adafruit learning system

# Metal Inlay Capacitive Touch Buttons

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# Guide Contents

# Overview

The MIDI sequencer project in the video above requires some previous experience with woodworking, so I am going to break down some of the more interesting portions of the project into self contained guides.

This guide will focus on creating metal inlay using a fine metal powder that you can make at home. I have used this technique for years as a way to add a decorative inlay to turnings on a lathe, but the same technique can be used to create unique capacitive touch buttons. You can make the button as simple as a drilled circle, or create very intricate designs with a laser engraver.

First, we'll look at the small set of materials needed for this project.

# Required Materials

There's a small set of materials needed for creating metal inlay, and some of the tools are optional depending on your needs for your project.

## Creating Metal Powder

Here's a small set of tools that are required if you choose to create the metal powder yourself.

- Aluminum Foil (http://adafru.it/el9)
- Cheap Coffee Grinder (http://adafru.it/ela)
- Dust Mask (http://adafru.it/elb)

## Commercial Metal Powder

There are plenty of options for purchasing metal powder if you don't want to make the powder yourself. Buying the metal powder is a lot more expensive, but it's much less work.

- Premium Metal Inlay Powder (http://adafru.it/elc)

## CA Glue

There are a few choices for Cyanoacrylate (CA) glue, but the main thing you are looking for is the thinnest glue possible. Look for CA glue with the lowest centipoise (cP) value possible. The best I have found is in the 2-3 cP range.

- Starbond EM-02 Super Fast Thin CA Glue (http://adafru.it/eld) - Viscosity: 2-3 cP
- Hot Stuff Thin Instant CA Glue (http://adafru.it/ele) - Viscosity: 3 cP
- CA Glue Pipets (http://adafru.it/elf)

## Woodworking Tools

There are a few tools that are needed if you are following this tutorial step by step, but you can also accomplish the same thing using other methods if you are inlaying the metal into plastic or some other material.

- 1/2" Forstner Drill Bit (http://adafru.it/elg)
- 1/16" Drill Bit (http://adafru.it/elh)
- Power Hand Drill
- Card Scraper (http://adafru.it/eli) or Sandpaper

# Grinding Metal Powder

If you would like to make the metal powder yourself, the first thing you will need to do is find a flat service to work on outdoors or in a garage. The fine metal dust created during the process is very bad for your lungs, so you want to do this in a place where the least amount people will be exposed to the dust.

> Make sure to wear a dust mask during this process! Aluminum dust is very harmful to your lungs!

After you have a workspace cleared off, plug in your coffee grinder and set it on a sheet of paper. The piece of paper will allow you to easily collect the dust you create later.


Rip off a one foot section of the aluminum foil, and fill the cup of the coffee grinder with very small pieces of aluminum foil from the one foot section. You do not need to add the entire one foot section right now, so please be careful not to overfill the grinder.

Put the lid on the grinder and start grinding the aluminum foil. Shake the grinder a bit while grinding to make sure the foil doesn't get stuck below the blades. If you feel the grinder getting hot, stop for a few minutes to let it cool down.

Once you get the first batch of foil ground down to about the consistency of coffee, add another batch of small foil pieces to the mix. Repeat this process until the entire one foot section of foil is in

the coffee grinder.


The final bit of grinding will take about 10-15 minutes. Make sure to open the coffee grinder every few minutes to expose the aluminum to air. There is a chance you could cause the fine aluminum dust to ignite if you grind for 15 minutes straight.

> In finely divided powder or dust form, aluminum and its alloys are combustible in air and present a serious combustion explosion hazard. Make sure you work in a well ventilated area.

You should stop grinding once you get the foil ground to about the consistency of a fine crystal sugar. You could attempt to grind more, but there is a chance the CA glue will not be able to flow through the fine particles.

You can now dump out the powder on to the sheet of paper, and close the lid of the coffee grinder. Make sure to label the grinder so no one attempts to use the grinder for grinding coffee!

# Drilling the Button Holes

Next, we are going to drill two holes in wood for our button. You could also use a laser engraver or carve a design for this step, but drilling will work well for this example.

For this step, you will need a piece of wood, a power drill, a 1/2" forstner bit, and a 1/16" standard spiral drill bit. Secure the forstner bit into the chuck of your drill, and drill a 1/8" deep hole into your piece of wood. Be careful not to go past 1/8" deep while drilling because you will have to use more metal powder to fill the hole.

