Optium® Museum Display Acrylic™

TRU VUE®

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Case Fabrication Guidelines

anti-reflective | anti-static | abrasion resistant | UV protection

Coating removal and proper cementing are important steps in fabricating museum quality display cases using Optium® Acrylic Glazing. These fabrication guidelines provide guidance for achieving excellent joints using Optium Acrylic Glazing and solvent cements or polymerizable (two-part) adhesives.

Fabrication

It is recommended to leave the protective masking on the sheet to protect the anti-reflective coating from damage during machining.

Optium® can be fabricated with conventional power saws, routers, drills, and other wood-working equipment, provided that the proper blades and bits are used. A TCG (Triple Chip Grind) blade designed for plastics is recommended.

All cutting tools must be kept sharp to prevent melted or chipped edges. Contact between a chipped or melted edge and the solvent cement may cause crazing (the appearance of tiny cracks in the part). Finish all rough edges with a jointer, shaper or edge finisher, or wet-sand the edges with a flat surface or block.

Although extruded acrylic sheets, such as Optium Museum Acrylic® and Optium Acrylic®, have the most uniform thickness, they are also the softest of the acrylic family and care must be taken to avoid "gumming" during fabrication.

Flame polishing, laser cutting, line bending, or thermo-forming an Optium sheet is not recommended as the heat can cause crazing and/or delamination of the coating.

Do not buff scratches or use an acrylic cleaner on Optium® Acrylic Glazing products.

Optium products can be cleaned with glass cleaner sprayed directly on a lint-free or microfiber cloth.

Troubleshooting

Problem	Possible Cause	Solution
Edge melts	Overheating	Use coolant such as air or water.
		Use a blade with less tpi.
	Dull blade	Replace or sharpen blade.
	Feed rate is too slow	Increase feed rate.
	Vibration	Stabilize platform.*
	Incorrect blade angle	Angle blade parallel to direction of travel.
Excess chipping	Feed rate is too fast	Slow the feed rate.
	Vibration	Stabilize platform.*
	Wrong blade	Use a blade with higher tpi.
		Replace or sharpen blade.
Crazing of machined edge	Excessive stresses	Increase feed rate.
		Replace or sharpen blade.
		Anneal parts.

*Stabilize platform using a straight board clamped to the sheet near the cutting line. The board should be used as a saw guide and will assist in reducing vibration.

Coating Removal

All Optium products have a hard-coat and an anti-reflective film on both surfaces (approximately 0.005 in) that must be removed from the joint area prior to cementing.

When removing the coating, ensure that the bonding surface is flat, clean, and stress-free. The hard-coat can be removed by scraping, by wet sanding the joint area with 500 grit, or finer, sandpaper mounted on a sanding block or by machining with a router or milling machine.

Set the width using painters' masking tape with electrical tape on top or a table saw fence. A vacuum hose connection can be used to remove and collect small particles.

Joint Type

Miter joints have an advantage because the coating is removed when the miter is cut. In addition, the anti-reflective properties of the Optium are maintained to the edge of the completed joint. The disadvantages include material thickness variations which can prevent the joints from mating together cleanly and extremely precise cutting requirements.

Butt joints can be used with Optium so long as the hard-coat is removed from the joint area. Introduce the adhesive into the open side of this joint using a suitable syringe. Avoid bubbles.

Joining

Polymerizing adhesives fill better and, therefore, impose fewer demands on the accuracy of fit between the parts. Best used where high strength and resistance to environmental conditions are required.

If properly done, solvent cements also yield strong, transparent joints, but do not have filling properties, which may result in bubbles when it dries.

Extruded acrylic sheets (Optium Museum Acrylic® and Optium Acrylic®) absorb glue differently than cell cast acrylic sheets (Optium® Museum Display Acrylic™). To avoid joint failures or incomplete glue joints, slower drying/evaporating solvents may be required.

Solvent and polymerizable (two-part) cements, such as Acrifix 190 (Evonik Industries) or PS-30 (Caseway Industrial Products), are recommended for the best joints. Newer UV curable cements, such as Acrifix 192 (Evonik Industries), combine the functionality of the two part cements with a much shorter cure time.

Other two-component adhesives like epoxy resins, isocyanates (polyurethane), phenolics and aminoplastics are not suitable for bonding due to low adhesion.

The ideal temperature for cementing acrylic sheet is between 70°F and 75°F. Do not attempt to cement in room temperatures under 60°F or over 100°F. Be certain all parts fit together properly. Then firmly join pieces with polyethylene tape or clamp in a supporting jig.

The ultimate strength and appearance of your joints will depend on how carefully you make them. Producing good joints requires considerable skill and practice. It is recommended that fabricators practice on scrap pieces before cementing the final product to ensure accuracy of joints. Please contact us for fabrication samples.

Before using any solvent or other cement type, be sure to obtain and review the Material Safety Data Sheet (MSDS) for that particular product. MSDSs are available from the manufacturer. In addition, adequate ventilation must be provided and the manufacturer's guidelines for proper use should always be followed.

Polymerizable Cementing

The easiest method for applying two-part polymerizable cement is to use a cement dispensing gun, which mixes the cement components and permits relatively easy application. Alternately, a weigh scale (with an accuracy of one gram), mixing containers, a vacuum, and applicators are necessary. Use round beakers and rods made of glass, polyethylene, or other insoluble materials as mixing tools.

A glass vacuum chamber, along with a vacuum pump, capable of evacuating the chamber to a pressure of -11 to -12 psi, is needed. Disposable syringes for applying the adhesives are also required.

