QUASIGLASS

An R&D Project by Rick Boyette, NAR #31375
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OBJECTIVE

The purpose of this R&D project was to research the existing fiberglassing methods & develop a simple, inexpensive alternative means of reinforcing coverings for both model rocket and high-power airframe components. The method is applicable primarily to cardboard body tubes, but can also be used on nose cones, fins, and transition sections.

APPROACH

The standard method for fiberglassing tubes is to apply flat sheets of fiberglass cloth. Typically, one draws a straight line down the length of the tube, then adheres the edge of the cloth along this line using CA glue. Then the cloth is carefully wrapped around the tube, keeping the edges aligned while trying to prevent wrinkles from forming. The following edge is overlapped and secured with another bead of CA, thus forming a seam which must later be sanded smooth. Several coats of epoxy are then applied, again while trying to keep the edges aligned & preventing wrinkles.

This is a messy, wasteful, time-consuming process which often leads to a lumpy, uneven finish that requires a great deal of sanding & filling to obtain a satisfactory finish. In recognition of this, several hobby suppliers offer tubular fabric materials designed to eliminate the seams and wrinkles while saving time & reducing waste. The products work well, but are relatively expensive ($10 per foot or more) and designed for high-power rockets. Also, they generally are not well suited to smaller-diameter, lightweight, Estes-type model rocket tubes.

I felt there had to be inexpensive tubular fabric materials and coatings that could be used to obtain similar results on smaller-diameter tubes; thus was born the “Quasiglass” technique.

PROCEDURE

To evaluate the suitability of alternate materials, I obtained several weights of nylon hose (for tubes up to 5-1/2" in diameter) and Cariff *Drain-Sleeve* tubular fabric material (for larger diameters). I obtained a sampling of various sized body tubes, ranging from 1-3/8" diameter (e.g. Estes BT-55) to 11-1/2" diameter (e.g. PML phenolic). To adhere the fabric material to the tube surface, I purchased a quart of Miniwax *Polycrylic* water-based semi-gloss clearcoat.

Carriff Corp. Drain-Sleeve *tubular fabric material*

I first experimented with the Estes & LOC tubes and nylon hose, beginning in 2001. I used scrap lengths of BT-55, BT-70, BT-80 &.4" LOC

tubes. I stretched the fabric tightly over the tube, twisted each end then tied the ends off with an overhand knot. I stood the tube on end, then brushed on a thin coat of Miniwax *Polycrylic,* allowing the excess to run off down the side. This step took no more than fifteen minutes from

Nylon hose applied to 5.5" LOC tube

An 11.5" PML tube with 8" Drain-Sleeve *after application of* Polycrylic *clearcoat*

start to finish, on a 4" x 48" tube. The *Polycrylic* is very thin and easily applied with a foam brush, which can be rinsed out & re-used. I allowed the coating to dry (about 1 hour), sanded lightly with 220-grit wet-or-dry sandpaper, then applied a couple of thin coats of laminating epoxy to the fabric to provide a hard, waterproof finish.

The nylon hose worked great on smaller tubes, but I was also looking for an inexpensive alternative to the costly “Aerosleeve” tubular fabric materials sold by various high-power rocketry suppliers. I came across Cariff *Drain-Sleeve* at the local Lowes home improvement store and decided to give it a try– at less than $3 for a 10' length, the potential savings for fiberglassing large tubes was quite high! The *Drain-Sleeve* synthetic fabric, designed for use in septic tank drainfields and other harsh outdoor applications, is quite strong. It easily stretches to fit various sized tubes and does not react with the alcohol-based fiberglass resins commonly used for rocketry applications. It is readily cut with scissors or utility knife and adheres tightly to cardboard tubes with a single coat of *Polycrylic* clearcoat.

PREVIOUS RELATED WORK

The inspiration for Quasiglass came from an article I read in an issue of *Model Aviation*, the AMA journal. The article detailed a method of covering foam wings with nylon stockings adhered to the foam with *Polycrylic*, as an alternative to *Monokote* or thin wood veneer coverings. The advantages of using the nylon hose over flat fiberglass cloth were light weight, the lack of seams and the high tensile strength of nylon, which when coupled with the tension caused by stretching the material, results in a lightweight yet very strong & durable covering.

After reading the article, I realized the same basic method could be applied to thin-walled cardboard tubes and other model rocketry components.

EQUIPMENT & PROJECT BUDGET

The equipment and materials used, and the approximate cost/value of the items, were as listed below. The larger (6", 8" & 10") *Drain-Sleeve* materials were free samples obtained from the manufacturer. Some of these items were leftover/scrap materials from previous projects. The smaller tubes were done on a workbench; the larger tubes I stood on the floor. I used cardboard as a work surface to protect the countertop & floor. The tubes were set on scrap hardwood so as not to adhere the ends to the cardboard surface.

Estes BT-55 (1-3/8"), BT-80 (3") and BT-101 (4") body tubes	$20
LOC 4", 5.5" and 7.5" body tubes	$95
A previously built 7.5" to 11.5" transition section with posterboard skin	$30
Several packages of 2X & 4X weight pantihose	$20
Disposable foam paintbrushes.	$15
Cariff *Drain-Sleeve* septic tank drainpipe covering, 4", 6", 8" & 10" sizes	$25
Miniwax *Polycrylic* water-based semi-gloss acrylic clear coat, quart can	$16
Laminating epoxy, 32 oz size each part	$30
220-grit wet-or-dry sandpaper	$10
Thick gel-type CA glue	$ 4
TOTAL APPROXIMATE COST	$265

DATA COLLECTED

Several test runs were done on scrap tubing, using nylon hose on Estes & LOC tubes up to 4" diameter, and *Drain-Sleeve* on 7.5" LOC and 11.5" PML tubes. The tests were done to verify the suitability of the materials, the degree of stretching required to prevent sagging, the diameter range that each material can be satisfactorily used on, and to ascertain how many coats of Polycrylic and laminating epoxy would be required to adhere the material and provide a smooth finish.

