PHOTOGRAPHS BY KURT HERTZOG

Stabilising wood – part 1

In the first part of his series on stabilising wood, **Kurt Hertzog** introduces us to the topic of stabilising wood and shows how effective and simple the process can be

When you talk about stabilising wood you need to define whether it is a temporary aid to making final cuts, stiffening some soft or punky areas or completely and permanently stabilising the entire blank. Each and all will be covered in the coming months. This month, we'll tackle the subject of permanently stabilising the entire blank. This used to be the realm of the commercial stabiliser whose apparatus and access to industrial grade chemicals precluded the home hobbyist or even the woodturning professional from performing it themselves. If you had wood needing stabilisation, you shipped it off to a company who would batch process it along with many others. You paid by the weight increase, i.e. after weight minus before weight times the per ounce multiplier. It could get costly very quickly depending on your needs not to say the delay in shipping, processing and return shipping. Over the years, many woodturners experimented with various chemicals and processes with the hopes of finding a home version of stabilising. Virtually every wood finish, adhesive, preservative and more was thinned, vacuum processed, pressure pot processed and just plain soaked in this search. That search led to a chemical and home process that could be done safely without a huge additional investment. I'll cover the process and the two materials that I've used successfully for the past several years.

Whether spalted, punky or otherwise difficult to turn, stabilisation using heat cured resin offers assistance

Cactus Juice and Stick Fast stabilising resin

There may be more than two companies offering stabilising resin to the non-commercial woodturner but I am not familiar with them. I include the TurnTex Woodworks Cactus Juice stabilising resin and TMI Products' Stick Fast stabilising resin in this article on stabilising wood because I have personal experience with using both. My experience with stabilising began in 2011 and I've been a fan of it ever since. If you have access to other stabilisation products in your area, by all means investigate them for your personal use. I do urge caution against the basement chemist offerings, however. You need to be certain that there is a company behind the product with the testing and safety documentation to support their products. Just because someone on some forum has a way to dissolve some plastic in a solvent and claims it is the real deal doesn't make it so. Always be safety conscious when working with chemicals.

SAFETY

Both of the companies offering the resins I use provide specific use instructions on the packaging and will provide the MSDS documentation. This includes PPE, safe handling and storage, transport, etc. You should always read the instructions thoroughly before starting a project; this will help to ensure that you are following their recommendations correctly. The chemicals from both companies are listed as safe for use. They do always recommend safety glasses and gloves to minimise contact but the chemicals are water soluble and clean up with soap and water. That said, be certain to read and follow their instructions particularly with the vacuum recommendations. Because you'll be dealing with curing temperature ovens and vacuum and/or shop air pressures, be certain to read and understand what you are doing prior to launching into this. It is all straightforward, easy and safe providing you follow the instructions in the correct manner.

KEY POINTS ON SAFETY

1. Always wear your safety glasses and gloves when handling any chemical
2. While curing is 200°F, use protection against burning
3. The vacuum used will range from 27inHg to 29inHg so follow directions
4. Never leave your curing oven unattended
5. Resin can be cleaned using soap and water and is drain safe

THE RESIN IMPREGNATION PROCESS

Both stabilising processes are nearly identical. The wood you wish to stabilise is put into a vacuum chamber with stabilisation resin. A vacuum is drawn to remove the air in the wood allowing for infiltration of the stabilising resin. That resin impregnated wood is then cured at the specified temperature for the time needed to fully penetrate the entire piece of wood. At the conclusion, the resin is cured to a plastic that will stabilise the wood forever. Properly done, the wood blank is now either solid wood or solid plastic throughout and the plastic will withstand temperatures around 400°F. The keys to the process are few yet unforgiving. The wood should be dry. Although dry is a relative term, it doesn't hurt to put your wood to be stabilised into an oven at a low temperature; this will help to drive the moisture content down. Once done, seal it in a plastic sandwich bag to prevent reabsorption of the moisture until ready for stabilisation. The wood to be processed is placed in the vacuum chamber and prevented from floating by use of a weight or a holding mechanism. The stabilising chemical is added until there is more than enough to cover with allowances for absorption. The chamber is sealed and a vacuum drawn to remove the air from the wood. The time required can vary based on the porosity of the wood as well as the quantity being processed. The vacuum is maintained until the size and amount of bubbles leaving the wood is miniscule. At that point, the vacuum is released allowing the wood and chamber to return to ambient pressure. Depending on whose process you use, you either let the blanks continue to be submerged in the resin for additional 'soak up' time or you can package the blanks for heat curing. If you are allowing for additional soak time, when that is over, you follow the same exact process of wrapping the blanks and performing heat curing.

