DIY Welding Rod

Written By: Hackett

TOOLS:

- Digital pocket scale (1)
- Hot plate (1)
- Pliers (1)
- Safety glasses (1)
- Tempered glass cooking vessel (1)
- Toaster oven (1)
- scrap metal round stock (1)
  or mortar & pestle

PARTS:

- Silica gel packets (1)
  collect them from shoeboxes, etc.
- 100% lye (1)
  sold as a drain cleaner
- 2' metal wire or coat hanger (1)
- Newspaper (1)
- Plastic Cup (3)
- Nitrile or latex gloves (1)
- plastic stir sticks (1)
  or wooden

SUMMARY

There are a bunch of DIY welder articles and how-tos out in the maker ether, ranging from the super-simple, dumb, and brutally effective (three car batteries, wired in series) to the high-tech and fancy (TIG machines from microwave bits, oxy-hydrogen torches from split water and plumbing supplies). With all of the information out there, it is safe to say that experienced makers will be expertly fusing metal even if an oddly specific, exceptionally brutal catastrophe were to strike the welding industry. If civilization and supply chains collapse the anti-zombie fences will still get built, and the Thunderdome will be sturdy and made from steel.

However, all of the DIY welders I have seen assume you have access to welding rod. For

the less weld-informed (see what I did there?) a good, solid weld involves more than melting and fusing metals -- the weld zone needs to be free of oxygen, otherwise the normal oxidation of metals that leads to rust, patinas, and discoloration happens at a dizzyingly rapid rate, accelerated, as are many chemical reactions, by the high heat. This is not just an aesthetic issue -- the oxidation happens inside the weld, so instead of a solid metal bond you get a brittle foam filling. Removing the oxygen is usually achieved by flooding the weld area with inert gas -- regulated, pressurized gas from a separate tank in the case of MIG and TIG welding, gas created from vaporizing flux in oxy-fuel, stick and flux-core welding. The standard, coated arc-welding rod is the common currency of welding, used to hold the world together. They are ubiquitous. You can get them everywhere. Until you can't.

Even the finest DIY welder is useless without welding rod. I did a bunch of research, Google-ing and drilling down through increasingly sketchy forums, ranging from the mainstream DIY to the super-sketchy survivalist fringe. Tons of interesting information on every imaginable topic, but, as far as I can tell, it seems like no one has ever made their own welding rod and documented it online. A minor, but potentially crucial gap in the DIY world, solved here.

My first step, as is often the case, was to look up patents. Patents lay out the crucial core of a technology, the bits that make that particular invention unique, new, patentable. Often, the process involved in the making of the thing is laid out as well, protecting the inventor's rights to the means, as well as the ends. This keeps patent attorneys employed, and provides a nice step-by-step for MAKE writers to rip off.

After a little searching I dug up the patent "Electrode for Arc Welding," filed by Reuben Stanley Smith, a resident of Milwaukee, Wisconsin in 1918. (Mr. Smith was a prolific inventor, churning out 45 patents for pumps, manufacturing processes, and welding equipment. Some more info on him can be found here.)

Basically, a steel rod is wrapped in cellulose (paper) soaked in sodium silicate. The wrapping is crimped to maintain close contact with the rod. The electrodes are then dried out (I used a toaster oven -- a rod oven, or some time in the sun should do the trick as well.)

The rod is the electrode and filler, the paper/sodium-silicate wrapper spews out shielding gas upon combustion, and provides a path of plasma to guide the arc. The rod does not deposit a protective ceramic slag like modern welding rods, but, as Mr. Smith states in the patent, "I have found, also, that the coating of slag produced by the use of known covered electrodes is not essential to the production of eminently satisfactory work." I tweaked the patent procedure a little to use commonly available materials, stuff one would reasonably find

around the house.

