CREATING THREE-DIMENSIONAL, CAST AND THIN-WALLED FIBERGLASS LAMINATED PROPS AND SCENIC ELEMENTS WITH AQUA-RESIN® ··A "GREEN" APPROACH TO SET BUILDING ··

by Louis Lieberman, Aqua-Resin®

Figure 1

It is often necessary for a scenic artist to make his/her own three-dimensional props and scenic elements. It has now become "standard operating procedure" to try to produce them as safely as possible, not only for the sake of the artists making them, but also for the health and safety of the performers and stage crew who might otherwise be breathing the outgases of various resin products, such as those from polyester and urethanes.

Aqua-Resin®, being water-based, non toxic, and non-outgassing, lends itself to safe handling and part fabricating. Additionally, since Aqua-Resin® is water-based, it cleans up with water, and no solvents need be used. Another relevant feature for the scenic artist is that Aqua-Resin® has an ASTM E-84 "A" classification fire rating, the best designation for this particular test—an important consideration for any set, an absolute necessity in virtually all situations.

The use of Aqua-Resin® for set construction parallels the use of polyester resin and fiberglass very closely. Anyone already familiar with hand lay-up or pour casting procedures for these materials should have no problem applying them for Aqua-Resin®.

There are two basic categories of fabrication for producing three dimensional parts with Aqua-Resin®: working directly in the positive, as in direct application over an armature which could be made of foam, hardware cloth, cardboard, and similar materials; and hand lay-up or casting into a mold. We will be discussing only this second category—casting and laminating into molds.

Molds

Molds can be of any conventional type of material including Aqua-Resin® L/S3 itself. Mother molds (jackets) can also be made with a fiber-reinforced L/S3 mix. RTV rubber molds, such as silicone or urethane, are very commonly used. Silicone, which needs no mold release, is a good choice.

Mixing

Power mixing is recommended for all batch sizes, although for less critical applications, batches of less than 1-2 pounds may be hand mixed. The S3 Powder is added to L Liquid in the desired proportions as per the chart on page 6. Mix, in a disposable container, until uniformly smooth and lump-free, then mix an additional 30 to 60 seconds. The mixed material should readily run off a spatula or mixing blades. All equipment should be kept clean; hardened material on the mixing blades, brushes, etc. will contain active catalyst, which will shorten the pot life.

Note: To keep dusting to a minimum when mixing, after adding the S3 Powder Component to the "L" liquid, first mix the batch by hand, using a spatula, wooden paint stirrer, etc. Once all the powder is incorporated into the mix, then continue the mixing using a suitable power mixer.

See Figures 2-5 on page 6 for mixing demonstration.

Figure 2

Figure 3

Figure 4

Figure 5

Casting Solid

For small pieces, an L/S3 mix may be poured directly into a mold. Four parts S3 or more to one part L (by weight) should be used for this purpose. Vibrate into mold if necessary. Casting solid is useful primarily for small props, no larger than a fist. Anything larger should be laid-up with fiberglass or other suitable fibers such as burlap, in a thin walled lamination. *(Fig. 6&7)*

Figure 6

Figure 7

Thin-Walled Laminations

The Aqua-Resin® L/S3 system provides fiberglass laminating and gel/surface coat mixes in which the L Liquid Component and S3 Powder Component are combined in simple proportions by weight or by volume.

LAMINATING & GEL/SURFACE COATS
(Not for Casting Solid)

	Liquid	**Powder**
Weight	1 part "L"	2 to 3 parts "S3"
Volume	1 part "L"	2 parts "S3"

The typical pot life – 30 to 60 minutes – is, to a large degree, variable, as are other properties, simply by adjusting the quantity of powder.

Extra powder will: increase hardness and stiffness, decrease flexibility, decrease set time, and decrease beta (*see p. 8*).

Less powder will: decrease hardness, increase flexibility and chip resistance, increase pot life, increase beta, and facilitate wet-out of the fiberglass.

Gel/Surface Coat

Using a medium-stiff brush ("chip brush"), paint the gel/surface coat-mix into the prepared mold. One or two coats are sufficient. Once the gel/surface coat has solidified (not necessarily cured), approximately 5 to 10 minutes for brush coats, the laminating coats can be applied. Gel/surface coats can be quite thin, typically about 1/32" thick.

