

A Micromesh Advanced Users' Clinic

by Kas Thomas

Plexiglas—being the strong, lightweight, see-throughable stuff that it is—is a truly marvelous windshield material. (If the inventor of clear acrylic didn't get the Nobel Prize, he or she certainly should have.) But Plexiglas does have one major, irredeemable failing: Its surface hardness is only slightly better than day-old mozzarella, which means that over time, zillions of tiny scratches (incurred by blowing debris, paper towels, watches and wedding rings—even fingernails) inevitably accumulate, until whole sections become fogged, making every flight MVFR.

When Plexiglas begins to get that spiderwebby appearance, you can temporarily fill the surface fissures in with wax (by using Pledge, Turtle Wax, or similar products). But there eventually comes a point when repeated waxing/polishing just doesn't restore the pane's optical qualities. That's when you need to call in the heavy artillery. In a word: Micromesh.

Most aircraft owners who've been around awhile (i.e., those who've subscribed to *LPM* for more than π^2 fortnights) know about Micromesh. The Micromesh system—as sold by Micro-Surface Finishing Products, Inc., of Wilton, Iowa—consists of little pads of abrasive (not unlike sandpaper, although much finer in grit) that a person can use in a succession of grades, from merely fine to *ultra-ultra*, to bring the smoothness of the surface to something approaching that of melting ice. The process can be done wet or dry; and it can be applied to small sections or whole windows. And the results can be truly impressive. (If you've ever been to

Micromesh booth at Oshkosh and watched their demonstration, where

a guy scuffs one half of a fresh piece of Plexiglas with coarse sandpaper, then restores it to perfect smoothness using Micromesh, you know what I'm talking about.)

I say "can be," however, because many Micromesh users find they sometimes don't get the results they wanted (or saw at Oshkosh). The process is not only labor-intensive, but technique-sensitive. You can get a like-new window in the end (saving yourself up to \$12,000, if you're a Cessna 414 owner), or you can screw things up royally. Perhaps it's time for a "Micromesh advanced user's clinic." Let's go over the whole process once again, but with an emphasis on tricks and ideas that experienced Plexiglas refinishers use to get the best results, time and again.

Understanding the Process

Getting the most from Micromesh requires a more-than-surface-deep appreciation of how the restoration

process works. Newcomers to the process, for example, are accustomed to thinking of Micromesh as simply a series of fine-grade sandpapers that achieve their effect by pure abrasive polishing. That's not really it at all. For one thing, *sandpaper* has a *paper backing*, whereas Micromesh pads have a soft cloth backing; also, the abrasive crystals in Micromesh are set in a soft, rubbery matrix, whereas the garnet crystals in ordinary hardware-store-variety 220-grit open-coat are glued (cast in concrete, as it were) to an inflexible substrate.

You should also note that where the crystals in conventional abrasive pads are locked at irregular heights and random angles (with many of the smaller crystals never actually coming into contact with the work surface), Micromesh pads—because of the soft backing and rubbery matrix—allow the crystals to float to the same relative height (or nearly so) during use. In addition, the individual Micromesh crystals are free to *rotate*, so that all the crystals seek more or less the same planing angle during each stroke against the work surface. (Beginning to get the picture?) These properties make it possible for the makers of Micromesh to use *fewer crystals* of relatively large size and spacing so that comparatively large valleys exist (on the pad itself) between crystals. This in turn means that the many microscopic chips of shaved (not merely abraded!) Plexiglas that are liberated in the "sanding" process

(Continued on next page)



The KR-70 kit contains 7 grades of mesh, a foam block, and anti-static cream.

Polishing versus Microplaning

Deep scratches can only be removed through drastic measures—you obviously wouldn't expect a mere polish job to remove scratches caused by keys, watches, or rings (or sandstorms, etc.)—and yet, there are times when polishing is all that's needed. Recognizing this, Micro-Surface Finishing Products, Inc.—the selfsame people who came up with the Micromesh "cushioned abrasive" system—also sells a liquid polishing compound called Micro-Gloss.

The simple fact of the matter is, a suspension of very fine abrasive particles, applied directly to acrylic (or other plastic) by hand, will remove most fine scratches. (Not just *fill them in*, as a wax does, but actually remove them.) The catch is that the scratches have to be *very* fine indeed. And the abrasive has to be ultra-fine as well.

