Damascus steel or pattern welding is the process of forge welding together steels of different chemistries to create a pattern. Once the stack is welded together to create a bar or block or billet it can be etched to show the hidden pattern.

The different compositions etch at different rates showing grey, or black or silver lines. Black typically from high carbon steels such as O1 or W1 or W2. The gray often from mild steel and the silver line from 15N20 or nickel layer.

The acid attacks the high carbon low nickel first and the nickel or 15N20 slower since it has the resistive nickel in the layer, creating the silver lines.

**Acids**

Various acids can be used although the gold standard is ferric chloride. I have used nitric and sulfuric for harsh topographical etches.

**Acid safety should be used.**

Although ferric chloride is relatively mild acid when it comes to burns all acids should be treated with respect.

- Acid bath should be in container to catch spills
- Neutralizer bath or wash available for spills, baking soda on hand
- Add acid to water for diluting not other way around.
- Rubber gloves used
- Safety glasses/goggles as a minimum Glasses and face shield best.
- Do not breathe fumes, good ventilation
- Long pants and plastic/rubber apron in case of splashes
- Clean rinse water to clean any affected skin or eyes

The point with any acid is to not get it on your skin, in your eyes, or in your lungs!!!

The ferric chloride I use I got a few years ago from Neutron Electronics in Guelph, 519-836-9220. Call to see if they have any in stock. There are other places that sell it. Primarily used for etching printed circuit boards or copper etching.
Gloves, Safety glasses, tooth brush for scrubbing, baking soda for neutralizing, ferric chloride from Neutron.
You will find different recipes for the concentration of ferric chloride. 3 to 1 or 4 to 1 distilled water to ferric chloride seems to be about right. Remember add acid to water in acid proof container. I have etched in undiluted ferric chloride but it gives a harsh etch.

I use a 5 gallon pail that has a 3 inch ABS pipe with a cap glued on the bottom as the acid bath. This way any drips or small splashes end up draining into the 5 gallon pail. If the pipe leaked at any point the acid would also be caught by the pail.

**Preparation of the steel.**
The etching is one of the last steps before putting your handle on the blade. Unfortunately I did not have a blade prepared for etching so for this article I just used an available billet.

Grind and sand, harden and temper and final sanding to shape and size all done before etching. Sharpening I do after etching. The higher the grit you take your blade to the more contrast you will get with the silver shiny line and the O1 or high carbon steel background. I would recommend 400 to 800 grit for a nice strong contrast.

Next degrease the whole knife. Gloves are good here so you don’t leave any finger prints.
The billet I use in this demonstration has only been quickly sanded to 200 grit. Enough to show some contrast.

I place it clipped on to a hook in the ferric chloride bath.

There is a cross bar to hold the hook out from the sides. Slosh the knife around once in a while to allow fresh acid to attack the steel.

About 3 to 5 minutes in remove the piece and scrub with the tooth brush in the fresh water (pail in the back ground).

Check the etch. You should start to see some pattern. If it is a slow etch try another 5 or 10 minutes and scrub with the tooth brush.

After a little time in the acid bath a black sludge will form on the steel. This can be removed with the tooth brush or piece of 1500 grit wet/dry emery paper used very lightly. This will help to polish the 15N20
layer and if used lightly leaves the O1 a dark colour. You will have to repeat this several times until your desired depth and darkness of etch is achieved.

This is the pattern I got after about 15 minutes of etching. For me this is just a quick etch on the billet to see what pattern I am working with when I turn it into a knife.

Next step is to neutralize in fresh water with baking soda. At that point the steel is very clean and is susceptible to rusting quickly so needs to be coated with oil to prevent the rusting.

The 15N20 can be a bit of a challenge to get small quantities to try out the Damascus process. 15N20 is commonly used for large sawmill band saw blades. A friend of mine Desiree Cullum womenofmetal2003@gmail.com is selling heavy duty band saw blade plasma cut to size. I have tested the material she has and it behaves like 15N20. I will be using it in the future when my current supply runs out. Send her an email if you are interested in availability and pricing.

I would also encourage getting the book Damascus Steel Theory and Practice by Gunther Lobach ISBN 978-0-7643-4294-3

This is a very quick overview of the etching process. Many variations in techniques and recipes exist. Worth doing your research first but this may get you started.