

FIBERGLASSING WITH EPOXY RESIN

(Section VII B of The Epoxy Catalog by System Three)

Outside surfaces of boat hulls are usually epoxy/fiberglassed to create a thicker, stronger epoxy coating. This provides higher abrasion, impact and moisture resistance. In the case of most wooden boats the purpose of reinforcing cloth is to strengthen the epoxy coating, not to reinforce the hull. Chines, keels, bow and transom corners are structurally reinforced with fiberglass tape and epoxy. Fiberglass tape has been judiciously used to great advantage by woodworkers to strengthen unseen edges of complex miter/bevel joints in panels.

Some small, dry-sailed boat hulls made from plywood other than fir don't need cloth. Several coats of epoxy alone are usually all that is needed, though seams should be fiberglassed for structural reasons. Rotary cut (is there another kind? gem) fir plywood should always be fiberglassed on outside exposed surfaces or the plywood may check and crack the epoxy coating. Epoxy resins have all but replaced polyester resins for the fiberglassing of wood. Polyester is a poor adhesive, delaminating when moisture gets between the fiberglass substrate and the wood.

Because the fiberglass is structural to the epoxy coating rather than the boat hull, it's possible to use a lightweight cloth. Six-ounce cloth is sufficient for most surfaces and can be doubled in high wear and impact areas. Don't use cloth that is too heavy for the intended service, you'll use a lot more epoxy and have a heavier boat, gaining little else. Tests show no appreciable difference in peel strength between the two most popular finishes of fiberglass cloth, Volan and Silane. Four and six ounce cloths are nearly invisible when wet out with SilverTip Laminating Epoxy. Heavier weight fiberglass shows the weave pattern under certain lighting conditions.

Avoid using fiberglass mat with epoxy resins. The binder that holds the mat together is dissolved by the styrene in polyester resins. Epoxies don't use styrene as a diluent, making it almost impossible to properly wet out the mat. Woven roving is wet out well by epoxy but we know of no reason to use it in building a wooden boat. Clear Coat epoxy due to lower viscosity and higher solvating power will wet out fiberglass cloth faster than other systems.

Regardless of the type of the cloth or resin system used, fiberglassing is done essentially the same way. There is no need to be intimidated by fiberglassing, what you are really doing is gluing the cloth to the surface with a minimum amount of resin. Use just enough epoxy to wet out the cloth, you'll fill the weave of the cloth later. Work on as horizontal a surface as possible. Fiberglassing is much easier if you are not fighting gravity.

The first step to doing a good fiberglass job is to pre-coat the wood to avoid the problem of having unsealed wood soak up too much epoxy, starving the wood/glass bond. Pre-coating doesn't use any more epoxy than the more difficult one step method (for experienced fiberglassers only!) and helps to assure that maximum peel strength is achieved. After the first coat cures fill any holes with SilverTip QuikFair or an epoxy /microballoon mixture to provide a smooth base for the cloth. Sand off high spots and burrs or knock them down with a Surform or body file. Clean the surface with compressed air or brush off and wipe with a clean damp rag to remove any remaining traces of dust. Don't use acetone or similar solvents for this. Much acetone sold today is reclaimed and may have impurities that interfere with secondary bonding by leaving a film of residue on the surface. Avoid the use of tack cloths as they may transfer some of the waxy material on them to the epoxy surface causing secondary bonding problems. Next lay the fiberglass out on the pre-coated, tack free

surface, smoothing it out and doing any rough trimming. Masking tape may be necessary to hold the cloth in place if the surface has any slope.

Mix no more than 15 fluid ounces of resin and hardener. Work with small batches until you get the hang of it. Start at one end and pour the resin out over an area equal to about 1 square foot per fluid ounce (15 ounces does a 3 x 5 foot area). Pour in "S" curves as described in the coating section (on steep surfaces apply the epoxy with a roller cover and roller tray), spreading lightly into the dry areas with a squeegee (we like the rubber Thalco squeegee for laying down cloth). Let the resin wet the cloth out. Don't try to "force" it through the weave with the squeegee. Notice how the cloth disappears as it wets out.

When this first area has been covered and the cloth has disappeared, take the squeegee and use reasonable pressure to squeeze the excess resin away from the wet cloth. Work it down into the dry cloth area only if the surface will be painted. If you intended to clear finish the part you should discard the frothy squeegeed resin as it may not expel all the microfoam before curing. You can wipe the squeegee edge on a cup or can to remove the resin. Squeegeeing removes excess resin and entrained air, sticking the cloth down right next to the wood surface. The squeegeed cloth should now have a semi-dry look with the weave pattern showing; the cloth itself will be invisible.

Keep on going, section by section, until you are finished. If you are working on a very large area use a dry roller cover on the previous three or four sections to give a final smoothing. On smaller boats the roller cover can be used after the entire hull has been fiberglassed.

