

HARDENING YOUR HOMEMADE TURNING TOOLS

Robert Love sends along this information for all members. He's been making tools if he doesn't have them. You can buy tool steel at various outlets in Syracuse or online and then form your tools.

This can be complicated or simple. Complicated involves choosing a medium to high carbon steel and heating to form a metastable martensite and then reducing the fraction to provide the desired properties. Yeah, let's go simple.

SAFETY

This project involves torches and high temperatures. Have a fire extinguisher and work in a safe place to prevent a fire. A concrete pad or a metal table is a good choice. Your saw dust and shavings covered work bench is not a good choice. Use your head and avoid creating an unwanted fire and burns to yourself.

TOOLS NEEDED

A heating torch, Oil (at least a quart, more is better), Large Magnet, Grinder, Kitchen Oven (*shhh! Don't let your spouse know!*)

METAL SELECTION

Choosing a good tool steel is a necessity. You could order some exotic metal combination that has been cryogenically treated for A LOT of money, but why. An oil harden tool steel is cheap and easy to work. Abrasive Tool in Syracuse carries oil hardened tool steel and sells it by the foot! Abrasive Tool is located at 111 Leo Avenue. I was able to purchase a 3 foot piece 1/4" oil hardened drill rod for just a few dollars. From this 3 foot piece, 3-5 tools can easily be made.

Oil hardened tool steel is, well, "Hard". You cannot just cut it with a hacksaw. It needs to ground. To cut it to length, I use an angle grinder with an abrasive disc. I also use the same angle grinder to rough shape the cutting end to the desired profile.

CREATE YOUR TOOL

If you are making a swan neck or bent scraper for hollowing you need to bend the metal. If you are making a straight tool, then shape the cutting edge with a grinder. I use a hand held torch (like Bernzomatic-sold at the big box home improvement stores) to heat the metal for bending with MAPP gas (comes in a yellow cylinder). Mapp gas burns hotter than the propane that comes in the blue cylinder. To cool the metal, use oil. I prefer to use a cheap olive oil as it doesn't stink when heated up. You can also use vegetable oil or motor oil. But motor oil will smoke a lot, so use it outside! Create your desired cutting profile by rough grinding on your bench grinder or right angle grinder. Just get the basic shape, you will finish grinding after re-hardening.

HARDENING

After all the heating and grinding, the tool is not as hard as it started. To re-harden the steel, you will need your torch, oil and a large magnet. Slowly heat the cutting end and back at least one inch until the metal is cherry red. Touch the hot metal to the magnet. When the metal is hot enough, it will no longer be magnetic. Keep heating and testing for loss magnetism. Use a large magnet that will easily be left behind when pulling the tool away. If you use a small magnet and metal is not hot enough, the magnet will stick to it and now you have a very hot piece of steel with a magnet stuck to it that needs to be removed! Not fun!

When no longer magnetic, quickly plunge the rod into the oil and swirl and swirl it around until it is cool. The swirling allows the tool to come in contact with the cooler oil and cool it down faster. The metal is now hard again (probably harder than when purchased). You can test the hardness by trying to file the surface. A properly hardened surface will not be cut by file. The file will skate across the surface. If the surface is cut by the file, re-

Steel can be treated by intense heat to give it different properties of hardness and softness.

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harden the tool. Either you did not get it hot enough or did not quench it in the oil quick enough or have enough oil to cool the tool quickly. The surface will now be covered in black scale and ugly. Sand and polish off the black scale surface until clean and shiny again.

ANNEALING

Now the metal is hard, but it is brittle. Dropping it on a concrete floor or a good catch while turning could break the tool! The metal needs to be annealed which makes the metal not as hard and restores some flexibility. The easiest way to anneal the metal involves your kitchen oven. I suggest you anneal several tools at once to conserve energy. Place the tool in the oven on the center rack and heat the oven to 450-500 degrees and bake the tools for one hour. Turn off the heat and let everything cool down naturally. You should see a slight blue to blue gray color on the tool.

[Editor’s note: A toaster oven retired from the kitchen to the shop can also be used for annealing!]

Sharpen the tool on your grinder and make a handle for it. Then put it to use.

You can make larger hollowing tools using the same methods. Just use larger drill rods and a bigger torch. An oxy-acetylene torch is ideal for this, but not cheap to purchase for just a few tools. Instead, you could use a charcoal fire like the brawny black smith of days of old or get some fire bricks and stack them to form a closed in tunnel. This will help to hold the heat in and allow you heat larger pieces of metal. A vise comes in handy to help bend the steel to shape.

You can also make a triangular point tool, a straight hollowing tool, round skew, a bedan (but you’ll need square or rectangular metal). No bending needed for these tools. But I would still harden and anneal these tools to get a better cutting edge.

Your homemade tool may not be as hard as some of the expensive name brand tools and may not last as long. But just for a few dollars each, you can make many tools for the cost of 1 purchased tool. If you have a special need tool to reach that hard spot, try making your own tool. There is a lot of satisfaction from creating and using you own tools. Have fun and be safe and keep on turning.

Tool Steel Color vs. Temperature

2000°F	Bright yellow	1093°C
1900°F	Dark yellow	1038°C
1800°F	Orange yellow	982°C
1700°F	Orange	927°C
1600°F	Orange red	871°C
1500°F	Bright red	816°C
1400°F	Red	760°C
1300°F	Medium red	704°C
1200°F	Dull red	649°C
1100°F	Slight red	593°C
1000°F	Very slight red, mostly grey	538°C
0800°F	Dark grey	427°C
0575°F	Blue	302°C
0540°F	Dark Purple	282°C
0520°F	Purple	271°C
0500°F	Brown/Purple	260°C
0480°F	Brown	249°C
0465°F	Dark Straw	241°C
0445°F	Light Straw	229°C
0390°F	Faint Straw	199°C