Solar Storm Forge
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CuMai Process

To all of those that video their work, I can't give enough praise. The effort to stay in frame, keep the video rolling and then editing the video after is a task comparable to the actual forging.

I have been short on posts lately due a trip to the beaches of Jamaica where I am writing this from. This will be a multipart document as I document the process of making two matching CuMai Tantos.

This is how I make my CuMai steel. First a disclaimer. I am only an ABS apprentice smith, just starting my 3rd year, and mostly self taught. Through trial and error this is how I have been able to create my CuMai knives.

I start by making the Damascus for the outer layers. My target is 120-160 layers on each side. I will then use a 3/16" 1084 core with .4 - .6mm of copper depending on the desired thickness. This post will cover the creation of the Damascus.

For tools, I have use:

- 2x72 Velocity Grinder with a 2hp motor and a VFD
- 100 lb anvil, Hammers and tongs I made
- A ribbon burner forge (the first thing I built). It will hold a 20" billet, and reach about 2400 degrees with the ends blocked. I based my design off of Bonifab Custom's videos https://youtu.be/CYvM3gL-lME
- A 12T Rams Head press.
- I use a cheap Canadian Tire Mig welder for the billets. Really all that is required is to hold them together so a big fancy welder is not required. Disclaimer: When you see the welds, I am NOT a welder.
- 5" Angle Grinder to do all of my cutting.

I start with 4'x2" lengths of 1084 and 15n20 steel. I used to use 1.5" wide steel, but found if I do wider billets and make the larger damascus billets that I can use for multiple knives, i can limit the forge loss. Since most patterns start with a simple layer count, this is one step in efficiency. I can then cut it up and use the base for different projects.

I find that the Damascus looks better if I use thicker sections of 1084, the dark/black part of the Damascus, and thinner sections of 15n20, the shiny part of the Damascus. Although this can vary greatly depending the desired pattern.

For this build I am using 1084 at 3/16" and ⅛" and 15n20 at 3/32" and 1/16".

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I start off by marking the entire length of the steel with its type. I use a different colour for each steel as well just in case I cut a piece that doesn't have the whole number on it. Too many times I have cut stacks and then lost track of what stack is what type of steel because they all look the same when polished up. I did discover a trick though if you do loose track. Etch the edge of one of the pieces and compare it to a known piece. But for now I have learned to over mark everything.

I only have an angle grinder to do all my cutting with, so I clamp the steel together to create 5 ⅞" pieces allowing ⅛" for the cut. Getting maximum use of the 4' length of steel.

I clamp the 4 pieces of steel together to cut 4 pieces at a time. I am targeting 21 layers. I always put a thicker piece of 1084 on the outside layers because the outside layers are subject to greater forge loss. Plus when I cut and restack, they suffer the grinder loss as I clean up the pieces to restack. I use one of the pieces from the first cut as a size template for all of the other cuts to make sure I don't mess up the measuring.

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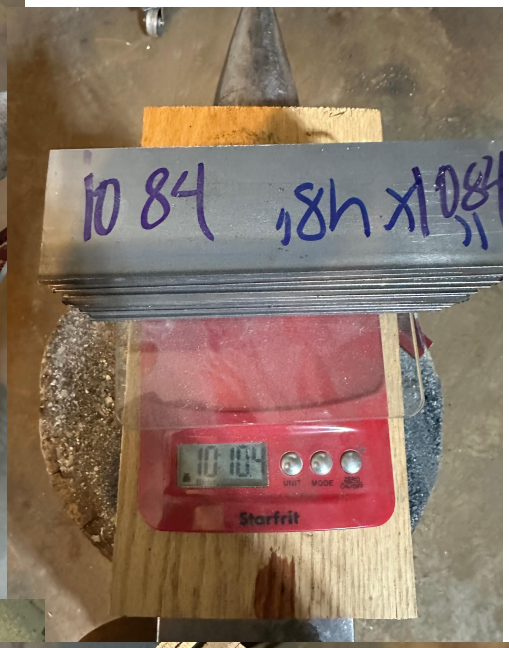

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After they are cut I take them over to the grinder with the large wheel I built. I bought the wheel from amazon. Bought a couple of bearings, and made an axel from a bolt, and the tool arm from the scrap bin at the metal scrap yard. All told I spent a little over $60 for my large wheel.

Before grinding them clean, I now mark the ends because I am about to loose the writing on the flat side as we clean up the mill scale. Again using the color coding for the two steel types.

