

TECH REPORT: UV-curing adhesives for glass

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Q: How good are UV-curing adhesives?

I recently evaluated several uv adhesives for bonding to glass (soda-lime float glass was used) and environmental resistance. This report summarizes the results with 'Norland Optical Adhesive 61' available from Norland Products, Inc., 2540 Route 130, Building 100 Cranbury, NJ, 08512, (609) 395-1966 voice, 395-9006 fax. Feb 1, 95 pricing was \$12.00/ea for a 6 gram syringe (\$25 min order). Contact Norland directly for most recent pricing and availability information.

Norland describes '61' as a proprietary mercapto-ester that's tough (slightly flexible), providing excellent adhesion to glass and metal, and fair adhesion to plastic. Clear; refractive index = 1.56; >90% transmission from 0.4 to 2.5 microns. Preferred adhesive for precision optical bonding. Low shrinkage and resiliency of adhesive minimizes strain. Used for optics exposed to temperature extremes (can withstand -150 to +125 deg. C). Shelf life is 4 months (store at 5-22 deg. C). Environmental resistance was empirically estimated by accelerated age-testing. This consisted of several samples, each exposed to various conditions for various times of up to one week: 100 deg C dry, 90 deg C water, 20 deg C water pH=6 (tap water), 20 deg C water pH=11 (NaOH), 20 deg C water pH=3 (HCl). Weight loss/gain for all samples was nil. 'Clouding' of all samples was nil. Strain seen as birefringence in a polariscope was 'satisfactory'.

'61' is supplied in a nice syringe with a very satisfactory reusable cap. It's 'water thin' when first applied, but a short (5 sec) uv exposure (pre-cure) with a battery operated UV-lamp results in a slight thickening which allows minor adjustments to be made. Final UV cure (like setting in the sun for an hour, or 10 min. with a 100 W Hg lamp, more or less depending upon the bonded material and lamp strength), followed by 'aging' (which occurs over about 1 week, but can be greatly accelerated with heat: overnight at 50 deg C works well) yields the final bond. Two issues of concern were oxygen inhibition and bubble formation during polymerization.

These are both a problem with many UV adhesives, but not with '61'. Oxygen inhibition yields an 'uncurable' sticky surface when unpolymerized adhesive is exposed to air. Bubble formation is typically due to contraction during polymerization and solvent trapping. '61' is a single-component, 100% solids, solvent-free material.

Excess adhesive can be cleaned-up with acetone or alcohol after the pre-cure. Fully cured parts can be separated by soaking in acetone for up to several days. This can be done relatively safely in a coffee can with a sheet of glass for a lid.

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