Use the smallest tank you can to minimise the need for quantity of resin to cover. Unabsorbed resin can be reclaimed

The catalysed resin is poured in to generously cover the wood being stabilised. Sufficient resin is needed to allow for impregnation

The chamber is evacuated but done slowly to prevent foaming over the rim. Use any vacuum limits per your chamber manufacturer specs

Maintain the vacuum until the rate and size of bubbles diminishes to a minimum. At that point, the vacuum can be released

After the vacuum is released and the blanks have had their 'soak' if you follow those instructions, the excess resin can be reclaimed

KEY POINTS ON RESIN IMPREGNATION

1. Be certain your wood is dry prior to resin impregnation
2. Wear gloves and glasses when handling resin
3. Be certain your vacuum chamber is in safe working order
4. Work within your instructions on safe vacuum limits
5. Resin is reusable so reclaim the unabsorbed resin

HEAT CURING THE RESIN

With the wood fully impregnated with the stabilisation resin, you can now prepare your wood for the heat curing process. If you are working with multiple pieces, you'll need to wrap the pieces in aluminium foil so each piece is separated. Failure to do so will fuse all of the pieces together, which you don't want. The foil separation allows for easy separation at the conclusion of the heat curing process. If you have one block of wood, then wrap it entirely in foil. The purpose of the foil is to contain any resin that leaches out of the blank during the heat curing process. It is a safe plastic but it will make a clean up of the oven necessary unless you contain it in the aluminium foil overwrap. While you can use your food service oven for this, I do recommend you have a toaster oven or shop oven instead. The curing is nearly odour free and the chemicals are safe with easy cleanup but I always try to separate my processing from our food preparation equipment. It is important that you heed the temperature and process information very carefully at this point. Failure to do so will cause problems with your stabilisation and it is a one way trip. Temperature is key: both manufacturers ask for 200°F as the process temperature. Regardless of your oven selection, I can almost guarantee that the dial is way off. I use a modestly priced digital thermometer with a remote probe that I can place in the oven. I begin preheating the oven to 200°F and let it settle in to that area by adjusting the temperature dial. Regardless of the temperature dial reading, I use the digital thermometer as my guide. Once I have the oven under control, I quickly open and place my foil wrapped blank(s) into the oven. At that point, I monitor the oven to be certain that the temperature stays within the 200°F area. It will wander a bit but stay close. How long depends on the size of your blank(s). It is a heat penetration problem. Much like your Christmas turkey, you can add a lot of heat energy from the outside but it still takes time to get all the way down inside. The bigger the bird, the longer it takes. Be certain to wait long enough. It doesn't hurt to let it heat soak all the way through and then some. Removing the materials from the oven prior to curing all the way through leaves a partially processed blank. Once cooled, it can't be reheated to try to complete the process. At that point, what you have is all you'll get. In short, avoid huge, thick blocks of blanks in one go. Thinner and smaller batches make it easy to be successful. Of course, a one piece blank will need what it needs. Give it sufficient time while controlling the temperature within the window specified.

