Custom American Mah Jongg Tile Construction

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This study reveals secrets to constructing your own custom Mah Jongg tiles. Here we assume you have a custom design in digital form that you want to turn into real tiles. I use our JLMahJongg tile designs as an example. For a summary of how our JLMahJongg designs were made, see here. Also, I plan to write a separate report on secrets to making high quality digital tile images. The goal of this study is to find the easiest way to create a full set of 152 tiles with acceptable quality, at least in my opinion.

Update 30 Jan 2026:

We played a few games with a tile set I made. Here's my comments:

- The tiles from the modified mold are a little small in height and width. American Mah Jongg standard height is between 1 1/8" to 1 ¼" (30 mm to 32 mm). The resulting tile size using the existing molds is about 1" high by ¾" wide by ½" deep. The advantage of the small size is they are lighter and take up less space. I prefer the larger size.
- I made the tops and bottoms of the tiles bulge outward slightly (about 1/32"). This curvature, the perfectly smooth surface, and small height relative to depth make the tiles a little hard to stack. They are relatively easy to knock over. It is a little harder to make the front and back surfaces flat.
- The top clear layer is a little too thick. The tile image can be hard to see from some angles.

I plan to try to improve in these areas by changing the process to make the front and back flat (less epoxy) and making the tiles larger. To make the tiles larger, I need to develop a way to make a fully custom mold. I have some ideas. I made one mold so far that was partially successful. I'll update my progress in future reports.

1. Creating a Blank Mold

The first problem is getting the basic tiles constructed. You could buy blank tiles and apply stickers to them or paint them. I take a different approach. It would be too hard for me to paint all 152 tiles manually, at least with acceptable quality. It was hard enough generating the digital designs a pixel at a time. Instead, I encase tile images in epoxy resin. Epoxy is commonly used and readily available. Don't use inexpensive epoxy indoors without adequate ventilation and a mask. Tiles can be made by mixing epoxy and pouring it into a silicone mold (casting). Unfortunately, I am unable to find a blank silicone mold for Mah Jongg tiles.

However, an inexpensive (about $6 to $8) mold is available with standard Chinese Mah Jongg designs as part of the mold (not blank). Figure 1-1 shows a picture of this mold. It appears intended for you to paint the symbols it creates for tiles that appear etched. I want blank tiles so I can use my own designs.

See Appendix A for materials and tools that have been used for this project. The list includes approximate prices and Amazon links. Some of the items I have not yet tested (non-toxic epoxy). Note that many steps in the process require some practice to get perfect. So, consider this before starting.

Figure 1-1. *Available Silicone Mold has Existing Designs*

I have made four attempts to remove the existing mold designs. Don't try to repeat my first attempts. I describe them here to show what not to do.

You might not be able to tell from Figure 1-1, but the mold designs are raised on the mold tray bottoms. My original plan was to cut them off with a sharp blade. I started trying this, but it seemed too difficult. My next brilliant idea was to put silicone glue (sealant) over the designs to cover them.

Unfortunately, the silicone glue was too thick to get it smooth enough. I thought I might be able to sand the resulting surface, so I tried to make some tiles this way. Figure 1-2 shows how the mold looked with the glue applied. I used a small putty knife to apply and to attempt smoothing the glue.

Figure 1-2. *Mold with Silicone Glue Applied*

Examples of some of the resulting disaster tiles are shown in Figure 1-3. These are some of the better ones, ha ha. They are worse than they look in Figure 1-3. I'll discuss better ways to make tiles with images embedded in or stuck on later.

Figure 1-3. *Tiles from Glued Mold*

I was able to sand a tile, but this would be hard to do for all 152 tiles. It would also require fine sanding and polishing. An additional difficulty is getting the sanded tiles the same thickness. A rough-sanded tile example is shown in Figure 1-4.

Figure 1-4. *Tile after Rough Sanding*

The next thing I tried is just using the molds the way they are without trying to remove the existing design. The resulting tiles have both the mold patterns and custom patterns of the embedded images. The resulting tiles are shown in Figure 1-5. It is not desirable to have both designs visible.

