Stabilizing Wood

By Ken Northern

Ever find a beautiful piece of wood that is just too soft or punky to turn? In the past these would have been looked at longingly thinking wow what a waste, and then ended up in the trash can. Not anymore. Stabilization is the process you can use to turn these into workable pieces. There are products available to easily stabilize on your own at home. Dyes are also available to add color to these stabilized pieces and some are even adding Scents to the process.

The process of stabilizing wood takes place at the molecular level. Wood has two basic components, cell walls and the spaces inside the cell walls. When the tree is alive it uses the cells to store and move water and nutrients. When the tree dies moisture escapes from the drying wood, leaving behind small microscopic spaces inside the cells of the tree. The process of stabilization takes advantage of these spaces, filling them with a liquid compound that can then be hardened by heating the wood to cause a chemical reaction. To be effective the compound used to fill these spaces needs to have s sufficiently low viscosity to be drawn into these microscopic spaces. The most commonly used ingredient in current wood stabilization techniques is methacrylate (MMA). Methacrylate's easily form polymers because the double bonds are very reactive. MMA is a monomer. This is a small molecule that will fit in those microscopic spaces and link up with other molecules of MMA. MMA is mixed with a catalyst before it is placed in a vacuum chamber and drawn into the wood. The catalyzed MMA remains fluid until it is exposed to heat, at which time the catalyst initiates a reaction that converts the monomer into a single, complex chain polymer that is linked throughout the treated wood. All those single monomers join together to form one big plastic molecule interwoven throughout the cells of the wood. As this all takes place at a molecular level the natural grain of the wood still remains. Stabilizing will not fill the larger voids in the wood. Wood that has been stabilized will not absorb water afterwards, but like a sponge it will take up water into the larger voids. You will still need to fill and seal these larger voids.

<u>Items needed for stabilizing</u>

1. Material you want to stabilize
2. A stabilizing chamber (Some kind of container either homemade or Commercially available that will be able to safely hold vacuum)
3. A vacuum pump capable of achieving a minimum of 28" Hg at sea level. Higher vacuum will produce better stabilized blanks.
4. A toaster oven (you can use your wife's oven for bigger pieces but use at your own risk)
5. Some weights used to hold your wood down while being stabilized.
6. Aluminum foil
7. PPE, including rubber gloves and eye protection

Step One - Preparing the wood blanks

The blank must be DRY. A wet blank cannot be stabilized. The wood needs to be below 10% moisture content at a minimum. If you have a moisture Meter you can use it to check that it is below 10%. If you don't there are a couple of other ways to check that work well. Curtis Seebeck, (the maker of my preferred stabilizing resin Cactus Juice) suggests placing the pieces you are going to stabilize into your toaster oven for 24 hours at 215 degrees. My preferred method is to place them in a food dehydrator for a couple of days. Either will work well. It is very important that you cool the pieces to be stabilized completely before you stabilize them. (If you try to stabilize hot wood you will prematurely cause the resin to polymerize and the process will fail) Place them directly from the oven or dehydrator into an airtight Ziploc bag to cool. The Super Dry wood will begin to pick up moisture from the air as soon as you remove it. The airtight bag will stop it from doing so.

Step Two – Stabilize your blanks

Place the wood blanks into the chamber and weight them down to keep the blanks submerged during stabilization. Fill the chamber with enough resin to completely cover the blanks with at least 1" of resin above the blanks. The left over resin can be reused so there's no need to worry about waste. (Although if you are going to use color in the resin to color the blank you will not want to mix that colored resin back into your clear resin)

If you are going to color, then I would recommend Alumilite dyes. The powdered dyes available do not seem to mix as well or to color the wood as well as the liquid ones from Alumilite. Some types can also affect the cure of the resin if you use too much of them. You will need to use more dye than you think. Save the colored resins in their own containers as they can also be reused.

Seal the chamber and attach the vacuum lines to your vacuum source. Make sure whatever device or valve you are using to control the amount of vacuum applied is in the open position. Turn on the vacuum generator and slowly increase the amount of vacuum being applied to full. Initially the resin will foam due to the large amount of air being pulled from the blanks. Use the valve to control this foaming to keep the resin from getting to your vacuum source and contaminating or ruining your pump. Once the valve is completely closed and the foaming has slowed or stopped continue under full vacuum until you see very few air bubbles exiting the blank. This can take a long time on some materials, have patience. Very gently shaking the chamber can help release air more quickly from the blank. Be very careful if you do this as a sharp tap or bump can implode the chamber. (I have found that it is very hard to implode a good quality commercial chamber or a stainless steel chamber with an acrylic top, it is easy to do on a glass chamber or pickle jar) Once the bubbling has slowed to a minimum or has stopped, release the vacuum at the valve, and turn off the vacuum generator. (It is important to release the vacuum before turning off your pump if you are using a rotary vane pump as it can cause premature wear to turn it off while under vacuum)

It is very important to understand that the resin isn't being soaked up by the wood while under vacuum. It begins to soak up the resin when atmospheric pressure is allowed back into the chamber. Leave the blanks to soak in the resin for at least TWICE AS LONG as it took under vacuum to get the air out of the wood. While you may notice the fluid level drop when you remove vacuum remember the time it took to work the air out of the center of the wood. The resins need a while to work their way back into the cell structure of the wood. If you rush it you will remove the weight you used to hold the wood down and it will float up to the top of the resin. If this happens you need to repeat the vacuum and soaking process. When the blanks no longer float, remove the blanks from the chamber and wipe off the excess resin. Pour the leftover resin into the appropriate container and clean your chamber with a little soap and water.