After draining, the blanks are wrapped in aluminium foil to separate them, preventing fusing together and to contain bleed out

It is advantageous to keep the size of the package to be heat cured to a reasonable size. The full temperature needs to reach the centre

Regardless of the oven used, an accurate temperature reading is necessary. The dials are extremely inaccurate

Some of the bleed out shown to illustrate the final result. The resin within the blank is turned to a clear plastic stabilising it forever

KEY POINTS ON HEAT CURING

1. This is a one way trip, therefore it is important to get it right the first time
2. Be certain of your temperature. Dials are always off
3. The temperature is 200°F. Stay very close
4. Keep your thermal mass low; this will allow faster temperature penetration. The foil wrap will contain the resin that will leach from the wood
5. The block is hot. Let it cool before handling or use protective gloves
6. When curing, err on leaving in for excess time. Too long doesn't seem to be detrimental

CURING OPTIONS

The beauty of boiling water curing is the simplicity. Easily done anywhere, inside or out, and simple stable temperature control

I checked my low boil temperature and found it to be 197°F. The actual will vary with barometric pressure

Both manufacturers specify and illustrate in their videos how to use the oven technique to perform the heat curing. In discussions with the technical folks at TMI, they suggested a boiling water process much like the industrial customers use. In industry, these heat curing impregnation resins are used to seal porosity in castings. The casting is processed via the vacuum as we detailed and then it is immersed in boiling water. Because of the thermal mass of the casting and the heat conductivity of the water, it cures the resin far faster than any serious dilution can happen. They suggested their testing of the boiling process and I tried it. It worked wonderfully. After impregnation, the blanks were foil wrapped as usual and they were placed and sealed into a sandwich bag. The stainless steel vacuum tanks as offered by TMI were used as a boiling tank. The tank was filled to a level higher than the block height and the water was brought to a slow boil right on the stove. The plastic bag was immersed into the water with the anti-floatation mechanism used to keep it submerged. Floating off the bottom to prevent heat conduction from the stove yet being kept submerged provided a 200°F heating process. When measured, the actual temperature at that off boil point – at my elevation – was 197°F. In the range perfectly and stable at that temperature. Because of the high heat conductivity from the water to the wrapped blanks, the entire curing process was in the 20 minute range. In an oven with an air medium as the heat conductor, curing times range in the couple of hours time frame. Both work yet the water process seemed far superior because of the uniformity and lack of monitoring required that is needed with an oven heat cycling.

VACUUM SYSTEM OPTIONS

You will need a vacuum system to perform stabilisation. I own a vacuum pump for the lathes for their vacuum chucking capabilities. When I am using the vacuum chamber available from the Cactus Juice folks, I use my vacuum pump. I have one of their older chambers done in clear plastic. It will hold pen blanks and bottle stoppers in sufficient quantity and is weighted with a metal screen. Being clear, you can watch the process and easily clean the chamber when done. The folks at TMI offer a stainless steel tank system for their vacuum chambers. The tops are clear providing the visual access needed to monitor the bubbles being drawn from the wood. The stainless tanks are available in different sizes and also require a vacuum source. They recommend keeping the vacuum to 27inHg as a high threshold based on the size of the tanks and the covering system. You can do the sums, but suffice to say that forces are a cross-sectional area calculation along with the vacuum drawn and the ambient baro. Like compressed air, treat vacuum with the respect it deserves and follow the recommendations. In addition to the vacuum tanks TMI offers, they offer a vacuum generator. If you don't have a vacuum pump and don't wish to obtain one, you can use their vacuum generator along with a compressed air source to create the necessary vacuum. A venturi design, it uses the compressed air flow to create a vacuum. Nicely done in a small package, the vacuum source worked well with their vacuum tanks. Because the venturi design uses a pretty good flow of air, you'll need a compressor capable of a couple of CFM. My small shop compressor worked perfectly yet my silent airbrush compressor couldn't provide sufficient airflow to draw full vacuum. I expected it would fall short but it did provide enough air flow to draw nearly 20inHg.