Note that the mold designs do not have jokers or flowers. There are 7 rows of 5 tiles in the mold, 35 total tile designs. The standard bams, craks, dots, dragons, and winds require 34 designs. The mold has an extra green dragon pattern to fill the extra mold position.

Figure 1-5. *Tiles with Both Mold Designs and Embedded Custom Designs*

Rather than sanding all tiles, it is easier to sand the designs off the mold first. It seemed easier to sand the original mold than the horrible, glued mold. So, I bought more molds to try again. I wasn't sure you could sand silicone. I tried several sandpaper grits between 150 and 400. The sandpaper types are shown in Figure 1-6.

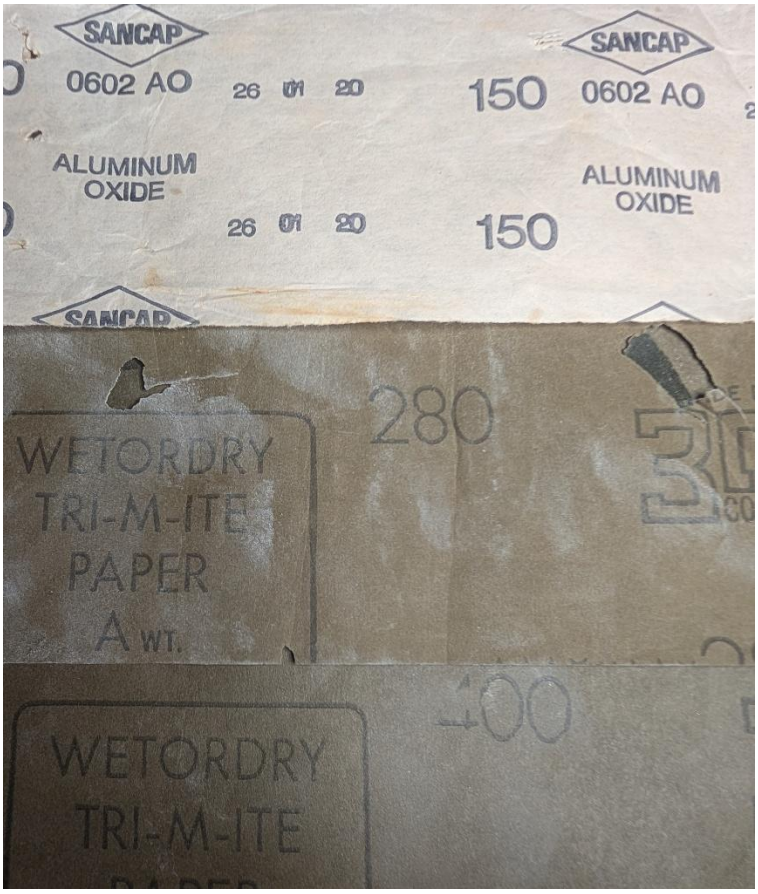

Figure 1-6. *Sandpaper Backs Showing Types and Grits*

Using the coarsest sandpaper tends to make holes in the mold and using the fine sandpaper takes a long time. I tried to fix the holes I accidentally made with silicone glue. The first sanded mold is shown in Figure 1-7.

Figure 1-7. *Sanded Mold Number 1*

Tiles from the first sanded mold are shown in Figure 1-8.

Figure 1-8. *Tiles from the First Sanded Mold*

These are better, but the surfaces would still need sanding and polishing. It is difficult to get the embedded images to stay flat and the desired distance from the tile surface. Some are too close to the surface to sand. These tiles are created with 2 layers of epoxy. A clear layer is put on the mold bottoms and images printed on photo paper are placed in the clear epoxy. After the epoxy has hardened, another layer of epoxy (of any desired color) is added to fill the remainder of the tiles.

