# Making Wood Bangles with Metal Cores

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Note: Please read this entire tutorial before beginning your bangle.

# **The Fine Print**

#### Disclaimer

When working with wood and shop tools it is important to wear safety glasses, hearing protection and a dust mask to protect your health and safety. Take time to understand your equipment and the associated hazards each machine or tool may pose to your safety. The importance of a good dust collection system cannot be overemphasized. Additionally, many wood species contain oils and/or substances that are known to be toxic or trigger allergic reactions including skin irritation and respiratory breathing difficulties. Since most wood purchased does not come with Material Safety Data Sheets (MSDS), it is important to do your own research to understand the potential negative health side effects before handling or breathing dust.

The following websites are just a few places you can find specific details on wood species and the associated health risks during woodworking activities.

http://www.woodbin.com/ref/etc/wood\_toxicity\_table.htm

http://www.woodworkerssource.com/wood toxicity.php

http://www.cedarstump.us/Cedarstump/wood\_toxicity\_chart.html

Lastly, turning of stabilized blanks adds other fine dust to the workspace that should be collected and carried away from the work area to a quality one micron dust collection system. High quality dust respirators are a secondary choice when the workspace cannot be made free of hazardous dust. In summary, taking steps to protect yourself and your health should be a priority before you begin.

#### About this tutorial

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# **Tools and Materials Needed**

In order to make the metal core wood bangle presented in this tutorial you will need:

- $3^{3}/_{4}$  " and  $2^{1}/_{4}$ " Hole Saw
- Drill press and vise
- Calipers or other measurement device
- Stabilized wood of your choice
- WildWood Design metal bangle cores
- Lathe and lathe tools (i.e., skew chisel)
- 4-Jaw lathe chuck (preferable)

- Degreasing liquid such as Acetone, Xylol
- Liquid Nails<sup>®</sup> Home Projects Adhesive
- Rubber mallet and wood surface
- Wood working clamps
- Sandpaper and finish wax or CA
- Oven capable of 200° F

Items in red are not required when purchasing WildWood Designs wood blanks

#### Introduction

It is now possible to make wood bangles from exotic woods, burls and other non-structural woods using metal bangle cores by WildWood Design. This tutorial outlines methods for making metal core bangles starting with wood selection, through cutting, gluing and final finishing. Important pointers will be stated in **Bold Print**.

## Wood Selection and Dimensional Stability

Wood is an ever changing material. As it acclimates to its surrounding environment, humidity and temperature cause this natural material to grow/shrink and change shape. It is important to remember that metal core bangles are best suited for wood choices that are dimensionally stable. As an example, in one test an *unstabilized* hard maple bangle blank subjected to 90% Relative Humidity (RH) for 60 hours changed diameter by 0.100" in the cross-grain direction. In other words, this bangle blank was round when dry, but quite an oval when damp!

In general, wood stability is directly proportional to wood density. The figure below shows dimensional stability for .75" x .75" x 3.0" blocks cut with the end grain across the 3.0" dimension. The samples were subjected to 90% RH for 95 hours and measured throughout the test with digital calipers.



Figure 1. Dimensional stability of various wood species.

**For best results**, it is recommended that your wood bangle blanks be stabilized with a high quality resin system. WildWood Designs offers pre-made bangle blanks as well as wood stabilizing services. Wood such as Cocobolo, Bocote, African Blackwood and Desert Ironwood are inherently stable and do not need to be stabilized. Additional wood species will be added to this list as they are identified.

#### **Cutting the Bangle Blank**

For the size 8 bangle made in this tutorial, a  $3^{3}/_{4}$  " and  $2^{1}/_{4}$ " hole saw will be used to cut the starting bangle blank. When cutting oily or gummy woods, make sure to cut with one edge of the hole saw slightly **off** of the wood blank. This may leave a slight flat spot on the OD of the blank, but this flat spot will be turned off when finishing. Use a dust collector to remove the wood chips and dust from the cutting area (or a dust mask) and safety glasses.

When cutting wood with a hole saw (shown in Figure 2), make sure to 'peck drill', clearing the chips

during cutting. On oily woods, use a wood or plastic block (with your left hand) and rub against the cutting surfaces of the hole saw as you peck drill (with your right hand) to remove the adhered wood chips. **This material must be removed during cutting to avoid burning and premature failure of the hole saw**.

