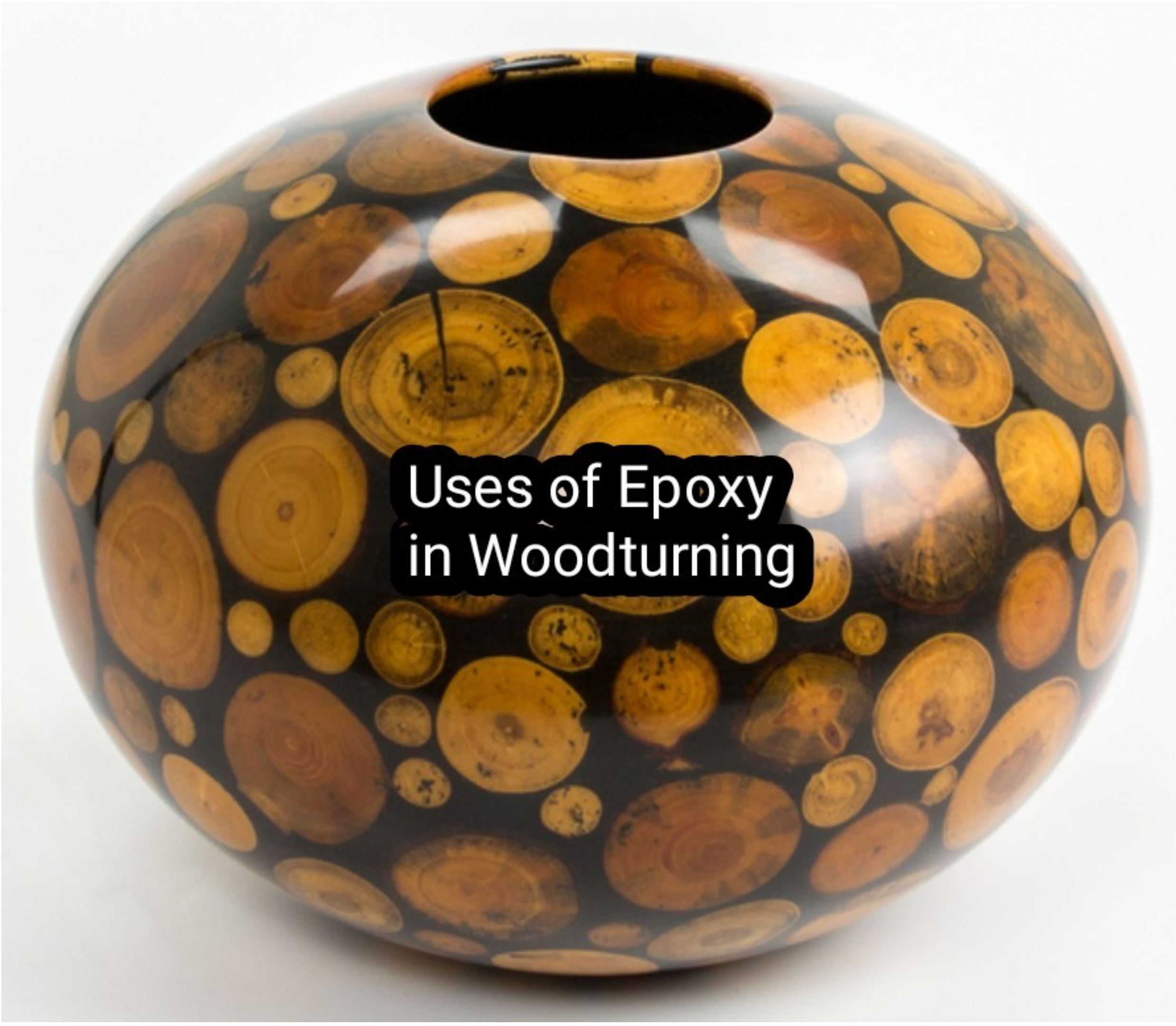


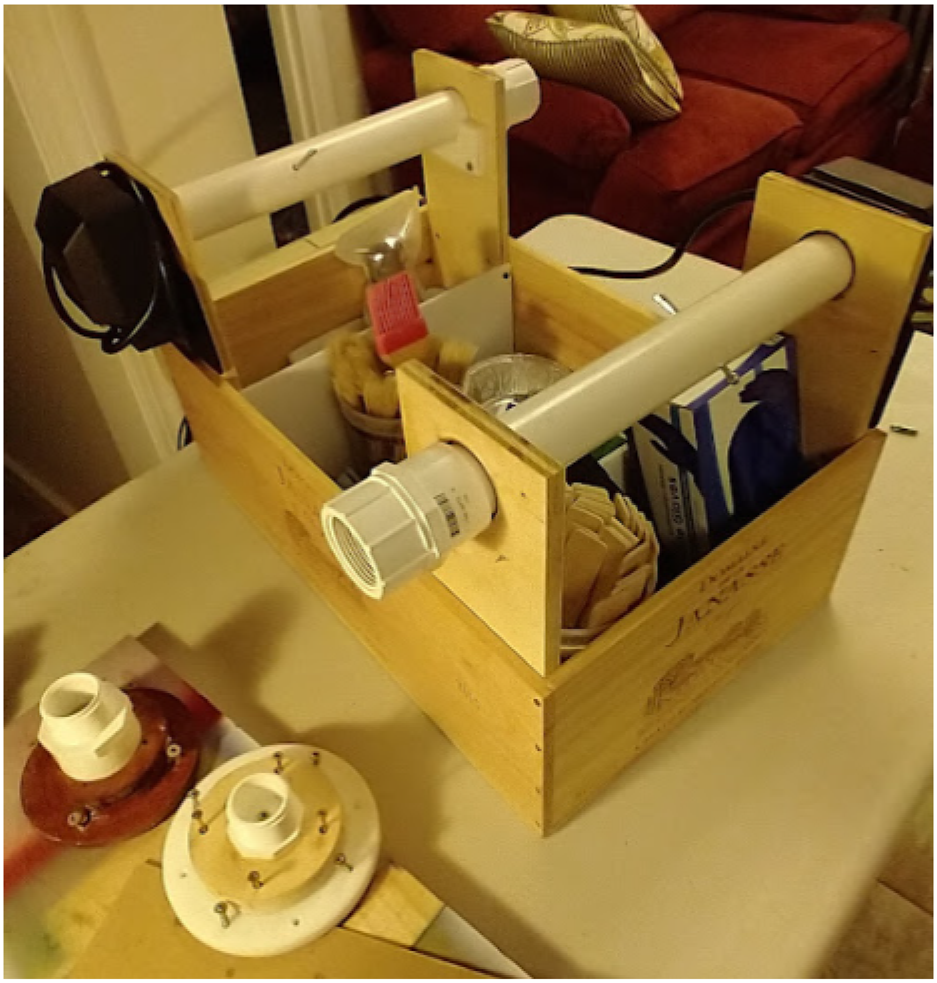
Outline for presentation by Robert Marshall, Brasstown Woodturners

- Inspiration - Moulthrop exhibit; Williams work at Brickworks gallery
- Major use categories:
    - Finish coating
    - Casting (molded) composites of wood and resin, often with dyed, pigmented, or ‘sparkly’ resin (option to use pressure pot to minimize air bubbles)

    - Corrective work:
        - Filling cracks and voids (‘coff-oxy’)
        - Stiffening soft, punky wood to reduce tear-out for final cut
        - ‘Petrifying’ soft or rotten wood (vacuum pot to suck epoxy into dried wood)

- Finish coating
    - Pros
        - High-gloss, smooth surface
        - Waterproof - can use bowls as top-mounted bathroom sinks
        - Food-safe when fully cured
        - Thick coatings can conceal some tear-out, surface irregularities
    - Cons
        - Requires special-purpose equipment, to deal with:
            - Viscosity
            - Long cure time
        - Steep learning curve
        - Labor-intensive

        - Temperature-sensitive for curing
        - Long-cycle for curing before additional coats
    - Special-purpose equipment



The “epoxinator:” two rotisserie motors, PVC spindles, HDPE bearings, HDPE face-plate, etc.

