Application note

Selecting a Healthcare Silicone Primer to optimize your bonding process

PRIMER CHOICES

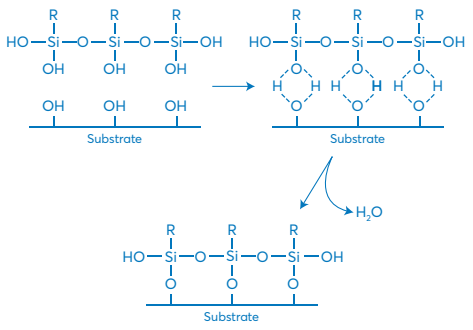
Part Number	Compatible Silicone Chemistries	Carrier	Percent Solids*	Description/ Substrates with improved bonding
MED-160	General Purpose	Naphtha, VM&P	4.5%	General Primer
MED-162	Addition Cure Systems	Naphtha, VM&P	15.0%	Polycarbonates
MED-163	Addition Cure Systems	Naphtha, VM&P	15.0%	Iradited® Treated Aluminum
MED-164	Condensation Cure Systems	Naphtha, VM&P	10.0%	Stainless Steel
MED-165	Addition Cure Systems	Naphtha, VM&P	4.8%	General Primer
MED-166	Addition Cure Systems	Isopropyl Alcohol	6.5%	General Primer
MED1-161	Addition Cure Systems	Naphtha, VM&P	5.0%	Aluminum
MED2-161	Optical Addition Cure Systems	Naphtha, VM&P	4.5%	General Primer
MED6-161	Addition Cure Systems	Naphtha, VM&P	8.5%	Titanium

* Properties are tested on a lot-to-lot basis. Do not use the properties shown in this table as a basis for preparing specifications. Please contact NuSil Technology for assistance and recommendations in establishing particular specifications

* NuSil primers are generally known to increase adhesion to Polyurethane (PU), Polyvinyl Chloride (PVC), Polycarbonate (PC), Polyphenylenesulphone (PPSU), Poly-ether-ether-ketone (PEEK), Polyimide (PI), Polyethyleneterephtalate (PET), Epoxy, Copper, Aluminum, & Stainless Steel.

HOW A PRIMER WORKS

Silane primers are used to promote adhesion between two non-bonding surfaces. Although designed for use with silicone adhesives, they can also be used with other adhesives, such as epoxies. The primers usually consist of one or more reactive silanes, a condensation catalyst and some type of solvent carrier. The reactive silanes typically have two different reactive groups; one compatible with the substrate and the other with the adhesive. These different groups form a compatible interface between the incompatible substrates and promote adhesion. The reactive silanes are usually added as moisture sensitive alkoxy silanes and, in the presence of water and a condensation catalyst, form the priming surface. The silanes and the condensation catalysts form a very thin polymeric film on the surface of the substrate; the silanes begin hydrolyzing with atmospheric moisture and the condensation catalyst starts joining all the hydrolyzed groups to form a primer film on the substrate. Leaving a bottle open to atmospheric moisture can start this reaction while the primer is still in the bottle, often forming a precipitate and rendering the primer impotent.



Theoretically, the best primer film is a mono-molecular layer with the compatible groups facing the substrate and the organic groups facing the organic silicone adhesive's surface. In reality, these monolayers don't exist, but compatible bi or tri-layers do. This illustrates the importance of thin primer films and the necessity of solvent carriers in the primer formulation. Thick, overly primed surfaces tend to build chalky primer films that can be points of adhesive failure.

PRIMER STORAGE AND HANDLING

The proper handling and application of silicone primers can enhance the overall strength and consistency of bonds. The following procedures are recommended for best bonding results:

1. Decant the amount of primer needed for use from the original container into a secondary container.
2. Containers should remain sealed when not in use. Silicone primers will react with atmospheric moisture and hydrolyze. Precautions should be taken to minimize exposure to moisture.
3. It is recommended that an inert gas, such as argon or nitrogen, be used to blanket the product before closing the container. Hydrolyzation is indicated by the appearance of a precipitate. The formation of moderate amounts of precipitate as a result of hydrolyzation is inherent in this material and will not adversely affect the performance of the material.
4. Discard primer from the secondary container once finished using this amount of primer. Do not return the primer from the secondary container to the original container.