My next attempt was to generate tiles using the sanded molds, but without embedding any image in them. Note if you use this approach, you might not need to remove the mold designs; just stick the images over the recessed design. I made the "blank" tiles out of epoxy dyed white. I printed the designs on adhesive photo paper, cut them out, and stuck them over the rough blank tile surfaces. The resulting tiles are shown in Figure 1-9. Two example blank tiles are also shown. On the first 4 tiles, 1 bam to 4 bam, I tried to coat the stickers with clear epoxy. This didn't work well – the epoxy discolors the photo paper and is hard to get smooth and adhere uniformly. The tiles not coated with epoxy look pretty good but are not very durable. They would be good enough for show, but they would not stand up well to use. The photo paper images are easily damaged by moisture or scratching. So, I continued to look for a better solution.

Figure 1-9. *Tiles using Stick-on Designs*

On my fifth attempt at tile-making, I tried to embed the adhesive photo paper image in epoxy with the image on the top rather than the bottom. With the image on the top, the rough sanded surface is on the bottom. I also tried to stick the images to a blue-colored bottom layer. I forgot to remove the backing paper from the bam tiles, but that was a fortunate accident. With the backing paper removed, the blue color from the epoxy discolors the photo paper and makes it look bluish gray. The bam tiles are less discolored because the backing paper protects the image from the dyed epoxy. The resulting tiles are shown in Figure 1-10.

Figure 1-10. *Tiles with Adhesive Photo Paper Images Embedded in Epoxy*

It was difficult to get the correct thickness of both the bottom and top layers.

Having the images on the top side was more promising, but the adhesive paper was not working out well. Therefore, I next tried embedding designs on regular photo paper with a blue lower layer and a clear layer on top. I was able to get better at producing the correct thicknesses of the 2 epoxy layers. The resulting tiles are shown in Figure 1-11.

Figure 1-11. *Regular Photo Paper Embedded on the Mold Top with Clear Epoxy Cover*

My 7th approach is like the last one, with adjustments to how the layer thickness is controlled and how the images are kept embedded at the correct location. I will give a detailed description of my latest process in Appendix B.

The resulting tiles are shown in Figures 1-12 to 1-17.