        - Slow rotation motor (3 to 10 rpm)
            - Sold for ‘cuptisserie’ craft projects, or BBQ spit
            - Rotation counteracts effects of gravity for the

slow-curing, viscous epoxy

    - Motor is driving a spindle made with PVC pipe and fittings
    - Supported by a bearing frame to carry weight
    - With attachment mechanism (face plate) at end of spindle, to hold your work
    - I've seen people use a lathe, with a separate motor turning the spindle at slow speed — not for me:
        - Ties up your lathe for a long time while epoxy is curing; can't turn wood
        - My turning shed is nowhere near clean enough for epoxy work
        - I set up equipment in the house where it is clean, not in my shop
  - Temperature sensitivity
    - Varies by product, but most epoxies perform best at 75° to 85° F
    - Low temperature increases viscosity and cure time; harder to apply and spread, and takes longer to cure
    - Warming epoxy can reduce viscosity and cure time, but can also lead to an exothermic 'run-away,' where epoxy begins to heat up on its own (chemical reaction releases heat)

        - Larger containers of mixed epoxy are more prone to exothermic ‘run-away’, because of higher mass-to-surface area ratio; get it spread out to help it cool down
        - Excessive viscosity can be reduced with *small* amounts of thinner (alcohol or acetone); ‘a little dab’ll do ya’
    - Multiple coats
        - Two coats is usually a minimum
            - First coat often soaks into wood, leaving bare spots
            - Second and subsequent coats have to bond either chemically or physically
                - Chemical bonding works if the base coat is still ‘tacky,’ so the next coat becomes one with the base; this is usually within a few hours, varies by product
                - Physical bonding requires that the base coat be fully cured (usually about 48 hours), then sanded to create a surface to which the subsequent coat can adhere
                - So, the subsequent coat has to be applied either (a) before the base cures past ‘tacky,’ or (b) after the base cures fully (hard) and can be sanded
        - High-end museum-quality work, like the Moulthrop pieces,

usually have 6 to 8 epoxy coats, followed by extremely fine sanding (1500, 3000, 5000 grit wet sanding), followed by rubbing compound (automotive) and polishing/buffing

        - Intermediate-level work, like that of John Williams, may have 3 to 4 coats, also followed by extremely fine sanding, rubbing and polishing/buffing
        - Most of my work has been in the 2 to 3 coats category
    - Epoxy materials
        - I’ve been using the epoxy John Williams recommended in a YouTube video, FGCI’s Hi-Gloss Ultra Clear; this is a 2:1 ratio mix, by volume (2 resin, 1 curing agent)
        - Not a rapid cure; several hours, usually
        - Expensive: $160 plus shipping, for 1.5 gallons
    - Application tools
        - Disposables: sponge-bob brushes, chip (‘cheap’) bristle brushes - avoids clean-up hassle, which is huge with epoxy
            - Chip brushes often leave embedded bristles; have tweezers handy
            - Sponge-bobs can fall apart in heavy use
        - Permanent: silicone brushes, such as BBQ basting brushes

            - Clean-up with denatured alcohol
            - Residue can be peeled or broken away; epoxy won't adhere well to silicone
        - Elbow-brush for hollow-core interiors
        - Silicone gradually stiffens with use and cleaning, but they're cheap
    - Application methods
        - Do bowl and hollow-core interiors before putting the object on the spindle; easier to reach that way
        - Do exteriors as the object turns on the spindle; no obstructions to your access
    - Attachment tools
        - Tried hot-glue; can't recommend it, too weak
        - Mostly use face plates now, with short screws (half-inch into wood)
        - Face plates can be a wood disk, but HDPE plastic is better; epoxy won't adhere to HDPE, so drips are no problem
        - Combination of plastic disk and threaded PVC fitting, with screw-holes through the disk to attach to wood
        - Steel face plate is not necessary (we're not cutting wood, just rotating it), and would be difficult to adapt to a PVC

    spindle

    - Have also used double-faced tape successfully, at least for smaller items

- Bottom-finishing

    - Use vacuum-chuck (or well-padded jam chuck) to hold the object on the lathe, while tenon is turned away

