

Compact Heated Bubble Etching Tank for PCBs

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After a long time of etching by pouring some etchant into a ziplock baggie or a plastic dish, I decided I should move up and build a real etching tank.

The most important improvement is having a heater; heating the etchant properly can make it etch many times faster; at room temperature I have had ammonium persulfate take over a half an hour to etch a board, but I have heard claims that with a heater it can be done in under 10 minutes. Typical aquarium heaters only allow the temperature to be adjusted to around 85 degrees F, which makes sense for fish and all, but for etching I need something more like 115 degrees F. The heater that I ended up with is a Hagen Thermal Compact 50W 6" mini, fully submersible heater (part no. A-722) It cost about \$10, and it's all enclosed in a glass tube except for the knob and cord entry, which is sealed rubber/plastic. I don't intend to use the heater fully submerged, so every part that is submerged will be solid glass, so there's no risk of etchant damaging it.

I got very lucky here, the heater just happens to have an adjustment range that let me reach 115 F without modifications. I think this is because it only has a +/- temperature adjustment, rather than a knob you can turn to a set, known temperature. Just to be sure, I also left it for a few hours and it maintained 115F the whole time, so i think it is going to work very well. I also tested how long it takes to heat up from room temperature, and it did so in under a half hour, which is acceptable. If I ever needed it heated in a hurry, there's always the possibility of perhaps placing a desk lamp with a nice hot light bulb a few inches from the side of the tank, just to get it up to temp faster.

Another thing I wanted was a good vertical etching tank, tall and wide in one dimension, but narrow front-to-back, so it doesn't require a ton of etchant to fill it. I was also hoping for something I could seal up to some degree when finished. I spent way too much time searching stores for a suitable container, and ended up deciding on this container, which is a "lock & lock" container I bought at Target (made by Heritage Mint apparently), but also available at Walmart and probably a lot of other places. It's 4.3" x 5.9" x 7.0" tall according to their website. The key to making it into a suitable etching tank was that I used a piece of plexiglass as a divider in the container, to partition off a smaller section of it. Another great advantage is, since I divided the container into sections of about 1/3 and 2/3, if I ever need more space (maybe for etching a lot of boards at once) I could just use the other side. The actual construction process is pretty straightforward. I used a piece of cardboard to make a template that fit snugly in the container, then traced it onto plexi and cut it one side at a time, with a plexi knife (bought at Home Depot, invaluable for cutting plexi, but use a utility knife if you don't have one) to score and then snap. The plexi fit pretty snugly without much gap on all 3 sides, so I either did a good job or got lucky. Then put it in place, trace the outline with a marker, and then lay a bead of silicone all along the lines. Put the panel in the container (not on the silicone just yet, put it in the 2/3 section) and push it into place from the side; that forces most of the silicone into the smaller section, which is helpful because it's too narrow to fit the tube of silicone into to actually put down a bead of silicone any other way. I used a plastic tool with a rounded end to reach in and shape the silicone bead (a toothbrush handle, if you must know). Then you can go back and lay a bead of silicone all around the other side, in the wider section, shape the bead, and then it should be a good seal all the way around. As for bubbling, I bought the smallest aquarium air bubbler they had at Petco, and sealed off the end of a piece of air tubing and punched some holes in it with a very small drill bit. This seems to be more of an art than a science, as if you punch some holes bigger than others, (surprise) the air takes the path of least resistance and the resulting curtain of bubbles is extremely uneven. After a few tries I ended up with something acceptable. I highly recommend putting a 90 degree elbow between the horizontal section of perforated tubing, and the vertical piece of tubing that feeds it from the pump. That way when you put it in, the bottom piece will tend to lay flat; if you don't, it's somewhat challenging to get it to do so, especially since you probably don't want to go sticking things down into etchant to push it into position. The pet store only had Tee fittings (no elbows) so I simply chopped off one port and epoxied the hole shut, to make an elbow. The other Tee you see is in the other section of the tank, not in the liquid, just ignore it. Also partly visible back there (behind the heater) is a one-way valve that helps prevent etchant from flowing back into the pump when it's turned off, which would most likely ruin it. And the latest image, the tank actually in use! It works great; my first board etched in about 6 minutes, I was shocked. And as a result, the over-etching was minimized and the boards came out great.