Figure 1-12. *Summary of All Tile Designs with Latest Construction Approach*

Figure 1-13. *Full Set of 152 Tiles*

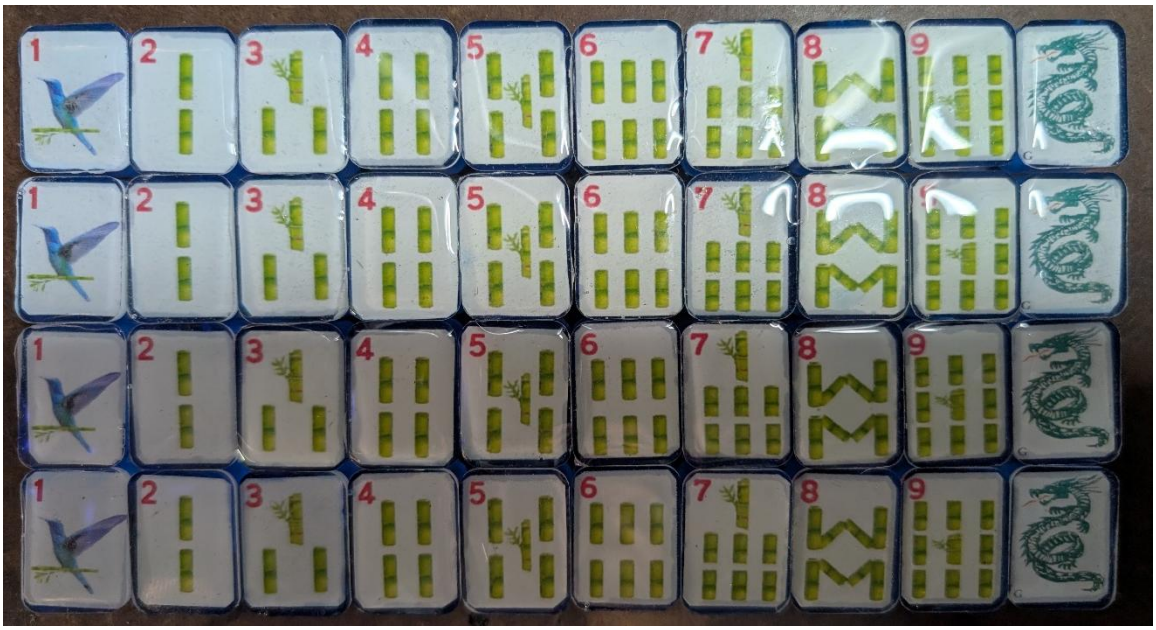

Figure 1-14. *Bam Suit Tiles*

Figure 1-15. *Crak Suit Tiles*

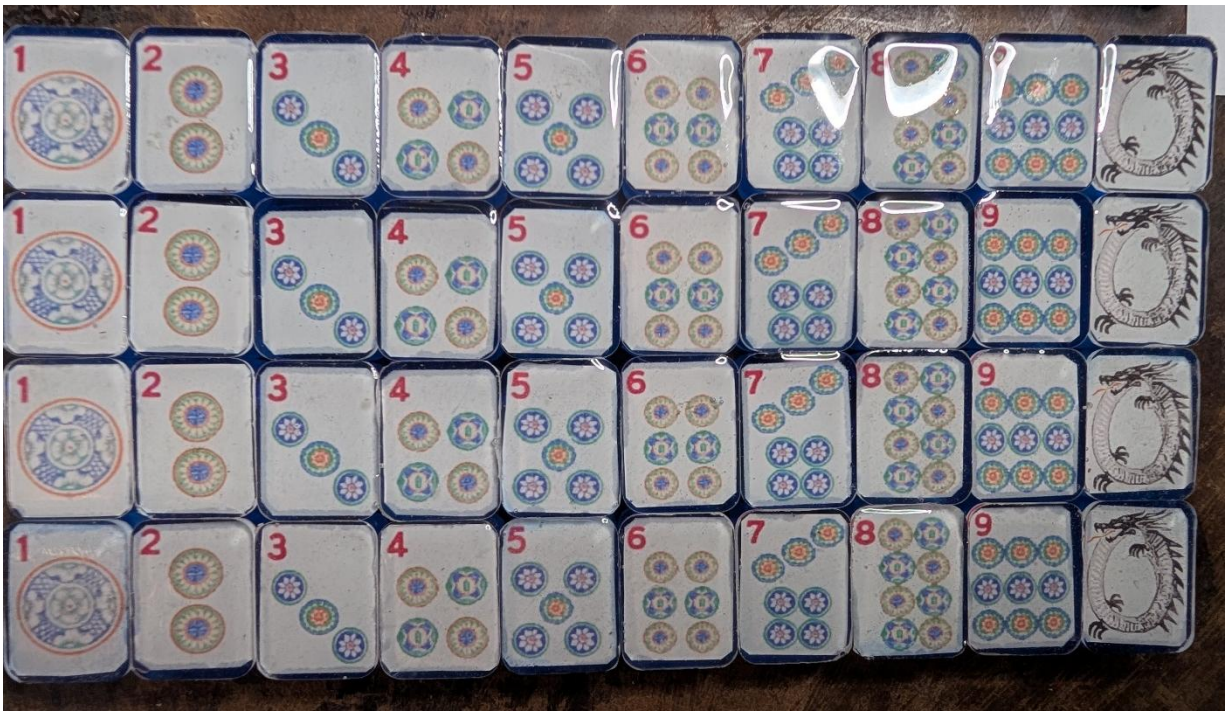

Figure 1-16. *Dot Suit Tiles*

Figure 1-17. *Wind, Flower, and Joker Tiles*

The quality may not be OMM quality, but it is good enough, at least for me. The tiles are waterproof, and the ink won't come off. Detailed instructions are given in Appendix B for creating tiles like this.