Toothpaste is a good example of a polishing compound that works well on superficial scratches in ordinary

plastics. Rub a little on a section of windshield (using a cushioned backing—such as your finger) and you'll see. Superficial imperfections quickly disappear, because the tiny silica particles in the paste can reduce a 10 micro-inch RA finish down to 5µi or less. (Next time you see an ink stain on a Formica countertop, rub some toothpaste on it and watch what happens.) Chalk suspended in turpentine or tallow also works well. (Raw wheat flour is a superb final polish for bare aluminum.)

Of course, if you're not careful, you can create a heck of a static charge when buffing with a cloth. Preferably, you want some anti-static cream in your cloth as you buff. Micro-Gloss polishing cream gives you this. If your windshield-restoring requirements are minor, you might try Micro-Gloss first (about \$10 through Trade-A-Plane mail-order houses). With any luck, you won't need to go to the heavy artillery.

restoration; Micro-Surface sanctions it in its Technical Bulletins. There are caveats, however. If you are using an electrical sander, it should be a high-speed (12,000 rpm) orbital type, with a 3/32-in. orbit and a 4 x 4.5-in. footprint. (If you've got access to a pneumatic sander, plan on 15,000 rpm or better, an orbit of 1/16 inch, and a 4 x 4.5-in. footprint.) And you should expect to generate fishhooks, which will later be blended out with the Micromesh pads themselves.

Before you rush off to get that powered sander, note that your pad grit number is limited by the thickness of your windshield (or window). Obviously, the thicker the acrylic sheet, the coarser a grit it can stand.

Window Thickness	Start with Sandpaper Grit
1/2"-3/8"	80 (open coat)
3/8"-1/4"	120 (open coat)
1/4"-1/8"	220 (open coat)
under 1/8"	320 (wet-or-dry)
	400 (wet-or-dry)
	600 (wet-or-dry)
1/16" or less	Micromesh only

Wherever your starting point happens to be, you must progressively work your way down the grit schedule *without skipping any grits*. For

(Continued from previous page)

ess can fall free of the crystals and be kept away from the work surface. So instead of many dust particles accumulating at the surface, where they only further abrade (not shave) the work surface, the dust particles are kept, for the most part, safely away from the surface. (You still have to

technique), but the design of the Micromesh system is such that high heat needn't be a problem, or even a consideration, in window restoration. A side benefit of this is that the Micromesh pads themselves last longer than ordinary abrasive pads. (Heat is what eventually destroys most sandpapers, by fracturing the crystals and

y). To speed the process, however, experts often skip from 600-grit wet-or-dry straight to 1800-grade Micromesh. Why? Because 1500, 1800, and 2400 will all remove a 600-grit scratch pattern, but each one takes progressively longer if you omit the preceding one. The best compromise is usually to skip from 600 to 1800.

Another good tip: Choose a worn piece of sandpaper, and use lighter-than-normal pressure on it, at the end of a step, before switching to the next grade up.

No matter what grade you're working with, periodically test the surface temperature of the work piece with the back of your hand. If it feels warm, move to another spot for awhile. (Also, don't work in the hot sun.) Remember, heat is your enemy; too much heat allows particle melting, scuffing, and other damage.

