Stone Inlay in Woodturnings

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At an AAW chapter meeting a member asked for the best way to turn alabaster. The vastly experienced and fast thinking woodturner Ted Bartholomew responded "in someone else's shop". Good advise - and especially true when working with stone inlay. Stone inlay requires the use of large amounts of CA glue and the fumes are very noxious. The process of sanding stone creates dust that is not as easily captured by a dust collector as is wood dust - your shop may get very messy. At the end of the article I address the health and safety issues in greater depth.

Stone inlay is a technique I have a personal fascination with and I'm glad to share the basic technique with you. The first time I saw this was at the Utah Woodturning Symposium in 1998 or 1999 where Kip Christensen presented his approach. It's a simple process and the only refinement I have added is some research into the minerals more easily worked, a few tricks to minimize CA glue staining, and some improvement in the initial stone grinding efficiency. In the past year I have begun creating scenes of nature such as trees, flowers, and insects but the stone inlay technique is the same. The scenes are freehand drawn and freehand routered with a Dremel tool, but these topics are not the subject of this article. Here I'll describe making a stone inlaid band to accent a small platter.

After a considerable amount of experimentation I've settled on a limited range of colorful minerals that are easily acquired at rock shops, including some on-line. The requisite tools used to form them into inlay are as basic as a chisel, coffee can, CA adhesive (or superglue), and sandpaper.

Selecting Stone

The stone selected for inlay needs to be soft enough to finish with normal power sanding tools, yet durable enough to provide lasting beauty. Within several minerals I have found a wide range of colors and 'reflectivity'. Reflectivity is something akin to chatoyance in wood where the coarsely crushed stone catches the light with facets associated with the mineral crystal structure. Simply put: it sparkles and shimmers in bright light.

The Moh's hardness scale is used by rock hounds and geologists to describe a mineral's hardness on a scale of 1 to 10. A hardness of 1 is talc (chalk) and a hardness of 10 is diamond. Aluminum oxide (corundum), used in sandpaper, has a hardness of 9.

At a hardness of 3-4 we find several minerals that are readily available, brightly colored, and/or translucent with high reflectivity. This range of hardness, equivalent to a copper penny, is fairly easy to work while still durable. My favorites in this range are azurite, malachite, calcite and fluorite. Turquoise with a hardness of 5-6 is popular but not as intensely colorful as these other minerals and usually much more expensive. All of these minerals are common and can be found in most rock shops locally or on-line.

Options certainly exist in other sources of stone, but beware. Soapstone, with a hardness of 1-2, is fun to turn by itself and pretty, but is too soft for a durable inlay. Minerals harder than 6 are very difficult to finish but that doesn't necessarily preclude their use. Layer these beneath a softer translucent mineral like calcite and the color of the harder mineral will show through while the surface mineral is readily finished.

Minerals can be mixed randomly, uniformly, or in patterns. The addition of brass or aluminum filings can enhance the overall effect. In adding metals I've found 'less-is-more': a small amount of metal adds a beautiful gold or silver glint whereas too much metal washes out the mineral colors.

Preparing the Woodturning

From soft spalted alder to hard maple the inlay results are always great as long as the wood is relatively dry, about 12% or less. In that case the wood movement of a finished piece through the seasons is small enough that I've never had the stone inlay disfigure.

When turning a notch for inlay, the notch needs to be very well defined. If the notch has tear-out in it's sides, the inlay edge will look sloppy. On soft woods use a wood hardener to get cleaner cuts.

I use a skew chisel to create the notch sides first, cutting about 3/16" into the wood. I then remove the area between the skew chisel cuts with a cutoff tool. It is not necessary to undercut the notch edge.

On soft woods it is advisable to cover the surface immediately around the area where a notch will be cut with any finishing wax. Then cut the notch leaving this barrier on the wood surface on both sides of the notch. This barrier will keep CA adhesives from staining the wood as you build up the stone in the notch. The notch must be free of wax so if any gets in there, retrim the notch for a clean surface.

Step 1 Pretrim the inlay band notch with a skew chisel to a depth of about 1/4".

Step 2 Remove the wood between skew lines with a cutoff tool to a depth of about 3/16".

A 3/16" allen wrench makes a handy depth gage.

Placing the Inlay

Large chunks of stone must be crushed to fit the notch width. I use a small coffee can and a concrete chisel held backwards so the flat end strikes the stone. Cover the top of the can with one hand while pounding the stone with the chisel, otherwise pieces of stone will fly all over the shop. A piece of stone the size of a quarter creates a lot of crushed material. The following steps summarize the process.

1. Crush the stone only enough to allow the largest pieces to just fit in the notch. The remaining pieces will be progressively smaller down to a fine powder.