If you have a pressure pot as well you can use it to help force the resin into the wood by using pressure. I like to take the wood out of the vacuum chamber after it soaks for about an hour and transfer it to another container along with resin. Make sure the blanks are again covered in resin completely and weighted to keep them submerged. Place this container in your pressure pot and place the blanks under 65lbs of pressure. Close the valve and leave them in the pot for a couple of hours. Then release the pressure and remove the weight from the blanks. If they begin to float up, replace the weight and re pressurize until they no longer float.

Step 3 - Curing the blanks

Preheat your toaster oven to 200 degrees. (I have never found one of these to be accurate by just setting the dial to 200. I use an oven thermometer to check and make sure it is at 200 degrees. If it's too hot it will not hurt the resin but it will make more of it leak out of the wood before it cures. Too cool and it will not cure properly.) Wrap each blank individually in aluminum foil. Then place the wrapped blanks into your preheated oven. The internal temperature needs to reach 200 degrees, for a minimum of 10 minutes, for the resin to cure. This usually takes about an hour to an hour and a half for a pen blank and longer for a larger blank. You can't really leave the blank in the oven too long and once you take them out, and let them cool down, if they are not completely cured, placing them back in the oven won't fix it. It is always best to cure them longer than needed until you get a feel for the process. You can use gloves and check the blank. Peel the foil back a bit and look at the resin. Cured resin will be hard and look crystallized. If the resin is still wet, put the blanks back into the oven until the resin is completely cured.

Let the blanks cool completely before you turn them. Remember that stabilizing will make the wood more brittle and you should turn the blanks as if you are turning acrylic. Avoid Heat buildup. Drilling and sanding should be done with care to avoid excessive heat buildup which can melt the plastic. As with acrylic blanks I like to use a spray bottle with water to cool the bit when drilling.

As you learn you will find that some species of wood work better when stabilizing than others. Now that you know the basic theory behind the technique, you understand that less dense species of wood have more space and are more likely to take in more resin, producing better results. Dense tropical

hardwoods have little space for the MMA to fill, and the oil in some species interferes with curing. But don't give up hope without a trial run. Curtis Seebeck, a wood turner who markets Cactus Juice Stabilizing Resin, reports that one of his clients successfully stabilizes ebony. Experimenting with a scrap or cutoff before committing the best of your stock is always prudent. To understand how much MMA your wood absorbs, weigh your wood before and after treatment to track the weight gained through stabilizing.

Sources of material

Turntex.com is my preferred site for my materials for stabilizing. Curtis Seebeck is the owner and is always available to help you with any questions you may have. He distributes his own "Cactus Juice" which is my preferred stabilizing fluid, Alumilite dyes, and vacuum chambers. He also was kind enough to donate one of his stabilizing chambers to the club so that we could raffle it off at this demo to help raise money for our club. His Cactus Juice stabilizing resin and his vacuum chambers are also available thru craft supplies USA.

Woodcraft also is a good source of stabilizing resin and equipment and carries the Stick Fast Resins, Dyes and chambers

Explanation of Vacuum and how it relates to Stabilizing

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Vacuum is a totally different animal than pressure! With pressure, given the right equipment, the amount of pressure is infinite. Vacuum, however, has a limit. The definition of a true vacuum is the absence of all molecules. This, of course, is unobtainable, even in outer space or the perfect laboratory setting. However, we can get fairly close with a good vacuum pump.

The 2 most common measurements for vacuum pump ratings of the amount of vacuum in the US is "inches of mercury" ("Hg) or microns. With "Hg, the higher the number, the higher the vacuum. With microns, the lower the number, the better the vacuum. A perfect vacuum (remember, this is not obtainable!) is 29.92" Hg at sea level on a standard atmospheric day (59° F) or 0 microns. For every 1,000 feet above sea level you live, you lose roughly 1" Hg of vacuum. However, since the air is thinner and the atmospheric pressure is less the higher you go, you still get the same effect at the lower vacuum reading since there is less air to begin with. It is really better to think of vacuum performance as it relates to stabilizing in terms of % of vacuum.