Now that we have tiles that the front looks pretty good, let's look at finishing the back and sides. Unless you are better than I at removing the mold design, the back surface will be rough. There are four options:

1. Just light sand and call it good enough
2. Sand and polish the sides and backs
3. Paint the backs with epoxy
4. Add another epoxy layer to the back

Sanding and polishing the tiles is difficult for me. I have been using a Dremel rotary tool. Still not able to achieve a glass-like smooth surface that happens when the epoxy dries naturally. A comparison of the tile backs using options 1, 3, and 4 is shown in Figure 1-18.

Figure 1-18. *Back Finishing Approach Results (top: light sand, middle: paint with clear epoxy, bottom: add epoxy layer)*

Back and Side Finishing Tips:

1. I sanded first with 150 grit, then 280, then 400 for the top examples. You can use even finer sandpaper and/or epoxy polish to get smoother results. Make sure you wait a few days for the epoxy to fully harden before sanding.

2. For painting or adding another layer of epoxy to the back, first let the epoxy harden for 1.25 to 2.25 hours to help prevent the epoxy from running down the sides and ruining the front (The time depends on the amount of epoxy you mix and temperature). Painting the back makes it shiny, but not necessarily perfectly smooth.
3. To add another layer of epoxy to the back, I use a special mold I create by carefully cutting out the bottoms of a tile mold. See Figure 1-19 below.

Figure 1-19. *Special Mold Constructed to Add Another Bottom Layer*

With the mold bottoms cut out, there is enough space to add another layer. Make sure to first rough sand the backs so the epoxy sticks. Place 0.4 ml of epoxy on the back center of each tile. One pump of both epoxy and hardener is enough to add a layer to 10 tiles. Spread with a heat gun and brush. Use a syringe to suck up any excess epoxy or blow the epoxy back into the tile compartment. Harden overnight. Remove any additional hardened excess epoxy with a sharp blade. Sand and polish the sides, if desired.

Appendix A. Materials Needed and Recommended

The materials I used are summarized in Table A-1 below. Less expensive items may work fine or may not. Prices may have been sale prices. The minimum cost for the materials to make one set of 152 tiles is about $25. Some items may need to be bought in larger quantities than needed. You don't need 100 syringes if you are just making 1 set of tiles. You might be able to find a smaller amount of epoxy or photo paper for making 1 set too. So, the cost should be between about $25 and $100 for the first set.

I have switched type of photo paper because the paper listed in Table A-1 tends to discolor at the edges if you heat the edges when in epoxy (to remove bubbles).

Table A-1. *Materials Needed, Useful, or Recommended*

Item	Quantity	Unit Cost	Total Cost ($)	Links & Notes
Photo Paper	2 sheets	$28.30/50 sheets	1.14	Staples Glossy 75 lb. Photo Paper (Not adhesive)
Silicone Mold	1	$5.49	5.49	Mold, May want more for practice or making a special mold for an additional bottom layer. Currently it's hard to find for this price (found for $7.99 from a different source)
Epoxy Resin	~ 1 liter (32 oz.)	$39.19/1.1 gallon (4 liters)	9.80	Epoxy Resin Only use with adequate ventilation and a mask. I foolishly learned by accident that vapors are harmful.
VOC Mask	1	$32.77	32.77	Mask Example You might need a better one. I have not tried this one yet.
Low VOC Resin	32 Oz.	$64.99/gallon	16.25	Craft Resin (option) Claims no VOC, indoor use
Low VOC Resin	32 Oz.	$49/32 Oz.	49.00	Art Resin (option) Claims no VOC, indoor use
Single Edge Razor	1	$11.99/100	1.20	Stainless Single Edge Razor
Craft Brush	5	$9.99/100	0.50	Craft Brushes Only need if painting backs with epoxy to finish
Silicone Sealant	As Needed	$12.99/10.14 Oz.	-	Selsil Silicone
Epoxy Dye	~ 3ml	$9.49/160ml	0.18	Resin Dye
Mixing Cups	1 small, 1 medium		-	Included with Resin Kit (or use any plastic cups)
Sandpaper	6 sheets	$7.99/22 sheets	2.18	120 to 20,000 grit sandpaper
Stirring Spatulas	1	$5.98/6	1.00	Stirring Sticks, Not necessary – could use any stick, but silicone is recommended
5 ml Syringes	~10	$15.99/100	1.60	5 ml Syringes, May be able to reuse, but I wouldn't count on it. You need more if using 3 epoxy layers.
TOTAL	-	-	**22.59**	**Assumes using least expensive resin, but not including mask**