    - Epoxy coating of the bottom can be done without mounting on your rotation equipment, if you make the bottom like a shallow, flat dish; pour and spread epoxy

    - Another multiple-coat situation, just like the body of the object

- Measuring and mixing

    - Epoxy mixing proportions are fairly unforgiving; be precise

    - Most are specified by volume ratio (1:1, 2:1, etc.); some by weight (use a digital food scale)

    - My approach is to use throw-away graduated plastic cups for volume proportioning; pour in the resin, then add activator to specified level

        - For the epoxy I use, it is 2:1 by volume. So if I use 4 fluid ounces or resin, I will add 2 fluid ounces of activator

    - Use small paint-stir sticks to mix, thoroughly, but gently (to avoid stirring in air); scrape sides and bottom of cup to make sure that all of the resin and activator is completely blended together

        - Alternative: use small mixing bit with a drill; but this adds some cleanup effort

    - Do this ONLY when you are ready to apply; a compact mass of mixed epoxy can begin to heat up in the cup, and begin to partially cure, and you'll make a mess of things

        - Once you begin to apply it, it gets spread out and releases heat more easily, so it won't have a 'run-away' exothermic reaction (heat buildup)

        - If a plastic cup is left partially filled with epoxy, you may see it begin to deform (melt) from the heat, and even emit smoke; be ready to take it outside to let it harden

- Air bubbles in coating

    - Usually caused by air coming from inside the wood, and getting trapped in the thick epoxy; after the first coat, the wood is sealed, so this shouldn't be a problem

    - Epoxy's exothermic reaction warms the wood, causes air inside to expand, thus: bubbles

    - Bubbles can be dealt with in several ways

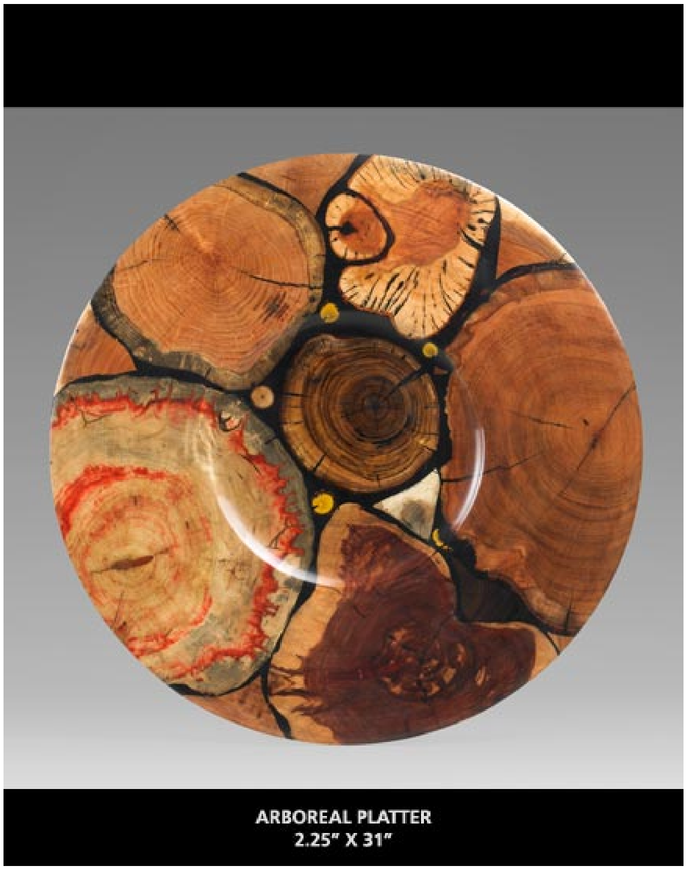
        - Lightly misting the epoxy surface with acetone (NO