**Figure 3** shows shows cutting the ID of the bangle blank using a carbide tipped Bosch<sup>®</sup> brand hole saw. These types of hole saws do not plug-up with chips and do not need to be cleared like the Lenox brand hole saw shown in **Figure 2**. (Notice the half-circle wood vice 'jaws' that were fabricated using hard maple, drill press vice and a 3 5/8 " hole saw, plus a little sanding.) The circular wood vice jaws will hold the bangle blank from spinning, without crushing the blank when the hole is formed.



Figure 2. Cutting the OD using a drill press, vise and hole saw.

There are many variations of tools and processes possible for this step. Whichever process is used, **It is important to make sure the ID an OD are fairly concentric.** 



Figure 3. Bosch carbide hole saw.



Figure 4. Bangle blank of Zebrawood.

#### **Drying and Stabilizing the Blanks**

It is very important to ensure your bangle blanks are dry before starting the final boring and finishing. Without pre-drying, a wet blank will dry over time and may split on the final bangle! Place the wood

blank in a convection toaster oven for at least 1 hour at 200° F. **The next step is <u>highly</u>** <u>recommended</u>, (see Figure 1). WildWood Designs stabilizes our wood bangle blanks using *TurnTex Cactus Juice*<sup>®</sup> (See Figure 5). Because a stabilized blank is much more dimensionally stable, it is better matched to the fixed OD of the metal bangle core. Figure 6 shows how a stabilized blank resists absorbing moisture over time when submerged in a water bath. Although a water immersion test is extreme, it quickly highlights the value of wood stabilization when mating wood and metal for use in dry or humid environments.



Figure 5. Stabilizing the Zebrawood blank in Cactus Juice.



Moisture Gain vs. Time (min)

Figure 6. Percent Moisture Gain over time for cross grain maple samples.

**Figure 7** shows the bangle blank being stabilized in a toaster oven while it is wrapped in aluminum foil. Bake for 1 hour at 200°F to cure the resin. Once the blank is cool, it is ready for final boring of the ID and rough turning the OD.



Figure 7. Curing the stabilized blank in the toaster oven.

## **Final Boring and Roughing**

The hole saw diameters chosen for this bangle blank were selected so that sufficient material remained to structurally support turning and boring during this step. The wood blank should have a wall thickness of approximately 5/8". For cracked, checked or weak materials, the blanks must be supported during these final steps. Use cyanoacrylate glue (CA), epoxy or wrap the OD with electrical tape to keep the wood ring together for turning. Of course, once the blank is glued to the metal core, it will become significantly more stable for final turning and finishing!

Once again, it is critical that the wood blank is oven dry before final boring and sizing. In Figure 8, an ID clamping chuck is being used to bore the ID of the blank. Approximately ½ of the blank is bored and the OD roughed\*, the blank is flipped 180° and the process repeated. It is important to keep your metal core nearby and check fitment as you bore. Turn the bore to an ID of approximately 0.040 – 0.060" oversize (.05" average). The wood blank should NOT be a snug or press fit onto the metal core. A nice loose fit is desirable, leaving room for the flexible adhesive chosen for gluing. A snug fit may lead to wood failure and cracking. Other wood turning or machining processes can be used to achieve these same results, depending on the tools available in your shop.

\*If the blank is structurally unsound at this point, skip the OD roughing step until the blank is glued to the metal core.



Figure 8. Rough turning the OD and boring the ID to accept the metal core.

Fit check the core to the wood bore often during the ID boring operation, making sure to not cut too much off the ID. A sanding drum can be used to do the fine tuning of the core/wood blank fitment (see **Figure 9**). Once again, there are many ways to cut the ID to size including sanding, reaming, boring and turning.



Figure 9. Using a sanding drum to fine tune the core fitment and fit checking the metal core.

#### Cutting the blank to length

As the blank gets closer to the final size, care must be taken not to break the wood bangle at this point, as it may be fragile. A hand ground parting tool can be used to get the blank close to the right length (this allows you to save these part-offs for future bangle use). A combination of sanding and turning can then be performed to fine tune the length. The blank length should be 0.005" smaller than the groove width in the metal bangle blank. It helps to have a set of digital calipers at this point for measuring, but it is not essential. In Figure 10, a parting tool is being used to cut off excess material.

At this point, it is a good idea to assemble the metal core (without the wood in place). Press or tap the bangle cores together so that mating line on the ID is tight (each core ships in this configuration). To separate the metal cores, insert a thin flat-blade screwdriver between the groove on the ID and gently twist (See Figure 11).