Tools and Equipment Needed:

1. Scissors
2. Printer & Ink
3. Sharp Blade (single edge razor)
4. Flat and Level Worktable
5. Protective Gloves

Recommended Tools:

Single Edge Razors – To trim excess epoxy and to cut designs off silicone molds

Heat gun – Good for removing bubbles and spreading epoxy. Many options to buy from $13 up.

Small paint brushes – If you want to paint epoxy on the back of the tiles.

Appendix B. Detailed Construction Procedure

1. Making Tile Images.

Make digital designs in a format you can print to photo paper. I use Microsoft Paint and Microsoft Word. To make a standard American Mah Jongg set you need these designs: 1-9bam+green dragon,1-9crak+red dragon,1-9dot+white dragon (soap), N, E, W, S, 1 to 8 flower designs, and 1 to 8 joker designs.

Size each tile to have 0.92" height and 0.70" width. In Word you can do this by selecting an image and then selecting "Picture Format." Using this size, you should be able to fit 10 rows of 10 tiles on a single 8.5 by 11" sheet of paper. I use these margins: Top: 0.7", Bottom: 0.5", Left: 0.5", Right: 0.3"

Print the tile images for all tiles you are making (about 152, more if you want extras or blanks) on photo paper and let it dry for a day or two. Carefully cut out each tile image. Try not to touch the image fronts because they might smear, especially if your hands are not completely dry. I cut the corners of the images to help make them fit better. You will tend to cut too much from the corner. Pay attention to the length you are cutting. It gets easier after a few hundred times.

2. Making a Blank Mold.

The approach here is to remove designs on a mold that has appropriate size tiles but has designs already molded into each mold bottom. Be careful buying molds – some are for sale that make miniature tiles. The tile sizes should be about 25mm high by 19mm wide. The finished tile depth will be 0.5 inches. If you can find a fully blank mold, it would be easier, but I have not been able to find one for sale. I give an alternate approach that you don't need to remove the existing design here (It may work – but I haven't tried it yet).

First make two tiles using the mold as it is (detailed instructions for epoxy measurements and mixing are given later). Use silicone glue/sealant or any other glue that works to glue the two tiles together. This makes a cutting and sanding block. Using the block makes it easier to cut off and sand the mold bottoms. I sand the block edges to emphasize the center area that needs to be cut or sanded, Figure A-1.

Figure A-1. *Cutting and Sanding Block Made from 2 Tiles Glued Together*

One at a time, push each mold compartment inside out with the block and cut off the existing raised design using a sharp knife. Of course, be careful not to cut yourself. I only cut myself a few times and sanded my finger until it bled once. Try to get the bottom as flat as possible. Then sand each mold bottom using the block and with the sandpaper on a flat surface. I sand sequentially with 150, 280, and 400 grit sandpaper. You might be able to continue with finer grits to get the silicone smoother, but I haven't tried. How smooth it needs to be depends on if you intend to finish the back with an additional layer of epoxy. When you have sanded enough, you should no longer be able to see or feel the design. The bottom of the mold will end up making the surface that is near the bottom of each tile.

3. Filling the Molds.

Bottom Layer. The next step is filling the molds with a bottom layer of epoxy. Make sure the mold is on a flat and level surface. Also protect the surface from dripped epoxy, if necessary.