I am going to start this billet of with approx 10lbs of steel targeting about 6-7 lbs of 120-160 layer random pattern Damascus. This is a stack of about 6” long x 2” wide x 3” tall

I start off with quick grind on a 36 grit shredder belt and the move up to a 100 grit. Not sure if the 100 is required, but I like to think the smoother surfaces help with the tack welds. I built a quick holder which is nothing more than a flat piece of mild with a “handle” and some magnets to hold the steel. If I ever get a milling machine I will mill grooves for the magnets, but for now this works with no issues.

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And after 36 Grit it looks like this.

Then on to the 100 Grit.

And once everything is cleaned up, we have lost about 3/32” from our original stack

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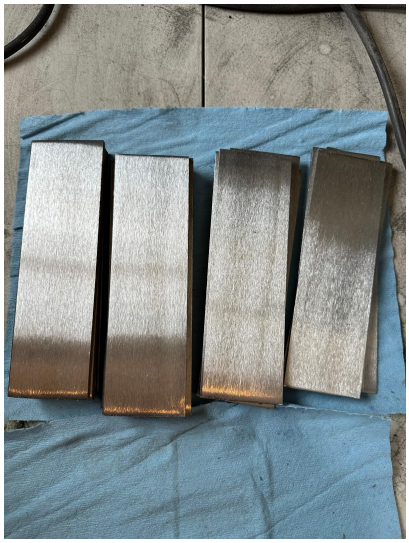
Next I want to remove all of the oil and other contaminants from the steel. I use acetone, but there many other things you could use. Just make sure they dont leave a residue.

I completely submerge the steel, then wipe them off. Making sure to keep track of the stacks at this point. I make a mark on the shop cloth with the appropriate color because the acetone will take off the edge color now.

Once everything is cleaned, it is time to shuffle the cards (stack the steel)



I used to use latex gloves when handling the steel to avoid finger oils from getting on the clean steel, but now I am just careful to only handle the edges once they are cleaned.

The blue ends are the 1084 and the red is the 15n20 steel for a total initial stack of 21 layers.

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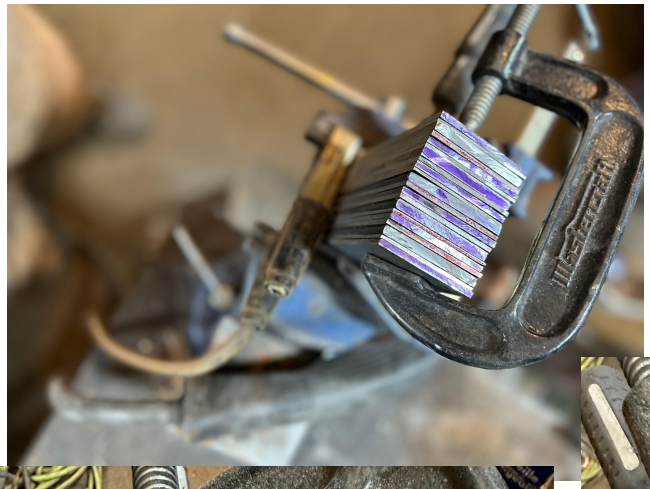
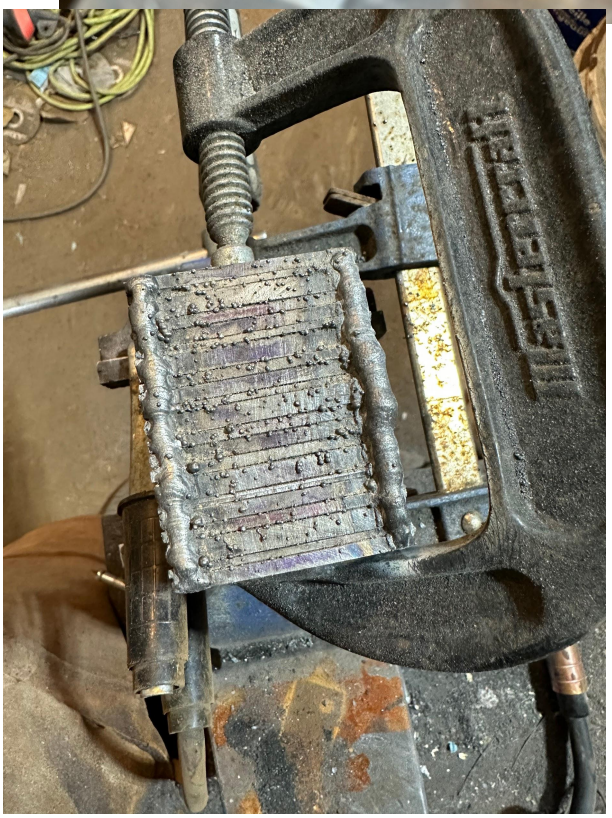


Next we need to tack weld the stack together. I weld the ends of the billet because those will get deformed and need to be cut off anyhow, so I wont contaminate the steel with the mig steel by welding on the ends. I add one bead to the middle to stop the layers from bowing as it heats up. I will grind that off once the the welds are set.