For example, at sea level, a 29" Hg reading on your vacuum gauge indicates a 96.9% vacuum or removal of air inside your blank (29/29.92). A 25" reading on your gauge at sea level indicates an 83.6% vacuum or removal of air inside the blank. However, in Denver, which is 5,000' +/- above sea level, the maximum theoretical vacuum is 24.976" Hg so a reading of 24.5" Hg on your gauge indicates a 98.09% vacuum or removal of the air inside your blank. In other words, make sure you know your elevation above sea level before you freak out that you are not getting enough vacuum! One person's reading is not necessarily the same amount of vacuum as another's! Calculate your maximum theoretical vacuum with my new calculator!

Now, the big question...how much vacuum is enough? Get as much vacuum as you can get and you will get better stabilized blanks! It only makes sense. The reason we use vacuum when home stabilizing is to remove the atmospherically compressed air that is within the material, thus making room for the Cactus Juice. The more air you can remove, the more Cactus Juice you can get into the blank and the better the blank will be stabilized.

Build your own vacuum chamber

There are a couple of ways to build your own Vacuum chamber. The first and least expensive is a pickle jar. With this method you simply get a pickle jar, drill a hole in the lid and attach an air fitting to it. You will need to have some type of air bleeding system in the line at some point to control foaming but that's pretty much it. A better and safer way is to build one out of a 3/4" thick piece of Plexiglas for the lid, some readily available air fittings, a ball valve, and a stainless steel container.

Parts list to build your own chamber

12" x 12" x 3/4" thick Plexiglas for the lid – Piedmont Plastics in Tempe 20.00

Vacuum Gauge – Grainger Part # 4FLT5 11.93

12 x 12 Buna N Sheet Rubber – Grainger Part # 1DPZ6 14.89

¼ Full port ball Valve – Harbor Freight #68254 3.99

¼ Female Brass Pipe T-Connector – Harbor freight #68197 1.99

¼ Barbed Fitting – Harbor Freight #68212 1.99 Or 1/4 in. Male Brass Industrial Plug – HF# 68180 1.99 Depending on how you are going to connect your Vacuum Pump.

First drill and tap to holes somewhere around the center of the Plexiglas to accept the ¼ fittings above. Drill them about two inches apart. One is for the vacuum gauge and one is for the T to thread into. Thread the ball valve into one side of the T and the Supply line fitting of your choice in the other. You will use the ball valve to bleed in air to control foaming. Next cut a circle about 4 to 5" around in the center of the rubber sheet. Make sure the holes you drilled and tapped are located within this area. You will use this clear area to monitor the bubbles coming from your blanks. Keeping this area small will allow you to use different sizes of pots as vacuum vessels. As long as rim of the pot can be covered by the Plexiglas top with the rubber gasket contacting the rim all the way around you can use any size of stainless steel container. For smaller projects you can just place another container inside of a larger one.

A great source for the stainless steel containers is bed bath and beyond. They have a couple of them that are used to hold kitchen utensils that are great for small and medium size vessels. My larger pot I picked up at a kitchen supply store. It is a serving pan made for the steam tables at restaurants.

Paint Pot Modification

Harbor Freight sells a Paint Pot that can easily be modified into a good working pressure pot with just a bit of work and a few fittings as well. I have read online that these are inferior but I've been using one regularly for about 4 years now right alongside of my 600 dollar Binks Pot and it has performed admirably and safely. These pots are rated up to 80 psi but I have found that the safety relief valves sometimes go off early and won't let you got to even the 65 I recommend for some tasks. I solve this by always replacing my safety valves on these inexpensive pots with a high quality 75 psi one from Grainger. Never remove or bypass one of these valves it is designed to let off pressure and stop catastrophic failures.

Parts needed

A harbor freight Paint Pot – HF#66839 these can be bought for 99.99 but you can use the 20% off coupons on this item.

Pressure Gage – HF#68250 4.99

¼ Male x 3/8 Female Brass Pipe Reducer – HF#68207 1.49

¼ Full port ball Valve – Harbor Freight #68254 3.99

¼ Mini Air Regulator with Dial Gauge – HF#68226 9.99

¼ Male Brass Industrial Plug – HF# 68180 1.99

First remove the tube that goes down into the pressure pot from the lid by unscrewing it. (Some people like to replace this tube with an elbow to deflect the air coming into the pot so that it won't blow whatever they are casting all over the inside of the pot. I prefer to build a rack to hold my castings and deflect the air as well) Thread the 3/8 to ¼ reducer onto the elbow above where this tube was removed. Then thread the ball valve onto this reducer. The regulator then threads onto the reducer and the industrial plug air fitting threads into the regulator. Make sure to use Teflon tape at each of these joints. This forms the input side of your pressure pot. You can use the regulator to set the incoming pressure and then close the ball valve when the proper pressure is reached isolating the pot so you can remove the air line. Remove the regulator that comes with the pot and replace it with a pressure gauge. You can use this gage to keep track of the pressure inside the pot after the air source is disconnected. Pots can leak a bit, some more than others. You may need to add air once in a while to keep the pressure constant on long casts.