Step 1 — DIY Welding Rod

- Gather materials. You will need coat hangers to cut into welding rod, silica gel packets (usually labeled "Desiccant: Do Not Eat" and packaged with electronics, shoes, and other things that hate the damp.) and lye to make into sodium silicate, and some decently absorbent paper (I used newspaper).
- Tools: a hotplate to cook the lye and silica gel into sodium silicate, a glass container to heat it in (use glass or a non-reactive ceramic container -- no metal, or Bad Things might happen), a scale, a toaster oven to cook the finished rods (I suspect that hot sunlight or a rod oven would work as well), a pair of pliers, nitrile gloves for safety. Safety glasses would prob be a good idea. I needed a mortar and pestle to grind up the silica gel beads, but I do not have one, so I used a steel rod to roll out the beads.

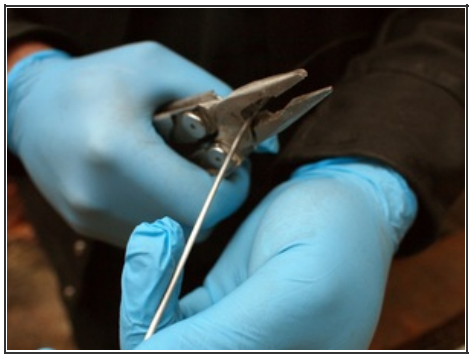
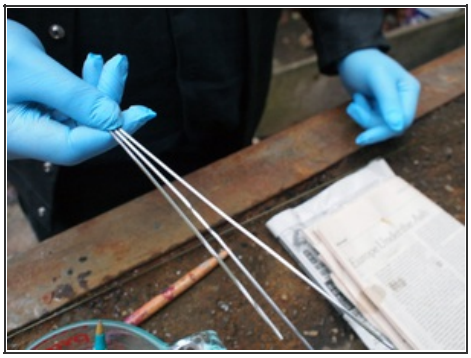
Step 2

- The first step is to make the sodium silicate (also known as "water glass," used for destroying engines and as an adhesive. If you have some lying around you can skip this step). Empty out the silica gel packs until you have a pile of beads about the size of a shrew or large walnut.

Step 3

- Get smashy with the silica gel beads. I tried to crush them by whacking them with the end of a steel rod, but they flew all over the place. Next step was to rig a paper cover over the "mortar," but that did not work very well.
- A tactic that kind of worked involved folding the beads into paper, then rolling the package with the rod. A real mortar and pestle would have worked better, but this was good enough.

Step 4

- Hangers are usually covered with paint or clear varnish to keep them from leaving your clothing wrinkle-free, but stained with rust. (This is actually totally conjecture on my part -- as far as I know, I have never used a hanger for the intended purpose.)
- Sand away the varnish or paint until you are left with a shiny rod of steel.

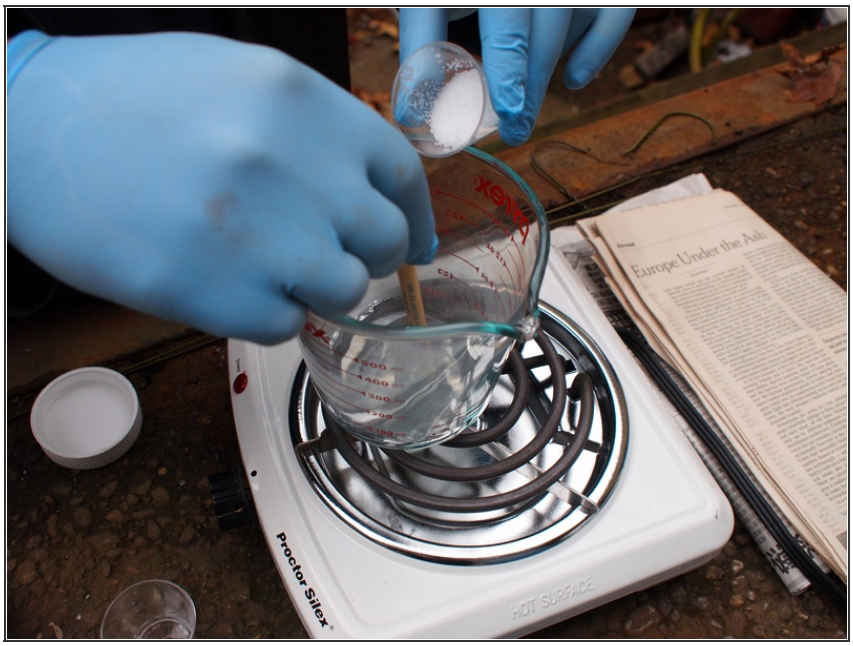
Step 5

- Time for some chemistry. Zero your scale.