Figure 10. Parting off excess material.





Figure 11. Assembly and disassembly of the metal core. When assembling the cores, make sure to use a soft cloth and light tack hammer, or rubber mallet on a wood surface as to not mar the metal core.

Once the blank is close to the finished length, it is important to fit check the width to the exact metal core that is being planned for use (each metal core may have a slight variation in width). This can be done by rolling the wood blank inside the metal core while looking for fit and gaps. Figure 12 shows a good fit and a fit with a gap where the wood blank is still too wide. It helps to roll the two pieces together like meshing gears. Once you have achieved the desired fitment, dry assemble the wood and metal. Ensure that when the core halves are pressed together, the wood blank rotates freely and does not bind. Disassemble the bangle dry fitment and prepare for gluing.



Figure 12. Fit check of bangle wood width. Sand the blank to achieve a loose but visually appealing fit.

## **Gluing it all together**

We are now ready to assemble the bangle! Start by wiping all of the components down to remove dust and debris. Degrease the metal bangle cores in Acetone, Xylol, or Alcohol. Make sure to remove all particles and debris in the recessed areas as this may prevent the metal cores from being pressed completely together. Also, wipe the ID of the wood bangle with the degreaser to ensure any oils from the wood or handling are removed (see **Figure 13**). **Make sure the cores and the wood bangle are dry before the next step!** We mostly use Xylol as our degreaser fluid as it dries quickly.



Figure 13. Degreasing the metal cores and the wood bangle ID.

It is now time to apply the adhesive and clamp it all together. The chosen adhesive for this project is one which has a high viscosity, long workability time and is flexible when cured. Even though steps were taken to ensure that the wood does not move (through stabilization and wood selection), **the wood portion of the bangle will still move with humidity and temperature changes. Some two-part epoxies and CA glue do not flex, and would cause wood failure under these conditions.** 

It is for these reasons that Liquid Nails <sup>®</sup> Home Projects Adhesive was chosen. This material can be purchase at Lowes or Home Depot Improvement stores or through the internet. This adhesive holds up well to temperature and shock, is easy to dispense (compared to mixed epoxies) and clean-up.

Apply a thin coat of adhesive to the entire ID surface of the wood bangle, making sure there is a thin coating on the wood. Then apply a thin coat to the right half of the bangle core where the wood will come in contact (see **Figure 14**). Insert the core into the wood bangle blank giving a 90 degree rotational movement while inserting. Then apply a thin coat of adhesive to the left half of the core and insert the core into the wood blank. Now, take a rubber mallet (or clamp) and press the two metal cores together, letting the adhesive squeeze out. Leave the squeezed out adhesive in place at this point and remove when dry. Xylol does a good job of removing the adhesive when it is dried.



Figure 14. Ready for adhesive.



Figure 15. Lightly tap the metal cores together, some adhesive squeeze-out will occur if the correct amount of adhesive is applied.

# **Clamping and Cure**

Any type of clamp will work for holding the cores in place while the adhesive cures. It is necessary to ensure that the two cores are pressed tightly together and that all adhesive is squeezed out of the internal areas. The parting line between the two core halves should be tight and almost unnoticeable (see **Figure 16 and 17**). The wood ring should also be free to rotate and not bound by a tight fit on the ID or width.



Figure 16. The assembled bangle with adhesive squeeze out. Wipe off extra adhesive on exterior surfaces before it dries, this makes finishing easier.



Figure 17. The clamped bangle, leave overnight to cure.

## **Final turning and finishing**

This step may take a little, or a lot of effort depending on how meticulous you are, and the level of quality desired. I will describe what I do to finish a WildWood Bangle.

After the adhesive has cured, scrape off excess adhesive with a plastic scraper or your fingernail and a rag. Wipe vigorously to remove all traces of adhesive. Chuck up the bangle on the lathe and begin turning the OD. I use a carbide square cutter which is a good all around turning tool. I prefer a slightly domed surface for the bangle, so I slowly remove stock, taking care not to allow wood tear-out. **Caution must be taken when getting your turning tools too close to the stainless steel cores. The cores will dull HSS turning tools quickly if you make contact.** Use carbide insert tooling if you are working with hard or dense woods and also if you are getting too close for comfort using the HSS tools. A final pass at a higher RPM will give you a finish ready for sanding. I use a homemade spacer ring made from MDF to keep the bangle a safe distance away from the chuck (and thankfully I haven't hit the chuck yet).