APPLICATION TECHNIQUES

Apply by brushing, wiping or dipping a uniform thin film onto the substrates. The following procedures are recommended for best bonding results:

1. Clean and degrease the surface being primed with an appropriate solvent and a coarse lint-free cloth.
2. Rinse the surface off with clean solvent.
3. When completely dry, apply a uniform thin coat by dipping, spraying or brushing. Use a brush or on smooth surfaces, a lint-free tissue. When priming substrates for use with addition-cure silicones, do not use sulfite containing materials such as brushes with wood handles or latex gloves as they may inhibit cure. Remove excess primer by gently wiping with a clean lint-free wipe. Dried primer coatings vary from being clear to having a slight haze. If dried to a whitish haze or chalky appearance, the coating is too thick (see Figure 1). Over primed surfaces will decrease the effectiveness of the primer. Clean and reapply. (The common misconception of "more is better" can reduce the effect of the primer.)
4. Allow to dry for 30 minutes at room temperature and 50% relative humidity. This primer is actuated by atmospheric moisture, so lower levels of humidity require longer drying times.
5. Apply the appropriate NuSil Technology adhesive/sealant.

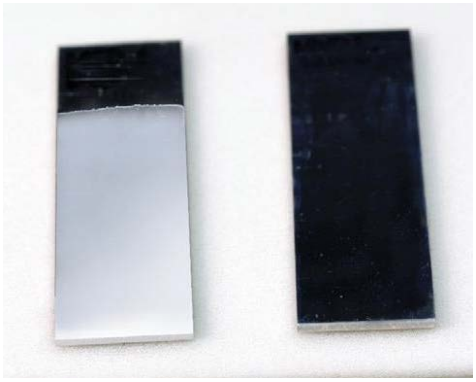


Figure 1. Overprimed (left) and correctly primed (right)

APPENDIX: ADHESION TESTING

The tables presented below evaluate 3 different adhesive cure systems using the Lap Shear Test:

- 1 part acetoxy cure
- 1 part oxime cure
- 2 part addition cure (fast cured with heat or room temperature cured)

The testing was conducted on lap shear panels that were 1" wide x 4" long and 0.075" thick. The lap shear panels were abraded with 40 grit sandpaper and then primed - unless they were control samples. After surface preparation, the adhesive was bonded between the two lap shear panels at approximately 0.020" thick. The crosshead speed of the MTS RT/5 load frame with 1000-lb transducer was 0.04 in/minute.

Not all primers or combinations were tested in this study, and data points not represented do not imply poor results. Differences between grades of plastics and vendors may play a significant role in bonding characteristics. These test results are meant to be a guide only; each application should be fully tested by the end user prior to implementing the use of a primer.