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Because I am a terrible welder and need a guide to weld in a straight line, I use an old scrap piece of steel show me what a straight line looks like then after the bead is down, remove the steel. I am welding ¼” away from the guide, not welding the guide to the billet.

Disclaimer, I am always embarrassed to show my welds in pictures…

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Because this is a heavy billet, I am going to attach two pieces of rebar instead of one so that when they get they white hot there will be more support. I cleanup the ends on about a 45 degree angle and this seems to give me better welds to the billet (but again, I am not a welder, your mileage may vary). I then tack the two pieces every 6” or so to give it a bit of rigidity.

Next step is to give it a good soak in some WD40. Others have used Kerosene, but I have WD40 on hand. I let it soak this bath for at least an hour. It’s a great time to go work on another project at this time.

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I put the billet in the forge at the same time I turn the forge on. My theory is that the billet will heat up slower and resist bowing the layers due to the greater temperature difference by placing it in a hot forge.

When I started forging, I bought flux from the supply shops. I have found no difference when using the $4 box of borax from the grocery store.

I pour a bit into my sprinkle bowl and put the box back on the shelf. I have had this box for over a year, and it looks like it will last at least 6 months more.

Your forge will be different, but for setting the initial tack welds, I run a propane rich flame. The gauge says 5lbs of pressure, however, that is not accurate because of the ribbon burner build. My gas runs to a hole drilled into a end cap. I cant remember the size, but I tried the .035 mig tip and it was way too small. All this to say, your gas settings will vary.

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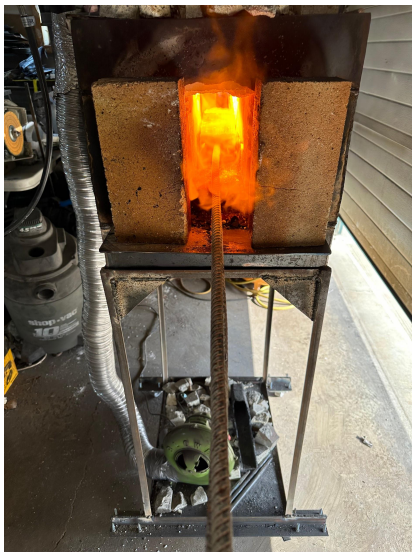
The next part is like watching water boil…

The Billet is heating up. I like to get it REALLY hot before I set the welds. I probably sprinkle with flux starting too early and then every 4-5 min with light sprinkles of flux remembering to do the ends of the billet as well



Nope, still not hot enough

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I use an infrared thermometer and measure the billet directly. I pull it out of the forge on the ledge so that I'm reading the temperature of the billet, not the forge.

Now we are ready to set the welds. Total time in the forge at this point is just about 45 min as the forge and billet came up to temp together.

I use the 12T press with flat dies, but barely kiss the billet on the first pass. Just enough that I can see the layers move together. I could probably do more, but here caution is king. Rushing this step has ruined more steel for me.

Note this billet has cooled quite a bit as the camera guy, me, grabbed his cameras to take the picture. When I first set the weld, the billet was white hot.

Once I have the welds set, more flux, and repeat 3 times. Then its time to get more aggressive on drawing

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out the billet with some rounding dies. I made the rounding dies from some RR track and rounded them a bit more.

I now have a solid billet of 21 layers. NIce even color all of the way through. If I have welds that did take I find you can see different colors in the layers.

Before we go too far, I need to grind off the mig weld in the middle of the billet as well as the ridges from the layers. The different layers of steel were ~2”. But not exact. So when I square up the billet, I dont want one of the wider layers folding over and creating a cold shut (piece where the steel did not weld)

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Now the billet is cleaned up, there are no delams and its back into the fire to draw it out.

To square up the billet and ensure a uniform size, I use kiss blocks. They stop the press from pressing at 2”. I am targeting a 2” by 18” by ¾” billet at the end of this stage so the kiss blocks are 1.5” with a .5” spacer on top.

And after repeated drawing and squaring, 18”x3/4”x2” of 21 layer steel.

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