The absorption rate for *Drain-Sleeve* is comparable to lower-weight fiberglass cloth; it took about a pint of *Polycrylic* and about 20 oz of laminating epoxy to initial-coat an 11.5" diameter x 48" PML tube, or about 1-1/2 to 2 fluid ounces per square foot..

RESULTS OBTAINED

For tubes using nylon hose material stretched tight, I found that "queen-size" nylon works well for diameters ranging from 1-3/8" (e.g. Estes BT-55) to 5-1/4" (e.g. LOC 5.25) tubes. Smaller-sized hose can be used on tubes smaller than BT-55, but the nylon tends to sag and is hard to stretch tight without tearing or "running" (partial tear). In the event of a tear or a run, however, the material is easily removed and the Polycrylic stripped away with a damp sponge.

A scrap piece of 5" cardboard Uline tube after covering with 4" Drain-Sleeve

A single coat of *Polycrylic* tightly adheres the nylon to the tube; only light sanding is required. The nylon covers up the spiral seams, the fine weave is easily filled with standard filler material and the end result (with just one coat each of *Polycrylic* & laminating epoxy) is a smooth tube of noticeably higher crush resistance.

For best results and a smooth surface finish, two coats of laminating epoxy gave the best results. A third coat resulted in an unsatisfactorily-heavy orange-peel texture. The weave was still slightly visible, but two coats of automotive grey sandable primer yielded a smooth finish.

For the larger tubes, the 4" Cariff *Drain-Sleeve* material easily stretched to cover a 7.5" LOC tube. A single coat of *Polycrylic* is sufficient to adhere the material to the tube, but after the first test I noticed the adhesion was weak at the cut ends of the tube. For subsequent tests I adhered the material to the edges with a bead of CA all around. I then brushed on three coats of laminating epoxy to provide a smooth, hard surface. The weave was still slightly visible; I used spackling after the second coat but a better choice would be Bondo filler. The final surface had a slight orange-peel dimpling; two heavy coats of automotive grey sandable primer satisfactorily filled in the dimpled areas

The 4" *Drain-Sleeve* would not stretch beyond the 7.5" LOC tube. The 11.5" x 48" PML tube required 6" *Drain-Sleeve*, which easily stretched over the tube. The larger sizes would be applicable to Sonotube projects. *Drain-Sleeve* is available in 10' and 100' lengths and diameters up to 24".

After I experimented with the application of *Polycrylic* to nylon hose and the Cariff *Drain-Sleeve* materials, in 2002 I wrote the "Quasiglass" article to establish a methodology for applications. Using the article as a guide, I led a well-received workshop at the 2003 NARCON exhibition that demonstrated the technique. I contributed a couple of "Quasiglass" kits for door prizes. The kits

Covering a strap-on booster cone for Long March scale *model with nylon hose, demonstrating application of* Quasiglass *method to nose cones*

A scratchbuilt 11.5"-to-7.5" transition section, with posterboard surface covered with 8" Drain-Sleeve, Polycrylic *and a coat of laminating epoxy*

included a pint of *Polycrylic* semi-gloss clearcoat, a package of nylon hose, a 4" x 10' length of *Drain-Sleeve*, a foam brush and a copy of the article for instructional use.

I have since used the "Quasiglass" method on a variety of model and high-power rockets, including scale models of Thor-Agena (a scratchbuilt replica of the classic Estes kit), tapered-shroud egglofters, a 12' tall, 11.5" diameter, M-powered, 12X upscale of the Estes Alpha; tubes & nose cones for a 10' tall, 8" diameter, 1:17 scale model of the Long March 2E satellite booster and a Sheri's Hot Rockets Gemini-Titan to name but a few.

The author with his 12X upscale, M-powered Alpha Male

DEMONSTRATION FOR JUDGES

I will present samples of "Quasiglassed" tubes as part of my presentation. I can perform a demonstration of the "Quasiglass" technique upon request. I would need to obtain the *Polycrylic* material locally, so please let me know if a demonstration would be desired.

CONCLUSIONS

Both nylon hose and *Drain-Sleeve* products worked very well in conjunction with laminating fiberglass resin to strengthen tubes and provide a waterproof, smooth finish. The *Polycrylic* coat provides strong adhesion while adding very little weight. This simple, inexpensive & quick alternative to standard fiberglassing techniques is well suited to rocketry projects small and large.

FURTHER WORK

Applicability to FAI-style competition body tubes and built-up foam ring nose cones will be explored at a later date.

LIST OF RELATED R&D PROJECTS PREVIOUSLY ENTERED

None; the "Quasiglass " method was demonstrated at NARCON-2003 in San Diego and the article published in the proceedings. A copy of the article is included herein.

REFERENCES

Carriff Corporation website:
http://www.carriff.com/Products/drain-sleeve.htm

Miniwax Polycrylic website:
http://www.minwax.com/products/water_based_clear_protective_finishes/polycrylic_protective_finish.cfm

Quasiglass demonstration & article presented at NARCON-2003, by Rick Boyette

The author with his scratchbuilt Long March 2E *at LDRS-23 in Geneseo, New York, as featured in the July 2005 issue of* Popular Science *magazine.*