2. Place the largest pieces in the notch in whatever pattern you desire, usually a deliberately 'random' arrangement is a good start. Don't allow the largest pieces to be centered in the notch necessarily. Position the pieces so they are uniformly distributed across the notch width.

3. Add enough super-thin superglue to hold these pieces in place. Use an accelerant sparingly to prevent clouding. I mist a small amount from about 2 feet above a piece just to hurry it along. The superglue will cure to a clear polymer but too much accelerant will result in bubbles or clouding of the CA polymer.

4. Fill voids with smaller pieces but don't use the fine powder yet. Add super-thin superglue but use very little additional accelerant.

5. Add brass or another complimentary material to the voids at this time. The result will appear like veins running through the inlay.

Add the fine powder to fill the remaining voids and repeat the application of superglue. It is important to build the superglue up in layers with progressively finer material to avoid pockets of liquid superglue within the inlay. These pockets will foul your sandpaper when finishing and pockets of unglued inlay material will tear-out during finishing on the lathe.

Coarse stone placed in the turned groove. It is often helpful to keep the wood in the lathe chuck and remove it from the lathe as a unit to maintain alignment.

The stone glued-up with finer crushed material added around the coarser pices. Tap the wood gently ro settle the material then add superthin CA glue.

Finishing the Inlay

Aluminum oxide [AlO] sandpaper has a hardness of 9 so it can cut through any of the minerals I have recommended. If the inlay is thick I use silicon carbide [SiC] sandpaper for the initial sanding then switch to AlO to finish. SiC, also known as stearate, is used most often on stone because of it's high friability.

1. Using power sanding, take the stone inlay down to where it is about level with the wood surface. At this time try to get the inlay almost flush with the wood surface. Just enough to see voids in the initial inlay setting.

Use power sanding to finish the stone. Start with 60-80 grit and take the stone down until it's just flush with the wood surface.

Progress through finer grits of sandpaper finishing the entire piece. If a large void occurs remove the wood plus chuck and repair, otherwise fill small voids with thich CA glue.

2. Remove the chuck and woodturning together and blow away any dust in the inlay voids. Apply more wax only to the wood as needed to limit staining the wood by the CA glue. Then add finer mineral pieces and mineral dust on top of the inlay to get the surface level. Reapply super-thin CA glue, this time dripping it onto the fine material and letting it spread. Return the assembly to the lathe and repeat sanding with 120 grit. Sand into the wood slightly to remove stains from the superglue or mineral dust. If needed repeat this step.

3. When the remaining voids are small enough that no wood is visible within the inlay and the largest void is less than about 1/8", use gap-filling superglue to fill these voids. This can be done while the piece in on the lathe.

4. Progress through finer sandpaper grades as you would in finishing any wood piece. The stone inlay may be a little tougher to sand when it's coarse but when the inlay is essentially completed go to 180-220-320-400 grits for the final sanding. Run the lathe slowly during this phase of power sanding and keep the sandpaper cool. In soft woods use care not to erode the wood around the inlay creating a stone 'dome'.

5. Occasionally a small piece of inlay will tear out during the sanding leaving a void. If it's small enough just refill with gap-filling superglue, other wise add a little mineral dust and use super-thin superglue. For these patches I use whatever grade of sandpaper I was up to when the tear-out occurred.

6. I polish the inlayed surface with a buffer and recheck for defects. The inlay will polish to a nearly perfect luster. Then apply your favorite finish and rebuff.

Replacing Bark Inclusions

Stone inlay can add spectacular effects to otherwise drab bark inclusions. Using stone that is laminar (naturally occurring in layers) I shape the stone with a file or sanding disc to fit the inclusion void. The void needs to be clear of rotten bark to provide a solid gluing surface. The stone is placed so the layers are parallel to the void surface to get a coral-like effect after sanding or at an angle to the surface to result in parallel lines of color.

Health Concerns

Like wood, sanding stone creates very fine dust. Use a dust collection system, and wear a well fitting mask. The fine dust coming off minerals adheres to the inside of dust collection bags. So give these bags a gentle shake after you've been working with stone to keep the filter pores open.

Do not use wet sanding to try to keep the dust down, at least not with calcite. Calcite can be etched with water and you can damage the surface or edge of the inlay if it stays wet very long.

Stone inlay requires the use of relatively large amounts of superglue. I used about 0.5 ounces in the platter project just described. Superglue fumes are very irritating to your eyes and respiratory system so keep the area very well ventilated.

Suppliers

I've purchased the minerals described here locally and on the internet. I've found that, for me, there is much higher quality and value to be found on-line. Currently I buy only from the following supplier: Great South Gems And Minerals at www.greatsouth.net or 1-888-933-Gems. I have no association with this company and receive no benefit from recommending them but I would appreciate you mentioning I referred you. You can spend $20-$30 total and get enough of these minerals to complete several projects.