Step 6


- Sodium silicate is made from water, silica gel, and sodium hydroxide (lye). The proportions (by weight) are six parts silica gel (crushed as best you can), four to eight parts lye (four will work, eight is stoichiometric, anywhere in between is fine) and ten parts water. Weigh out the parts individually.
- Wear gloves and goggles for this part. A little lye in the eye or in a cut on your hand will ruin your day.

Step 7



- Heat the water, then slowly add the lye while stirring. If you just dump the lye in you will get a solid, hard lump of a brutal base at the bottom of your heating vessel. The only way I found to remove it was neutralizing it with some decently strong hydrochloric acid. It totally looked like Science, but was an annoying waste of time.
- Heat and stir until you get a clear, but ominously thick solution. Be wary, but not too afraid -- it can smell your fear.

Step 8

- This next part can be tricky -- you need to add the silica gel powder to the lye/water solution, but just a little bit at a time. Take the solution off the heat when you add the powder, then return it to the heat while you stir. If you leave it on the heat too long it will boil over in an instant. If it gets too cool the silica gel will not go into solution, and clump at the bottom.
- The result will be a gummy gel. Sodium silicate!

Step 9

- Straighten the hanger, then cut pieces of welding-rod size: about a foot long will work.

Step 10



- Cut some paper a little shorter than your rod. It should be wide enough for eight to ten wraps around the steel.

Step 11


- Paint a layer of sodium silicate onto the paper. You want the paper to be as saturated as possible -- I found that painting both sides allowed the sodium silicate to soak in nicely and evenly.

Step 12


- Roll the saturated paper around the steel rod. Try to get it as consistently tight as possible. For me, this is far harder than one would think.
- Eight to ten layers of paper will do. Smooth the layers as they go, and smoosh the trailing edge into the rest of the wrap.
- Take a pliers and crimp the gooey paper tightly into the rod. Why? The patent states "The principle object of this is to secure uniformity in the density of the coating on all sides and thus prevent the coating from disintegrating faster on one side than another to such an extent as to destroy the crater. The creasing or scoring also tends to retard the transmission of heat and affords a means whereby the disintegrated portions may become detached, assuring the maintenance of a crater rim of uniform or regular contour." That's why.

Step 13



- Bake the rods. This drives out moisture, and also makes a carbonized shell that keeps the rods intact when stored. I let them cook at a low heat for about fifteen minutes. You want them to be totally dry and deliciously golden.

Step 14

- Ok -- ready to test. I guess for maximum punk rock DIY points I should have tested them using a car battery welder, but the arc welder was right there. You are more punk rock than me. You win.

Step 15

- I used the recommended settings for a 3/32 (ish) rod -- DCEP, around 100 amps.

Step 16



- Striking an arc took a couple of tries, but once I figured out the correct distance and angle it burned almost as well as an off-the-shelf rod. Tons of smoke, though, and the arc was not super-stable.

Step 17



- Totally welding with home-made electrode. Splattery and ugly (you can partially blame user error and a little bit of a learning curve) but definitely looks like a weld.

Step 18



- Notice the lack of ceramic slag -- just some ash.

Step 19



- Brushed it to see the glory of my weld. Looks OK, in parts. Again, you have to learn the rod.

Step 20



- Weld side is not pretty.
- Back side shows good penetration.
- Chopped the weld up for a closer look.

Step 21


- And success! No pitting, no craters, and total fusion of the metal. Welding, from home-rigged rods. Take that, zombies.

Photography by Becky Stern

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