In many cases, with a mold that has deep areas with steep side walls, the Aqua-Resin® mix will tend to run down the sides and pool at the low point of the mold. In such cases, thickening or reinforcing the gel/surface coat will prevent this. Some suitable materials for this purpose are THX-6™ thickener, and Aqua-Glass™ ½" chopped fiber, each used alone or in combination, or Aqua-Veil™ Surfacing Veil used by itself with the Aqua-Resin® mix. *(Figures 8-11)*

Figure 8

Figure 9

Figure 10

Figure 11

Fiberglass Laminating

The fiberglass laminating mix, in conjunction with suitable fiber reinforcement, can be brush applied anytime after the gel/surface coat has solidified. Three-quarter ounce fiberglass mat is an acceptable glass reinforcement material. Soaking the mat in water, and then wringing it out well or allowing it to dry, will both make the mat "drape" better, and increase the strength of the laminate.

Wet-out each layer thoroughly with the L/S3 mix; each side of the mat should have wet laminating-mix applied to it. That is, the mat should be placed on an area of the mold previously wetted with laminating-mix, then tamped through with the mix from the other side. Additional laminations may be added immediately, or at a later time. The use of a hard finned fiberglass laminating roller will help release bubbles, increase strength and reduce the amount of laminating mix required. For additional strength substitute Aqua-Glass™ 3.5-1" or 4.5" chopped fiber for all or part of the chopped strand mat.
See Figures 12-15 on page 8 for demonstration.

It is important to note that total wall thickness of properly applied laminating plus gel/surface coat layers typically is not more than 1/8". For many set applications, however 1/8" may be more than what is needed; 1/16" or 3/32" might be enough.

Figure 12

Figure 13

Figure 14

Figure 15

Do not attempt to test strength or hardness at this stage. After 24-48 hours the strength will substantially increase, and can be assessed then.

Demolding

If time allows, an overnight cure before demolding is preferable. However, if using flexible molds, demolding can be done as soon as the material is hard to the touch, usually within one hour of application. When demolding from a rubber mold, deform the mold, not the cast or laminated piece.

Beta Stage

Immediately after the mixed product has solidified, it is in the beta stage. At this point the material is very easy to work, and we recommend doing most tooling and wet sanding operations during this period. This stage can last up to 24 hours. (Please note that during the beta stage the material is not fully cured and maximum strength has not yet been achieved.)

Depending on thickness and beta, a demolded part can be cut with a utility knife, hacksaw blade, or a conventional fine cut wood saw. Power tools are seldom necessary, and are generally avoided because they can create excessive dust. Additional shaping can easily be done with a Stanley Sure-Form plane. If sanding is necessary, wet sanding using waterproof sandpaper is preferred both for the ease of sanding, and also because no dust is produced.

Figure 16

Figure 17

Painting and Surface Coating

Aqua-Resin® takes most paints well, and often requires no primer. It also has a fair amount of "tooth" and will readily accept most drawing materials, such as graphite, charcoal, crayon, and the like. Faux metal finishes are also possible using metal powders in a 1 part L Liquid to 1 part S3 Powder (by weight) mix.

For these faux metal finishes a small amount of 1/2" Aqua-Glass™ and XLR-8 accelerator is desirable.

We have touched on just some of the basics of working Aqua-Resin® in molds. There are many variations and techniques possible in laying up molded parts. Many of these are direct translations from procedures that have been used traditionally for years; others have been developed expressly for Aqua-Resin®. Fortunately, most of these specific techniques will come intuitively to any regular user. Hopefully, the safety, ease of use, and the forgiving mixing proportions and application procedures will make Aqua-Resin® a natural choice for creating props and scenic elements for any production.

This is the first of two articles discussing Aqua-Resin® for use by scenic artists; the next article, which is scheduled to appear in the December issue, will discuss direct application over armatures, such as over-coating carved rigid foam or constructed hardware cloth.

ABOUT THE AUTHOR

Louis Lieberman is the President and Technical Director of Aqua-Resin®. He has a BFA in Painting from the Rhode Island School of Design (RISD), and a Bachelor's degree in Biology/Chemistry from Brooklyn College of the City University of New York. He is also a graduate of Brooklyn Technical High School, where he first developed his "love of materials." Louis had been a full time sculptor since leaving RISD, and in the late 1970's developed Aqua-Resin® for his own work. Approximately a decade later, he trademarked Aqua-Resin® and made it available to the general public.

Figure 18