Epoxy and epoxy fumes are toxic, so don't get on your skin or breathe the vapors. Unless you use special non-toxic epoxy, the vapors are harmful and dangerous because they don't have much odor.

Note each full tray requires about 6.4 milliliters (ml) of epoxy. There will be two or three epoxy layers to make up each tile. I assume you are filling one tray of 35 tiles at a time. We will first be putting 5.4 ml of epoxy in each tray, 5.4x35 ml = 189 ml. Add about 10 to 20 ml to account for wasted epoxy. So, you will need to dispense about 100 ml from part A and 100 ml from part B (assuming you use 1:1 ratio two-part epoxy). The epoxy instructions say to put it in separate measuring cups and transfer to mixing cups multiple times. I find this unnecessary. If you use the less-expensive epoxy listed in Appendix A with pump dispensing, you can just count the correct number of pumps from each container (both A and B) directly into the same mixing cup (cup needs to hold at least 200 ml; medium-size plastic drink cup, 8 oz.). You can estimate the number of pumps required for getting 5.4 ml/tray by calculating ¾ pumps per tray. So, 35 trays requires ¾ pumps/tray x 35 trays = 26.25 pumps (use 27).

Add drops (or powder) of a desired tile back color to the epoxy. The tiles I show in the figures used about 20 drops of Royal Blue per tray. Mix part A, part B and dye with a silicone stick for about 3 minutes or until there are no more color streaks.

I recommend NOT using a mold release spray. It does not seem necessary and can cause problems with adding additional layers. However, the molds don't last forever and become rougher and more brittle the more they are used. This aging also makes the epoxy stick more. If the tiles start to stick too much, then you can use mold release to help.

Getting the correct amount of epoxy in each tray for each layer is important. Use a 5 ml syringe to put 5.4 ml of epoxy into each tray. I recommend blowing with a heat gun to remove any bubbles, especially around the edges of each tile. I use temperature set at about 300 deg F and half fan speed. Especially don't breathe the vapors if you are using a heat gun! Periodically check for bubbles for the first hour and remove with a heat gun. Don't try to remove any bubbles after that. Let this layer harden for 4.5 to 5 hours from when you mixed it.

Tile Image Placement. If the epoxy is no longer sticky on top, heat one tile center at a time for a few second at 300 deg (until it is sticky again). After heating, place the next tile image face up on the partially hardened bottom layer. Press gently in the center with a blunt dry object (not your finger unless with a clean glove on) to try to remove any air underneath the paper and stick the paper to the epoxy. Be careful not to smudge the image. Also, be careful not to push too hard on any edge so that the image stays flat and the epoxy underneath does not seep up over the paper. Don't try to heat through the paper (can burn, discolor, or curl it). If colored epoxy from below seeps up, you can remove it with a toothpick. Make sure the lower edges of the tiles have the image at least as low at the top edge.

Top Layer. Mix clear epoxy for the top layer covering the image. Use 54 ml total (27 A + 27 B) for 1 tray (35 tiles), 5 pumps of each A and B. A 150 ml urine sample cup works well; make sure it's clean. Mix for 3 minutes. Using a 5 ml syringe put 1 ml of epoxy on the center of each tile. Spread using a heat gun. Heating the epoxy will soften it. Press down again gently on the center of the image with a blunt object and make sure the image stays flat and underneath the clear epoxy (does not float up). Use a heat gun to remove bubbles as with the first layer. The tiles look best if the center of the top is a little higher than the edges. (But this makes them harder to stack.) This only happens if the trays are a little overfilled (not so much that epoxy spills out of the tray compartments). If underfilled, the tile centers will be lower than the edges due to capillary action.

Note: Using 5.4 ml for the bottom layer and 1ml for the top layer gives a top layer that is about 1/8 inch thick. If you want a thinner top layer, you can use more for the bottom (5.5

for example) and less for the top (0.9 for example). The sum of the bottom and top volumes should still be 6.4 ml.