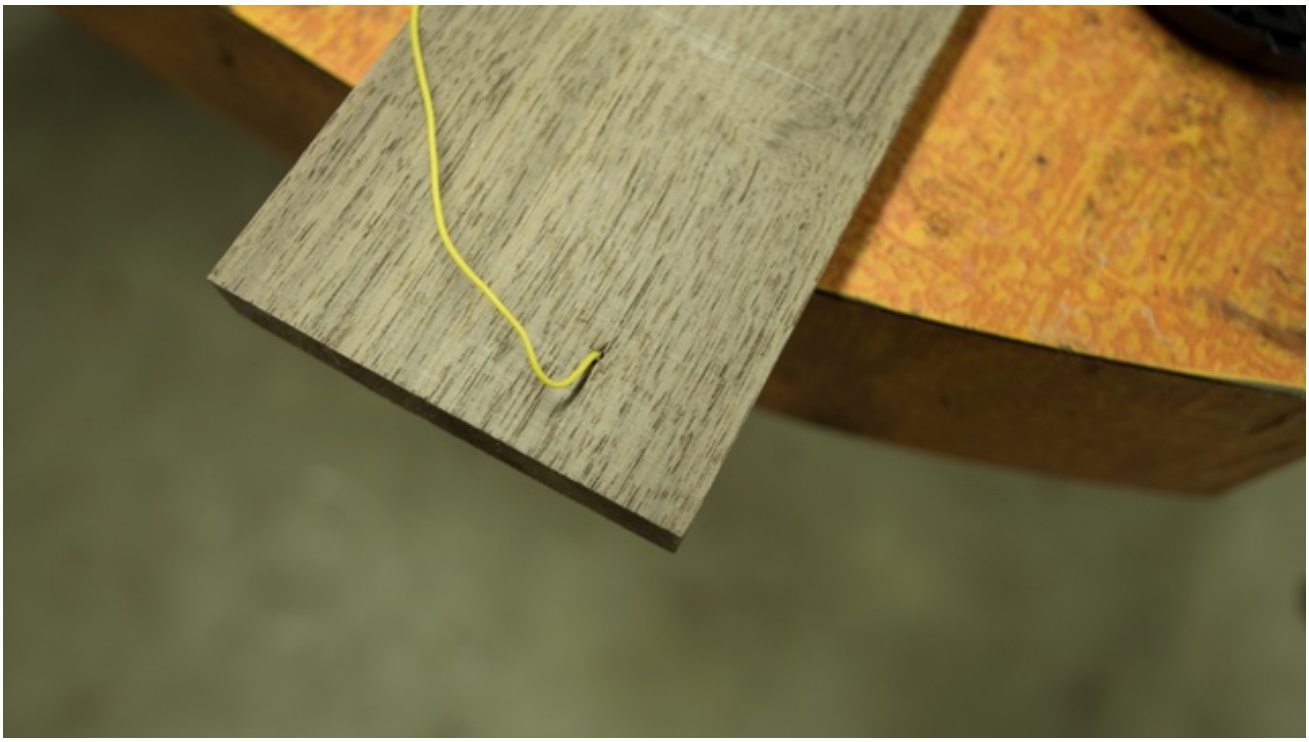
Once you have finished drilling with the forstner bit, remove it from the drill, and secure the 1/16" drill bit into the drill chuck. The forstner bit should have left a small impression in the center of the hole. Place your 1/16" drill bit in that impression and drill a hole through the piece of wood. This hole will be used for a wire that will be placed in the metal powder.

Now that you have both holes drilled, we are ready to add the wire and metal powder.

# Gluing the Powder

For this step, you will need your metal powder, the drilled piece of wood, your bottle of CA glue, a glue pipet, and a small length of 30AWG Silicone Cover Stranded-Core Wire (http://adafru.it/ekF). I have found that thicker gauges of wire do not work as well for this technique, and thicker wire will cause false touches to be read along the length of the wire instead of focused at the button.

Strip a small section of wire at one end, and place the non-stripped end through the 1/16" hole in your piece of wood.



Thread the wire through until the stripped portion lays flat on the bottom of the 1/8" deep hole that you made with the forstner bit.

Gluing the Wire in Place

Load your pipet about half full with CA glue, and add a small amount of metal powder to the bottom of the hole. Add enough to cover the wire, but don't fill the hole at this point. Use the pipet to place a few drops of CA glue on the powder. The powder will quickly soak up the drops of glue, and you should only add enough glue to evenly saturate the powder.

## Adding & Gluing the Powder

Now that the wire is glued into place, you can fill the hole with metal powder. Make sure the powder is packed down well, and that you add enough so that the pile of powder is slightly proud of the wood surface.

Starting from one end, start adding drops of CA glue to the powder. The CA glue will flow through the narrow spaces between the bits of metal in a process called capillary action (http://adafru.it/elj). If you ground the powder too fine, the CA glue will not be able to penetrate the powder, and it will sit on top of the powder. If this happens, you may need to grind a new batch of powder. Do not oversaturate the powder.

Let the glue dry overnight. It may feel dry to the touch, but it takes longer for the glue below the surface to dry. After the glue has dried, you will be ready to even out the surface of the button.

# Finishing the Surface

You can use a card scraper or sand paper to remove the excess powder from the surface of the wood. I prefer using a card scraper because it can quickly level the surface, and will provide a cleaner finish to the buttons. Sandpaper works fine, but the surface of the metal will not be as brilliant as a scraped surface. That being said, it is much more difficult to prepare & use a card scraper, so sanding is probably a safer choice if you have never used a card scraper.

There are plenty of resources available on line for preparing the edge of a card scraper and learning to use it, but that is out of the scope of this guide. Check out this video from Brian Boggs (http://adafru.it/eIk) if you would like to learn more.

Once the surface of the button has been leveled with the wood, you are done! If you would like, you can use a fine coat of your favorite wood finish to seal the wood. The finish will not interfere with the sensitivity of the buttons.

You can now refer to the MPR121 guide (http://adafru.it/eIl) to learn how to connect the button to your Arduino!

# Final Thoughts & Thanks

You can use this method to create more intricate designs with a laser engraver or by carving wood. You can also inlay metal into materials other than wood. The biggest thing to remember is that you don't want to use anything that's electrically conductive as your base material. Wet wood will not work well because of that, so make sure the wood you use is dry.

Below is an early test with inlaying brass powder into a carved version of the Adafruit logo. This method is a lot slower than using a laser engraver, but it might be a good option if you do not have access to a laser engraver.

The buttons on sequencer shown at the beginning of the guide was done with a laser engraver at the Baltimore Node hackerspace (http://adafru.it/eIm) with the help of Marty McGuire. Unfortunately the video I shot of that process was lost, but the results were great. Thanks, Marty!

We look forward to hearing any feedback you have about this guide, and please share any of your projects that use this technique. We'd love to see them!