SMOKING, PLEASE!); this reduces surface tension and bubbles pop

        - Carefully applying heat (heat gun, butane torch, etc.); also reduces surface tension, but if it heats up the underlying wood, may cause even more bubbling as air inside expands
        - Ignore bubbles, let first coat fully cure, then the sanding preparatory to the subsequent coat can eliminate visible bubbles; with the first coat on and cured, air shouldn't come up through it from inside the wood, on subsequent coatings

- Other contaminants in the epoxy coating
    - Work in a clean environment; epoxy coating is probably best NOT done in your shop
    - Still, you might get hair, gnats, bugs, other particles, that will show up clearly in the glossy surface
    - Have tweezers handy, to remove these things; you can stop the rotation of the object just long enough to take care of the problem, but get it going again before the epoxy begins to run or sag
    - If you missed a bug, you can allow the epoxy to fully cure and then sand it out, before applying the subsequent coat
- After the last coat … not through yet!

- Often it is necessary to do some post-epoxy work on your coated bowls or hollow-forms, correcting divots or blemishes
- Suitable sandpaper: 3M Trizact, in grits from 1500 to 5000, suitable for wet sanding ($$$ — expensive!)
- Rubbing compound (automotive paint rubbing compound)
- Polishing and buffing
- You can reduce the level of gloss through sanding and rubbing, if you prefer that satin-finish look



We're always trimming off the ends of logs, to get past the checking we want to avoid. Here, Philip Moulthrop has used those cut-off rounds to build a platter-blank from them, plus epoxy. And with the checking cracks filled with dark epoxy, they become "a feature, not a bug."

- Casting turning blanks with epoxy and wood (or whatever: pine cones, sea shells, nut husks, etc.)
    - The casting process combines epoxy and wood (or other decorative fillers), usually in a circular mold, to form a turning blank; other shapes can be used for pen blanks, bottle stopper blanks, etc.
        - The epoxy might be colored, with alcohol dye or other pigments, to provide contrast to the wood colors
        - You might "build-in" a wood base to use with a face plate

when turning; or, you can later (after molding) add a separate ‘glue-block’ for attachment using face plate or chuck

- The wood or other fillers in the blank may need to be fastened to the bottom, or weighted from above, to prevent them from floating in the epoxy; kitchen plastic wrap and masking tape can be effective to hold things in place
- If your blank is to be hollowed out, shaped like a bowl, you should probably use a “filler” (like a piece of cheap wood), to avoid having to carve out a lot of epoxy instead; epoxy is expensive!!!
  - Or, use a mold-in-a-mold, to prevent having to fill up all that meant-to-be-hollow space with epoxy (an inner mold)
- The mold(s) might need to be treated with a release agent, to avoid the mold adhering to the turning blank you are making
  - Cooking spray is a pretty good release agent
  - Silicone and some other plastics do not adhere to epoxy, so they will release on their own
  - Know what your mold material is, and how it behaves with epoxy; use release agent if necessary

- Air bubbles in the epoxy, or air releasing from inside the wood into the epoxy, can create unsightly voids inside your blank
    - The exothermic reaction of the epoxy can contribute to this, too, by heating up air entrained in the resin or in the wood
    - Using a pressure pot can reduce the air bubble problem, by compressing bubbles under several atmospheres of pressure, which makes them smaller and less noticeable
        - If you use a pressure pot, first make sure your mold will fit inside comfortably (with your fingers on the sides of the mold, as you are lowering it down into the pot); you can't just drop it in!
        - Put something under your mold to avoid getting epoxy on the pressure pot bottom (and perhaps accidentally gluing it into place)
- Allow cast turning blank to fully cure (hard)
    - When turning a cast-epoxy blank, you will get shavings from both the epoxy (feathery-soft, floaty strips), and from the embedded wood; makes disposal of shop waste a bit more challenging
- Sanding and finishing a cast-epoxy blank