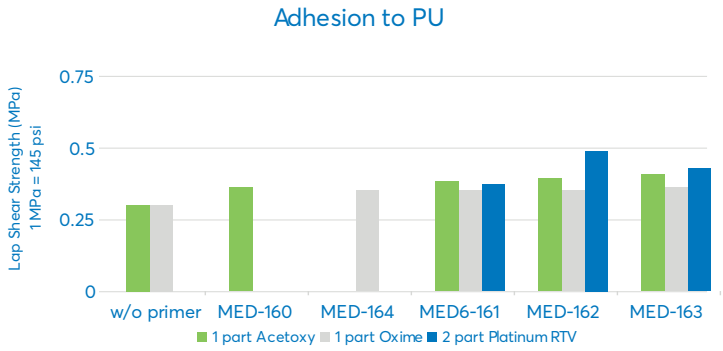


Figure 1. Polyurethane

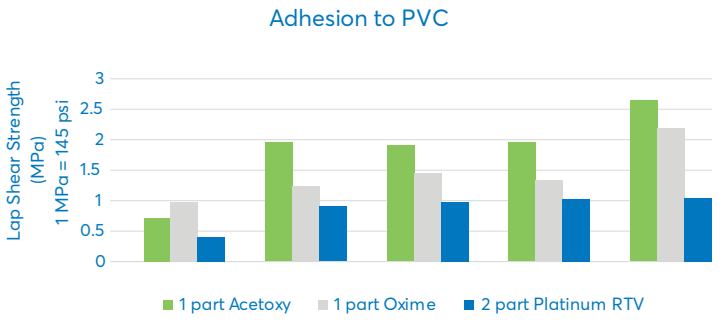


Figure 2. Polyvinyl chloride

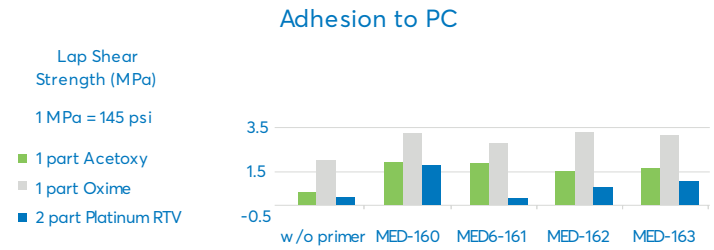


Figure 3. Polycarbonate

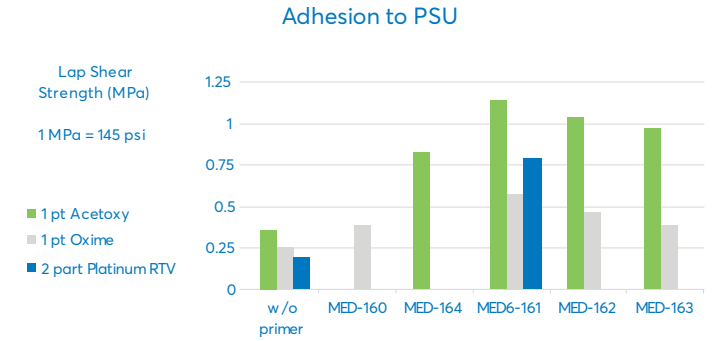


Figure 4. Polysulfone

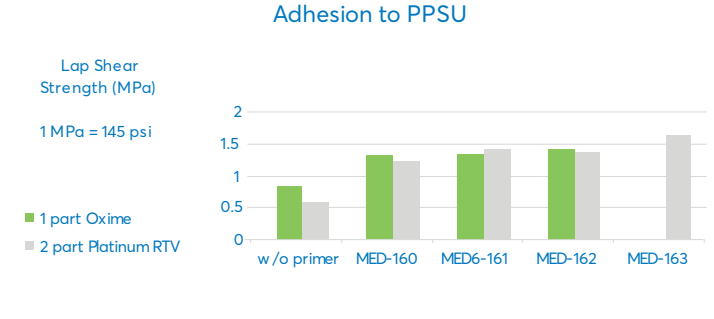


Figure 5. Polyphenylsulfone

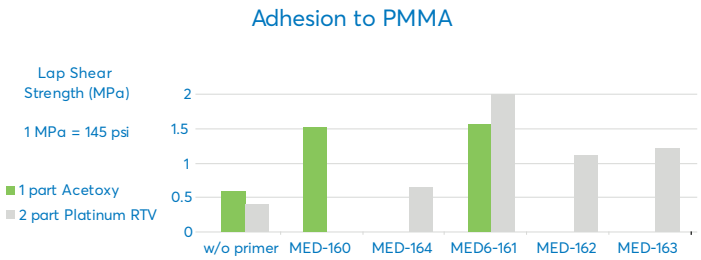


Figure 6. Polymethyl methacrylate

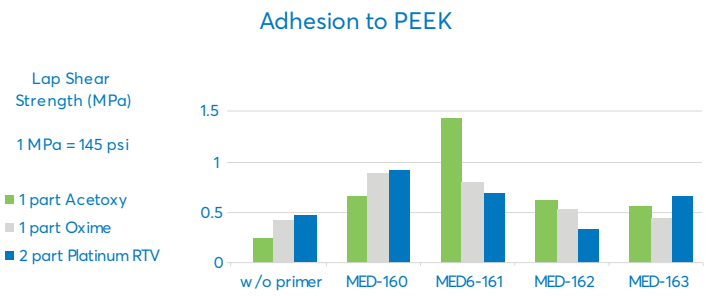


Figure 7. Polyether ether ketone

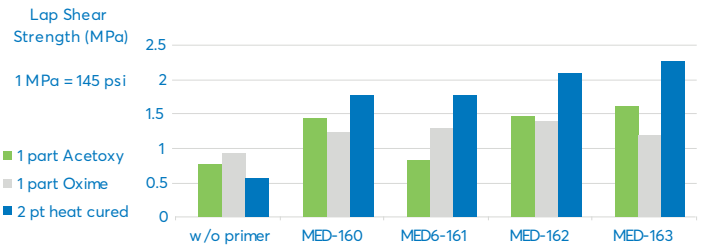


Figure 8. Polyethylene terephthalate