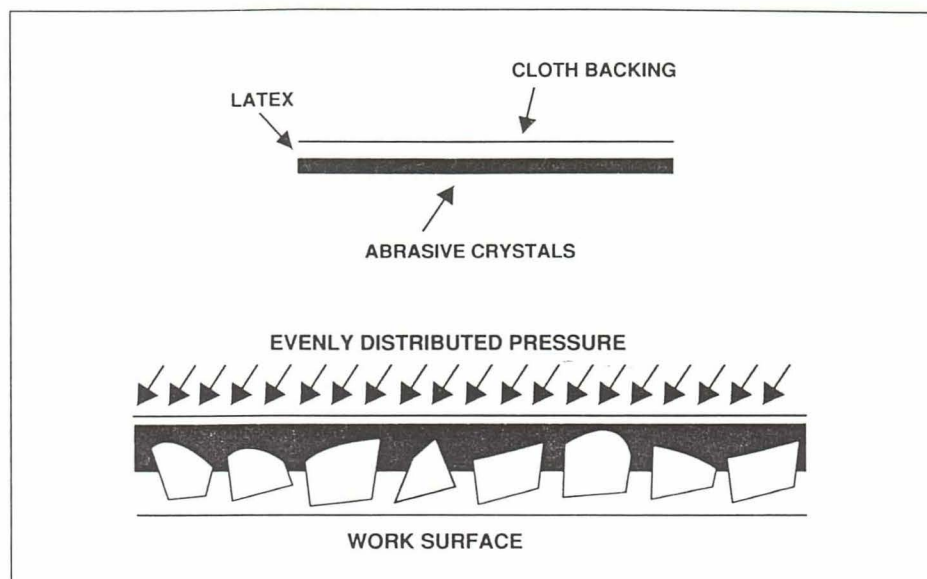
Note that you shouldn't be working with sandpaper at all if your window scratches are very fine (i.e., can't be felt with a fingernail). For light "spiderweb" scratches, simply start with 1800 or 2400 Micromesh, as needed. Sandpaper is the way to go if you have deep scratches. And if you've got a lot of them, a powered sander (despite the likelihood of fishhooks, which disappear later with Micromesh application) is the fastest way to a good finish.

Power Users' Tips

One of the keys to success in this business is keeping everything surgically clean. That includes your workbench or wherever you set your pads, wipe cloths, etc. If you accidentally pick up a piece of metal or loose garnet from your sandpaper, you can easily damage your almost-restored window. Watch where you lay things down.

A corollary of the above: *Clean the work piece* (the Plexiglas) between each step of the process. That means flushing the Plexiglas with clean water, paying special attention to crevices and moldings.

If you want to dry the window after each flushing, use a real (not fake) chamois, or 100% terry or flannel cloth. (Do *not* use paper towels or shop rags.) But why dry the surface, when you can leave it wet? Here's probably the biggest tip you're going to get (and we quote, direct from one



of Micro-Surface's technical bulletins): "Using Micromesh with water, or water and detergent, will generally result in less effort and a slightly better finish." Think about it. Water not only carries away dust and abrasion particles, but *acts as a coolant* to keep the polishing process from becoming too destructive. Micromesh can be used wet or dry. Why not do like the pros, and go with wet?

Incidentally, a little detergent in the water will definitely help carry off acrylic dust. Micro-Surface recommends Amway LOC or equivalent biodegradable detergent. (Micro-Surface actually supplies detergent in its biggest kit, NC-78-1.)

A familiar "equivalent" detergent would be Woolite (also good for airframe washing, by the way). Use a couple of capfuls to a small bucket of water.

Beginner's Mistakes

Probably the most common beginner's mistake is wearing out the first pad (Micromesh 2400, say) by trying to make it do too much work. If your scratches aren't going away quickly, stop, back up to the next coarser mesh, and try again.

Another common mistake is using circular motions instead of straight-line crossing patterns with the Micromesh. Remember, you're not polishing—you're shaving (or micro-planing) the surface.

Don't fixate on one well-delimited area; work a fairly broad area (large in comparison to the damage), and

attack a slightly larger area with each step of the process. This will keep you from making localized optical distortions in the glass. If you're working "dry," slap the pads out frequently. Don't let them load up with powder.

It hardly bears repeating here (this is an *advanced user's* clinic, after all), but you should always use the soft foam block in conjunction with the Micromesh pads. The pads, remember, are a *cushioned abrasive system*. Even though the pads themselves are soft and the individual abrasive crystals are set in latex, uneven pressure applied to the back of the pad (with fingertips, or your palm) can cause uneven results. Use the block that comes with the kit. It will conform to the shape of the window and allow equal pressure to be applied across every square centimeter of the pad surface.

And that's about it. If you have questions that weren't answered here, by all means contact John Archer, Micro-Surface Finishing Products, Box 818, Wilton, Iowa 52778 (phone 319/732-3240; Fax 319/732-3390). The Micromesh kits (KR-70) are \$15.95 from Chief Aircraft Parts at 1-800-447-3408, or any major FBO.

By the way, Micro-Surface Finishing Products, Inc., is also an FAA Repair Station (No. 304-68). If you don't have time to do a complete window restoration yourself (or you don't trust yourself to do it right), the people at Micro-Surface will be glad to give you a quote on any size job, from Super Cub to Lear 55.