        - Using an epoxy finish coating, after you've turned a cast-epoxy piece, simplifies the process, because you won't need to sand the epoxy surfaces to a glassy finish; the epoxy coating will take care of the gloss for you (in fact, the epoxy coating needs a little roughness to make it adhere properly)

- Using epoxy for corrective work
    - Cracks and voids
        - Sometimes, we leave these untreated, considering them as features of the wood
        - But, if they take away from the appearance or threaten the structure of the work, epoxy can be part of the remedy
        - Epoxy can be mixed with fillers like coffee grounds, small pieces of bark, sawdust or similar natural fillers, to make the filled void or crack look like a bark inclusion in the wood
        - Voids can be "dammed" on one side or the other with heavy tape (duct tape, gaffer tape, etc.), then packed with epoxy filler, leaving them 'proud' on both sides, to be turned and sanded after curing until flush with the rest of the work
        - Using epoxy filling in cracks may stabilize a crack, preventing or limiting further opening
    - Punky wood
        - I like heavily-spalted wood for its color and

grain-accenting, but the process that colors it also weakens the wood fibers, leading to tear-out, especially when turning end-grain surfaces

        - When that happens, I will turn the work to near the ultimate wall thickness I want, but stop short a bit to fix the problem
            - Prepare some epoxy using the normal mix ratio, but then add a thinner, alcohol or acetone, to make the mix runny, able to soak into the wood
            - That's usually 10 to 20% added thinner
            - Apply this with a sponge-brush, generously, concentrating on the end-grain area; get as much to soak in as you can
            - If you see it appearing on the opposite side of the wall you're applying it to, you're done there!
            - After it has cured (hard, no longer wet), then put the piece back on the lathe, and go for a final cut on the tear-out areas; it should turn out much better
            - Sometimes I use this same stiffening treatment on a tenon, where some soft wood makes its strength suspect, to help toughen it up
    - Punky wood "gone bad"
        - Sometimes I want to turn wood which is past punky, maybe "rotten", just because it's so figured
        - There are epoxy products made for this, called "wood stabilizers" (not the stuff in a MinWax can, though)
        - These epoxy products (Cactus Juice, SOS 3.0, and

others) are usually sold pre-mixed (resin and activator), but are formulated so the epoxy does not begin to cure until it is heated (usually around 190 to 250 degrees F)

- The process here is labor-intensive and time-consuming:
    - Thoroughly dry the wood to be treated, and cut to the size you need for turning (maybe pen blanks, stopper blanks, mosaic pieces for plates or platters, etc.)
    - Put the pieces to be treated into a plastic bucket, with enough epoxy stabilizer to thorough soak them in the bucket, too
    - Put the bucket in a vacuum pot, and apply a vacuum to it; this evacuates the air from inside the wood, allowing the stabilizer to take its place
    - Avoid “bubble-boil-up”, which can happen if the bubbling of the evacuated air gets too vigorous; back slightly off the vacuum with the release valve, as necessary; keep the bubbling down to what looks like a slow boil
    - After the bubbling stops, let the wood sit for a while in the solution, and then release the vacuum; the wood should be thoroughly soaked at this point
    - Use a grate to drain any excess stabilizer back into the bucket; stabilizer not absorbed into the wood can be re-used, without limit
    - Now, “cook” the epoxy-impregnated wood in a shop oven (not your KITCHEN oven!!!), for several hours,

at about 200 degrees (product instructions should be followed)

- After it is removed and cools off, you should have some solid, turnable wood, which has the same color and grain characteristics as the rotten wood, but which is now stable and turnable
- In a way, this is like a shortcut to “petrified wood”, with the advantage that it takes less than a day, versus several million years, and its easier to machine on a lathe!

Resources:

Videos:

Matt Moulthrop, Auburn Oaks
John Williams, Applying Epoxy to Woodturnings
Craft in America - Family (PBS) (Moulthrop family — first 16 min.)

Discussion:

Moulthrop family techniques (AAW forum)

Other:

Moulthrop Studios
Moulthrop Family - Wikipedia
John Williams, exhibiting at the Brickworks Gallery, Atlanta
Mosaic bowl (includes some how-to)