I use one of the older Cactus Juice vacuum chambers. It is clear and spec'd to 29inHg vacuum though my pump doesn't make it

TMI Hold Fast offers a very functional venturi vacuum generator. It uses compressed air to create the needed vacuum

The TMI Hold Fast vacuum chambers are stainless steel with clear plastic lids. They recommend 27inHg maximum for their use

KEY VACUUM SYSTEM POINTS

1. Follow the manufacturers' recommended vacuum chamber limits to be safe
2. Vacuum flow rate is low but the vacuum draw needs to be sufficient
3. When first evacuating the chamber, slowly introduce vacuum to prevent foaming
4. You can interrupt the vacuum process to add resin as needed
5. Keep the chamber seals clean and intact to allow for easy evacuation
6. The forces involved using a vacuum chamber deserve respect. If you have any doubts about the integrity of your chamber, don't use it until properly checked

COSTS OF STABILISATION

The end user costs of stabilising wood varies considerably. Both vendors have distributers and retailers in many countries of the world. You should be able to find it in your woodturning retailer. If not, the chemicals are shippable but like any weighty material, distance and weight can make the shipping costs considerable. Any unabsorbed resin is completely reusable so the only material used is what is consumed into the blank(s). You may have additional costs depending on your need for a vacuum source and/or compressed air. Chambers can be made but for the nominal costs the vendors offer, it is probably more economical to buy rather than use your time and materials to make one. Your choice. If you do the sums, you may find that you are better off sending your work out if you have a quality and readily available provider. I find that the fun and convenience of stabilising what I want, when I want, is well worth the cost. You'll need to determine that for yourself. The materials do have a storage lifetime. Once the resin is catalysed, the clock starts ticking. Stored at a cool temperature and in a UV free area, the catalysed resin easily keeps for six months and can be usable far longer. Heat and UV are the enemies. Both catalysed and uncatalysed resin should be stored in a cool dark environment for maximum shelf life. I've never tried to re-catalyse resin when it needs attention but I'm told there is a possibility of doing so. I err on the side of storing properly and using within its shelf life.

The dozen very porous blanks stabilized for this column consumed only 24oz of resin. All of the rest was reclaimed for future use

The catalysing resins are shippable yet are heavy. If your local retailer doesn't stock them, both vendors will ship internationally

KEY POINTS ON COST

1. The wastage is minimal but the more porous the material, the higher the cost
2. Shipping can be a factor because of the weight of the resin
3. Proper storage can stretch the usable life to eliminate out of date waste
4. Proper processing to get it right the first time eliminates lost wood and lost resin

BIGGER STUFF

The typical home user stabilisation has always been on the pen blank and bottle stopper size items. Commercial stabilisation really can be on the railroad car size but the home user doesn't have access to the vacuum chamber or curing mechanism. You can now do larger work by using the vacuum bags offered by TMI and the boiling water process. I used the larger bag available from TMI to enclose a spalted maple platter. Partially turned yet still very porous, it needed far more than CA adhesive was going to provide. Making a cradle as shown on the video available from TMI, the vacuum bag could contain the platter and will need a minimal amount of resin to provide coverage. I haven't yet processed it but plan to use a large stainless salad bowl with boiling water as my curing system. I'll find a baggie big enough to enclose it from the water and will keep you posted. The ability to do larger turnings or just large blocks of wood is now very doable using their vacuum bag and the boiling water process. The bag and boiling water curing process will work with any heat curing resin. Of course, the bigger the material, the more resin it will absorb, and the more costly your stabilising will become. You can decide if the blank you want to stabilise is worth the cost both out of pocket and time.

KEY POINTS ON BIGGER BLANKS

1. Vacuum chambers become unworkable because of the pressures involved
2. Vacuum bagging works great but is an additional investment
3. Larger pieces use more resin and therefore drive costs higher
4. Unless you use a kitchen sized oven, heat curing is a boiling process

Using a cradle for support and a vacuum bag, much larger work can be stabilised without large quantities of extra resin

Continued next month...

In part 2, we'll continue to explore stabilising wood covering the use of dyes, multiple colourings, processing of larger stuff, tips and tricks