al (kg/m)

Polymer (Springborn)	Primer	Adhesion to Solar Cells grey side	black side	Aluminum
9918-P	none	4.5	4.0	0.3
15295-P	none	1.6	2.2	1.4
9918	mod. 1205[1]	c	c	c
15295	"	c	c	c

(1) mod. 1205 = D.C. 1205 primer with 1 percent added Z-6030
c = cohesive failure in polymer at over 5 kg/in = 20 N/cm

Recovery of Adhesion by Drying After Being Boiled in Water (EVA Compounds Cured on C.R. Steel 15 min at 125°C)

Primer on Steel(or Ti)	Adhesion to steel - peel str. (Kg/in)		
	Dry	after 2 hr. boil	after 1 day in air
EVA A-9918			
Z-6030 + BDMA in iPA	c	3.7	5.2
D.C. 1205 + Z-6030	c	3.3	c
EVA 15295			
Z-6030 + BDMA	c	0.2	2.0
D.C. 1205 + Z-6030	c	2.2	8.0
EVA 15295 On Titanium			
D.C. 1205 + Z-6030	c	4.6	8.0

c = cohesive failure in polymer at over 8 Kg/in

Two Primers for X-Linkable EVA to All Surfaces

I. Glass, ceramic, and metals

Add 1% Z-6030 to Dow Corning 1205 primer. A trace of added $ZnCrO_4$ improved water resistance of bond to certain metals.

II. Plastic Surfaces, Kapton, Tedlar, Mellinex, Scotchpar, Arrylar, Korad, etc.

Add 10% Z-6030 to Dow Corning Q1-6106, and dilute to 10% solids with i-PA.

or-

10 parts Z-6040
10 parts Z-6030
80 parts melamine resin (Monsanto Resimene 740)
dilute to 10% solids in i-PA (isopropanol)

Bonding Cross-Linkable EVA to Polymer Surfaces

	EVA A-9918							
Primer on Polymer	Kapton	Mellinex	Tedlar	Scotch-Par	Acrylar	EH-723	Korad	Chemplex c-20
Unprimed	+ -	- -	+ +	- -	c c	- -	- -	+ -
Z-6030+1%BDMA	c +	+ -	c +	c -	c c	+ -	c c	c +
" + Lup. 101	c c		c c	c c	c c	+ -	+ -	+ -
Z-6030/40/Resimene	c c	c c	c c	c c	c c	c c	c c	c +
1% Z-6030 in 1205	c c	+ -	c c	c -	+ +	+ -	- -	c c
		EVA 15295						
Unprimed	+ -	- -	+ +	- -	- -	-		+ -
Z-6030 + 1% BDMA	c +	c -	c +	c -		+		c c
Z-6030/40/Resimene	c c	c c	c c	c c	c c	+ -	c c	c c
1% Z-6030 in 1205	c c	+ -	c c	+ -		+		c c

Ratings 1st symbol = dry, 2nd = after 2 hours in boiling water
c = cohesive failure in polymer at over 15 pli
+ = peel strength 2 to 15 pli
- = peel strength less than 2 pli

Bonding Cross-Linkable EVA and EMA to Metal Surfaces

Primer on Surface	Glass	Alumin.	C.R. Steel	Stainless Steel	Tin on Steel	Zn galv. Steel	Titanium	Brass	Solder on Cu
EVA 6717									
1% Z-6030 in 1205	c c	c c	c c	c c	c c	c c	c c	c c	c c
Z-6030/40/Resimene	c +	c +	c +	c -	c c	c +	c -	c +	
								—	
EVA 9918									
Unprimed	+ -	+ -	- -	- -	+ -	- -	- -	+ -	+ -
1% Z-6030 in 1205	c c	c +	c -	c +	c +	c c	c -	c c	
" " + $ZnCrO_4$	c c	c c	c +	c c	c c	c c	c +	c c	c c
EVA 3295									
1% Z-6030 in 1205	c c	c +	c +	c c	c c	c c	c -	c +	c c
" " + $ZnCrO_4$	c c	c c	c +	c c	c c	c c	c c	c +	c c

Ratings 1st symbol = dry, 2nd = after two hous in boiling water

c = cohesive failure at over 15 pli (pounds per linear inch)

+ = peel strength 2 to 15 pli

- = peel strength less than 2 pli