Let the epoxy resin cure to the "green" stage where it is pliable but no longer tacky unless pressed really hard. Now is the time to trim the excess cloth. Trim by

running a single edged razor blade around where the glass overhangs the edge. Press down any glass that lifted from the surface while trimming.

The selvage edges of the fiberglass have to be feathered before being covered by another piece of cloth. Wait another hour or so and do the feathering with a Surform. Do it while it is in the right state of cure. Too early and the wet fiberglass will lift, too late and it will be too hard to cut. The alternative is to wait a day or so until it is hard enough to sand.

It is not always possible to have a selvage edge on the cloth. Rather than have a cut edge fraying all over the place, which can only be cleaned up by a lot of sanding later, here's a trick that produces a very neat edge. Run a piece of 2" masking tape so that the inner edge of the tape is where you want to stop the glass. Lay down the cloth so that it runs at least an inch past the outer edge of the tape. Wet out the glass past the inner edge and about halfway across the tape. When the cure reaches the green state run a single edge razor blade right down the inner edge of the tape. Pull off the tape and presto; you have a nice edge right where you cut the fiberglass. If a little of the cloth lifts, press it back down.

The weave of the cloth can be filled once the resin has reached the green state of cure. Don't try to sand the weave smooth, fill it with epoxy. Apply fill coats the same as discussed in the preceding section on coating. Several coats may be necessary before the weave is filled. If you plan to paint the surface you may fill the cloth weave with SilverTip QuikFair in one coat using a squeegee. Don't use any filler on surfaces that are to be clear finished.

When the weave has been filled the surface should be sanded to prepare it for painting or varnishing. Sand the epoxy, not the fiberglass. Be sure to wear a respirator or dust mask while sanding. You'll probably get the fiberglass itch. Take a cool shower

after this step and put on clean clothes to minimize the irritation. If you do get the fiberglass itch, don't worry; it goes away after a few hours.

Applying fiberglass overhead is at best a difficult, messy job. Anyone who has tried it once has no desire to repeat the experience and will do everything possible to try to turn the work over or at least fiberglass on a slant. If this is not possible then here are several suggestions for accomplishing this job: If you are working on a relatively small area, wet the surface with mixed resin/hardener and lay a rough-cut piece of cloth into the resin. Surface tension will hold it into place without sagging if not too much resin is used. Using a squeegee overhead is a feat no one has yet mastered. Use foam rollers. Once the epoxy has cured you finish the overhead area in the usual manner.

Glassing large overhead areas calls for a different technique and a helper or two. Most successful jobs are done by rolling on a coating, then allowing it to cure to a tacky state. The cloth is then rolled out as smoothly as possible into the tacky coating. This is where you'll probably need more than one person. Get the wrinkles out as you go along, you won't be able to slide them out because the tackiness of the coating will hold the cloth in place. Once you've got the cloth where you want it press it into the tacky undercoat with a dry foam roller. Then wet it out using the roller cover and a roller pan. Use just enough epoxy to wet out the cloth. When cured finish in the usual way.

Corners and edges often require several layers of cloth. Giving thought to a "glassing pattern" will allow doubling at edges without going through extra steps. Corners are most easily "patched". Cut circles of different diameters from cloth scraps. Wet down, dabbing at it with an epoxy soaked brush. Lay down the next larger circle over this wetting it with more epoxy, if necessary. Continue the process until finished.

Each larger circle will fray the cut edges of the smaller circle under it. This process is self-feathering. Use the masking tape trick for the last circle and the job will require little sanding to look nice.

Heavy structural seams are best done using biaxial tape. Biaxial means that the fibers run at 45 degrees to the way the tape comes off the rolls. When run along a seam ALL the fibers run across the seam at 45 degrees. In regular plain woven tape half the fibers run parallel to the seam and add nothing to the strength. Biaxial tape is heavy at 24 ounces per square yard and it won't be clear like lighter tape when wet out with epoxy so don't use it for clear finished seams. Rather than feather edge biaxial tape by sanding we prefer to fair the edges using SilverTip QuikFair after sanding off the high spots.

In summary, fiberglassing is a three-step process:

1. Seal the wood to prevent starving the wood/cloth joint. Do filling and fairing on the sealed wood.
2. Stick the cloth down leaving a minimum amount of resin in the cloth.
3. Fill the weave any time after the wet cloth has reached the "green stage" and is stuck to the substrate.

Materials Required for Fiberglassing:
SilverTip Laminating Epoxy and hardener
Roller covers and frame
Fiberglass cloth
Thalco (rubber) squeegee
Measuring device
Protective gloves, dust mask
SilverTip QuikFair Trimming knife
Surform (Stanley Tool Works)
Sandpaper