Let it dry for about 24 hours. Remove tiles and trim any excess epoxy with a sharp blade.

4. Finishing the tile backs.

Sanding, polishing, and painting with an epoxy coat are straight forward are options that are straight forward. They are not described here. If you want a better finish on the back, you can add another layer of epoxy to approximately match the tile front and not require sanding and polishing. If you made the tiles as described in steps 1 to 3 above, the tiles won't fit upside down in an unmodified mold in a way that you can add another layer. To do another layer on the back you either need to make the front piece differently (see alternate here) or modify the mold. Make sure you are done with making all the tile fronts if you only have one mold tray. I modify a mold tray by carefully cutting off the bottoms with a sharp knife. The tiles can then be put in the mold with the front side down. There will be a small amount of space at the top that can be used to add another layer of epoxy. The trick here is to add a layer of epoxy without it running down the sides of the tiles and ruining the front or sides of the tiles. To prevent too much epoxy running down the sides, we limit the amount of epoxy applied and apply it after it has partially hardened. Because we still want to add an accurate amount measured by a syringe, we can't wait until the epoxy is too hard to suck into a syringe. Unfortunately, the maximum time you can wait and still use a syringe depends on how much epoxy you mix and the temperature. Smaller amounts of epoxy take longer to harden.

Sand the backs of the tiles before putting them in the modified mold with the back facing up. Push the tiles all the way through the mold, place the mold on a flat surface and press the mold down gently.

You may need to experiment with the times and amounts of epoxy for your conditions. I found that 1 pump of epoxy from both A and B can add a layer to 10 tiles and can still be dispensed with a syringe after 2.25 hrs. If you accidentally wait too long, I recommend discarding the epoxy and trying again. You might be able to salvage it if you heat the epoxy. Adding a layer to 35 tiles requires about 3 pumps and can harden for up to about 1 hr. and 45 min. Note: if you heat the epoxy, it will harden faster and the correct time will be unpredictable. Apply 0.4 ml of epoxy to the center of each tile back then spread with a heat gun and small brush. I apply the epoxy to all tiles before spreading it. Let it dry for 24 hours and remove any excess epoxy with a sharp blade.

Alternate Approach (Not Tested Yet – may need minor modifications to work well).

This approach avoids cutting and sanding the designs off the molds. That is one of the hardest parts. This approach does require at least 2 mold trays. Modify one of the molds by adding 3 ml of silicone epoxy to the base of each tile, covering the raised design. In this approach, this rough bottom surface ends up in the middle of each tile. Put 0.2 ml of epoxy (colored with desired back color) in each tray and let harden for 4 hrs. Apply images on photo paper with image facing up to each tray and press center with blunt object. Add a 1 ml layer of clear epoxy to make the top of each tile. Spread and remove bubbles with a heat gun. Let it dry overnight. Remove any excess epoxy.

In a 2nd unmodified mold tray, put the tiles upside down with rough side up and the image facing down. Mix enough epoxy to cover the tiles with a 3 ml layer of epoxy (3 ml/tray +25 ml extra/waste, dyed to the desired back color). (I might also try gluing the smooth bottom pieces removed from one tray to the bottom of another tray to add the required space.) Let the epoxy harden for about 1 hr. and 20 min or before it gets too hard to use a syringe. Put 3 ml of epoxy in each tray center using a syringe. (Potential problem could be too much epoxy running down the sides and ruining the front.) Remove any bubbles and spread with a heat gun. Amount of epoxy should be enough so that adding any more will make it run over the tray sides, but no more. Let it dry overnight. Remove any excess with a sharp blade. Fine sand and polish, as necessary.

I glued cut-out bottoms upside down in the bottom of another mold. The 35 cut pieces are shown below. I haven't tried this approach yet and expect the original approach to work better. With the original approach, you might not need to remove the mold designs if you add a 3rd back layer.

John

Cut Mold Pieces Can Be Used to Make a Modified Mold with Shallower Trays