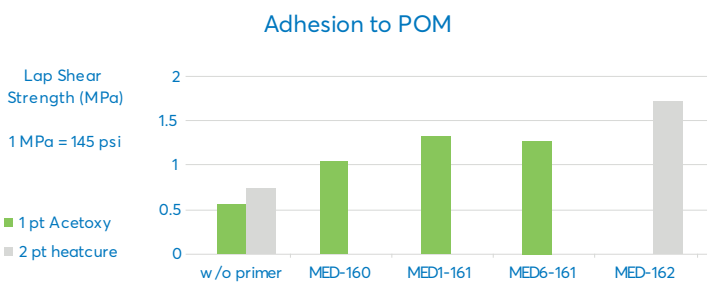


Figure 9. Polyoxymethylene

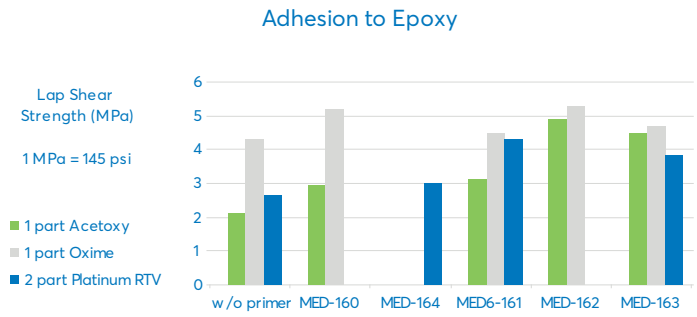


Figure 10. Epoxy

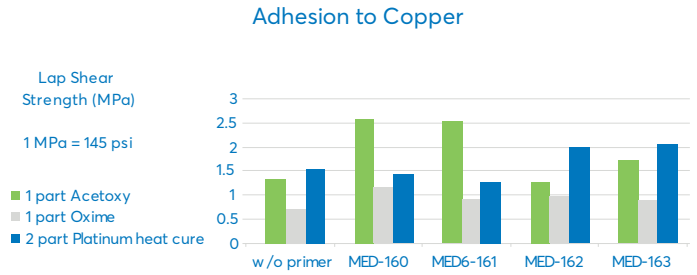


Figure 11. Copper

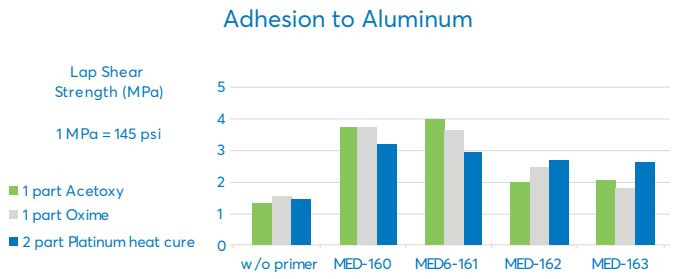


Figure 12. Aluminum

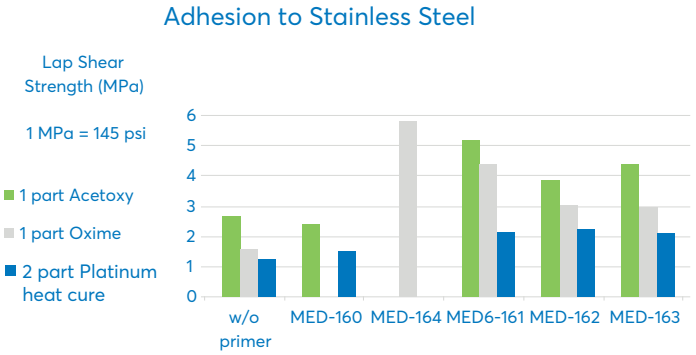


Figure 13. Stainless Steel

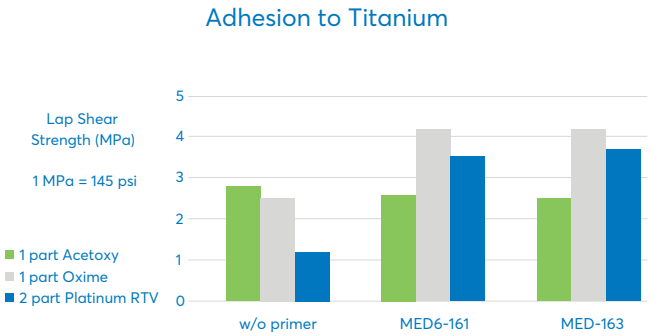


Figure 14. Titanium

Master Access Files and biological testing on the primers listed in this application note have been filed with the U.S. FDA.

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0320 Lit. No. 931033W