It is also important to avoid over heating the wood bangle while turning. Overheating is caused by taking too light of a cut, or by using dull tools. Touch the wood surface periodically during turning, if it is too hot to touch, then stop and let the bangle cool. High heat can cause the underlying adhesive to fail, which may lead to wood failure. Overheating is a large concern when turning hard or dense woods such as Ironwood, Blackwood or Manzanita. Carbide tooling is preferred with these materials.

Once you have achieved the shape you desire (flat versus crowned), sand with 600 grit sandpaper to remove all of the tooling marks on the wood. Also sand the transitional areas between the metal and wood, making sure to achieve a nice flush transition from metal to wood. Clean this area of all adhesive, again your fingernail and a rag work well. Sand the OD of the wood and metal surfaces until you reach the ID of the core. Remove all remaining adhesive with Xylol and a rag. Blow off all remaining dust and clear any voids that exist on the wood surface.

For finishing, I use Cyanoacrylate (CA) as it provides a hard, durable finish that can be wet sanded to a glass smooth surface. I use micro-mesh (MM) sandpaper from Peachtree Woodworking<sup>®</sup> or Woodcraft<sup>®</sup> and dry sand using 1500 grit MM. Start by applying a few drops of Medium CA on a 1" x 1" folded, lint free paper towel. With the bangle rotating at a slow speed on your lathe, apply the CA onto the bangle surface and allow to rotate for 1 minute. Use a CA accelerator to speed up the cure time. Next, apply 5 to 20 more coats of Medium CA and repeat the application process. Do not try to keep the CA on the wood surface, but let the CA coat the entire bangle face (wood and metal). You will only have a few seconds to get the CA applied before the CA starts to set-up (getting the CA leveled and smooth quickly will help shorten the wet sanding time). Let the bangle rotate while the CA slowly dries (5 min or so). Accelerator may be used once the CA is almost dry. Applying accelerator too soon, when the CA is wet, may turn the CA white or milky color.

It is at this point that should decide if you want to remove the CA from the metal surface, or simply leave it in place and wet sand it all together. We have done both and prefer to remove the CA, however it can be very time consuming.

To remove the CA, use a box cutter blade as a micro-turning tool and slowly turn the CA off of the metal surface. Take care not to cut the CA off of the wood area, attempting to stop right at the wood-to-metal interface. Use x 2.0 diopter glasses and get close to the work so you can see the details better. Again, this step is optional, however with the copper bangle cores, the copper will remain a bright copper color under the CA while the remainder of the bangle will take on a natural patina.

OPTION 1: If you are careful with your CA application (and a little lucky), you can start the wet sanding process using 1500 grit MM. However, if there are streaks or grooves, begin with 600 grit wet sandpaper and wet sand until the grooves are gone. Take care to not sand through the CA finish, as this will cause streaks in the finish which are very difficult to remove and may require you to start over by turning off the CA down to bare wood.

OPTION 2: To shorten the overall time spent during finishing, it is possible to apply fewer coats of CA (five to seven) and skip wet sanding altogether. This is done by applying EEE buffing compound (from PennState Industries) to the surface of the bangle and buff with a clean cotton rag. Lastly, apply a coat of Shellawax friction polish to obtain a mirror like finish.

Finally, for the ID finish on the metal core, we use a fine unitized abrasive wheel on a rotary tool to give the ID a slightly brushed look. We have tried to polish the ID of the metal cores and this can be quite time consuming. In general, an experienced wood turner can make a finished bangle in about 35 to 40 minutes. **Figure 18** shows the final Zebrawood bangle.



Figure 18. The final Zebrawood bangle.

## The End

This tutorial was written with the hope that you too can make beautiful metal core bangles for gifts, craft fairs or galleries. The end item is a unique piece of wearable art which is durable and water resistant. We sell finished bangles locally for \$80 to \$200 depending on wood species, and how attractive the final bangle looks. High end bangles with crushed turquoise inlay or alumilite cast balnks are popular and generally bring the most money at art shows.

WildWood Design carries everything you need to make wonderful wood and metal creations. We are continuously looking for new ways to expand our wood-to-metal product lines so check back with our website often. You can visit our gallery and store by going to <u>www.BangleGuy.com</u>. If you have any comments or questions, feel free to contact us at <u>BangleGuy@gmail.com</u>. As always, all of our products are fabricated in Western Colorado! This includes CNC machining and wood stabilizing. We are proud to be 100% MADE IN THE USA.

Happy Turning!

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