I get silicon carbide sandpaper from SuperGrit, Klingspor, and Rossini Marble Supply. Supergrit is a good source for smaller quantity purchases: www.supergrit.com or 1-800-822-4003. Remember you only need silicon carbide to smooth the inlay initially so get 60 grit and use your regular aluminum oxide thereafter.

Good Turning.

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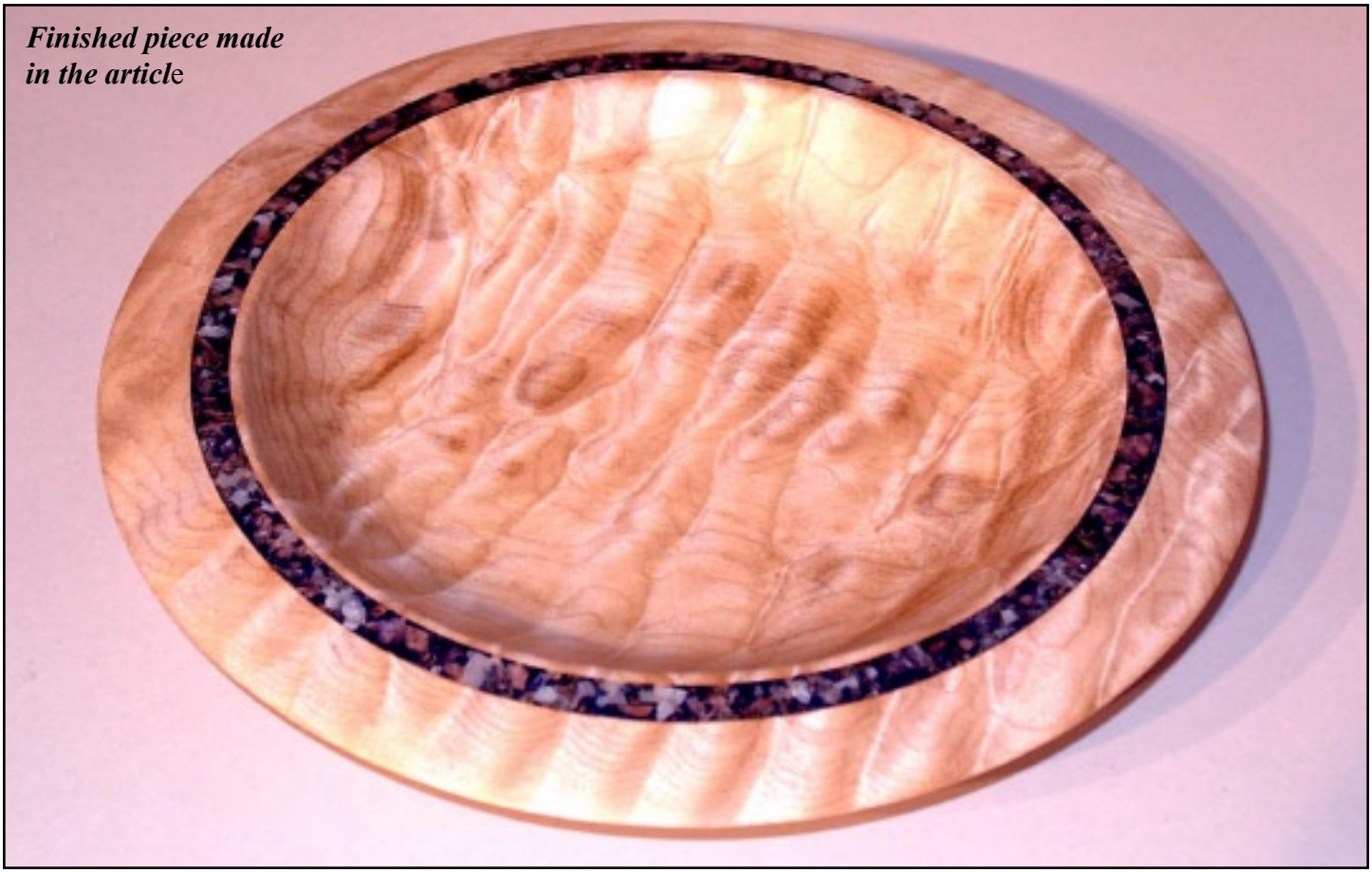

Finish the bottom as you prefer and apply any finish you like. This piece was finished with tung oil and caruba wax. The stone buffs to a high luster.

Addendum: Other Examples

Wetlands (No. 3) 16" diameter fiddleback maple inlaid with calcite, malachite, azurite, and black mica.

Autumn Breeze (No. 6) 16" diameter curly-figured-maple inlaid with calcite, dolomite, gold leaf, and black mica.