Jigs and fixtures can be used repeatedly as gluing jigs in mass production. Parts can be held with clips, clamps, lead weights, or vacuum.

Sealing of the joints to contain cement can be achieved by using #685 Specialty Tape from the 3M Company.

Shrinkage during polymerization and annealing is about 15%-20% by volume. The gap should be sufficiently over-filled with adhesive to prevent a concave surface. No cements will adhere to the anti-reflective film so any drips can be removed from the film (even after the cement dries) as long as care is taken to avoid scratching.

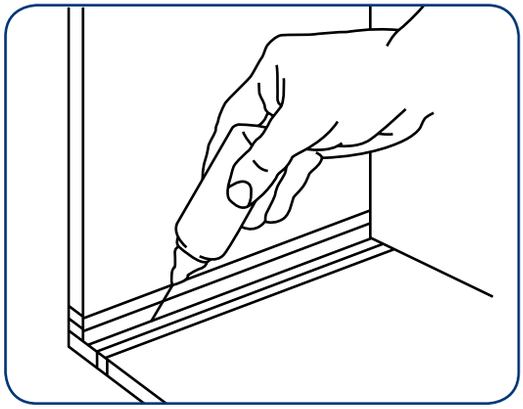
Solvent Cementing (Capillary)

During solvent cementing, keep the joint in a horizontal plane. Solvent resistant tape (Riveter's tape from 3M Co.) may be used to protect the area around the joint but it should be removed carefully after about five minutes. Solvent cement flow can be improved by spacing the two edges with shims. Use .004 in. shims with sheets .25 in. or thinner and .008 in. shims with sheets thicker than .25 in. Insert shims every two feet for long edges.

Let the cement soak into the edges 45 to 60 seconds, for sheet thicknesses less than 0.236 in., before removing the shims. Thicker sheet requires less time. Apply a small amount of pressure 0.7 to 1.4 lb./sq. in. (50 to 100 gr./sq. cm.) for three minutes, until the joint is set. Apply pressure carefully, as the joint area will be soft.

If the cement does not flow completely into the joint, tilt the vertical piece very slightly, about 1 degree, toward the outside. This should allow the solvent to flow freely into the entire joint. Tilt the piece back for a square corner.

The initial bond forms in 5 to 10 seconds. Wait three hours before subsequent processing. High strength is reached within 24 to 48 hours. Strength of the joint will continue to build over several weeks.



Troubleshooting

Problem	Possible Cause	Solution
Bubbles in joint	Uneven surface	Check joint preparation for squareness. Improve surface contact between parts.
Crazing in machined edge	Stresses in material	Use water cooling. Anneal parts before cementing. Use a different type of cement.
Whitening of joint (solvent cement)	Water in the cement Fast evaporation of cement	Replace cement. Reduce evaporation by adding glacial acetic acid (1-3%). Reduce environmental humidity.
Weak joints	Uneven surface Dry spots Extra solvent sqeezing from joint	Check joint preparation for squareness. Use slower evaporating solvent. Check cement storage methods. Solvent evaporation can change cement properties. Reduce clamp pressure.

Annealing

A bonded part should be annealed before finishing the adhesive joint. Bond strength can be increased by more than 50% by annealing for eight hours at 140 degrees F (60 degrees C). This also improves the weatherability of the joint. Cool slowly to avoid thermal stresses and support the sheet to avoid stress and warping.

Annealing before cementing reduces stresses and crazing from fabrication. The annealing temperature is 180 degrees F (80 degrees C). Each hour of heating time requires a corresponding hour of cooling time. The heating time and cooling time, in hours, is equal to the material thickness in millmeters up to 6.0mm, but should never be less than two hours. For example, a 3.0mm thick sheet (0.118 in.) is

Annealing *(continued)*

heated for three hours and allowed to cool gradually for three hours. Be sure to support the sheet to avoid stress and warpage. Cool slowly to avoid thermal stresses. Wait until oven temperature falls below 140 degrees F (60 degrees C) before removing items. It is not necessary to heat any piece for more than six hours.

Commercial ovens designed for annealing and heating plastics and incorporate air circulation and accurate temperature control systems are recommended.

Edge Polishing

Scraping, wet sanding, and buffing are acceptable methods for preparing a finished edge. Use tape or some other means to protect the anti-reflective film from damage in areas adjacent to the joint during machining and polishing steps.

After the edge is saw cut, start with 120 grit paper, progressing through 220, 320, 400, 600, 800, and finally finishing at 1200. All of the sanding steps should be done wet and the paper should be rinsed or changed frequently.

For best results, follow with a clean muslin wheel and polishing compound and a final buffing with a soft cotton or flannel wheel. Do not polish edges that are to be cemented as it will result in weak points.

NOTE: Optium® Acrylic Glazing is a combustible thermoplastic.
Precautions should be taken to protect this material from flames and high heat sources.
You should review MSDS sheets provided by the suppliers of adhesives, cement and solvent materials for information about the safe handling of these or any other chemical products.

All recommendations made herein are believed to be reliable. However, such recommendations, information and statements contained herein are not to be taken as warranty or representation for which Tru Vue, Inc. assumes legal responsibility nor as permission, inducement, or recommendation to practice any patented invention without a license. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose.

Sources: ACRYLITE® technical data retrieved from Evonik CYRO Industries website, http://www.cyro.com/methacrylates/us/products/sheet_products/downloadinformation/technicaldownloads/ & Bryan Olsen, Product Engineering Manager, Tru Vue, Inc.

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