

Vinyl Ester Resin

Adhesive Bonding

Vinyl Ester

A study was conducted to test for bond strength on a representative matrix of commonly used plastics and the adhesives best suited to them. For many of the plastics evaluated, the effect of polymer composition on bond strength was evaluated by compounding plastic formulations with each of the most commonly used additives and fillers for that plastic; common grades were used for the remaining resins. The effect of each additive and filler was determined by comparing the bond strength achieved with the specially compounded formulations to that of the neat plastic. In addition, the effect of surface roughening and chemical treatment of the plastic surface on bond strength was examined.

The block-shear (ASTM D 4501) test was chosen as the test method because it places the load on a thicker section of the test specimen that can withstand higher loads before experiencing substrate failure. In addition, the geometry of the test specimens and the block-shear fixture helps minimize peel and cleavage forces in the joint. How well the block-shear test method reflects the stresses that an adhesively bonded joint will experience in real world applications should be considered. Also, limitations on the data due to the variety of additives and fillers used by different companies should not be ignored.

Prism 401 and Super Bonder 414, both cyanoacrylate adhesives, and Loctite 3105, a light curing acrylic adhesive, achieved the highest bond strengths on the grades of vinyl ester which were evaluated. Black Max 380, a rubber toughened cyanoacrylate adhesive, consistently achieved the second highest bond strengths, followed by Depend 330, a two-part no-mix acrylic adhesive.

Surface Treatments

Surface roughening caused either no effect or a statistically significant increase in the bond strengths achieved on vinyl ester. The use of Prism Primer 770, in conjunction with Prism 401, caused a statistically significant decrease in the bondability of all the grades of vinyl ester which were evaluated.

Other Information

Vinyl ester is compatible with all Loctite adhesives, sealants, primers, and activators. Recommended surface cleaners are isopropyl alcohol and Loctite ODC Free Cleaner 7070.

Table 95.1: Shear strengths of vinyl ester to vinyl ester adhesive bonds made using adhesives available from Loctite Corporation. Values are given in psi and (MPa).^{b, c}

Plastic Material Composition		Loctite Adhesive					
		Black Max 380 rubber toughened cyanoacrylate (200 cP)	Prism 401 surface insensitive ethyl cyanoacrylate (100 cP)	Prism 401/Prism Primer 770 polyolefin primer for cyanoacrylate	Super Bonder 414 general purpose cyanoacrylate (110 cP)	Depend 330 two-part no-mix acrylic	Loctite 3105 light cure acrylic (300 cP)
Derakane 411-45	Vinyl Ester resin with C-glass veil - 15 rms courtesy of Dow	950 (6.6)	1900 (13.1)	800 (5.5)	1950 (13.5)	400 (2.8)	1950 (13.5)
411-45 roughened	Vinyl Ester resin with C-glass veil - 27 rms	1950 (13.5)	1900 (13.1)	800 (5.5)	1950 (13.5)	1000 (6.9)	1950 (13.5)
Derakane 470-36	High Temperature/Corrosion Resistant Grade with C-glass veil	550 (3.8)	>2200 ^a (>15.2) ^a	650 (4.5)	>2450 ^a (>16.9) ^a	350 (2.4)	1500 (10.3)
C-695 Black 229	20-30% glass fiber mineral filled courtesy of American Cyanamid	>1650 ^a (>11.4) ^a	>2100 ^a (>14.5) ^a	750 (5.2)	>1850 ^a (>12.8) ^a	600 (4.1)	1750 (12.1)

^a The force applied to the test specimens exceeded the strength of the material resulting in substrate failure before the actual bond strength achieved by the adhesive could be determined.

^b All testing was done according to the block shear method (ASTM D4501).

^c For more information on data presented in this table, contact Loctite Corporation at 800-562-8483 (1-800-LOCTITE). Request the "Design Guide for Bonding Plastics."

Reference: *The Loctite Design Guide for Bonding Plastics*, supplier design guide (LT-2197) - Loctite Corporation.