

Message 70706 From: "Graham Stabler"
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Subject: ECM, The poor man's EDM??

I have always loved the idea of home EDM, the fact that on my small mill I might be able to machine an electrode that was later plunged into a block of metal so hard I could never dream of machining it really appeals. Especially as I have an interest in making moulds.

I now have a reasonable idea of what is required to build a small EDM machine that would be pulsed and hence quicker than the normal DIY units that plans etc can be bought for but now I not sure if to bother.

Enter ECM

Here is the basic idea:

If you put two electrodes in a salt solution such as NaCl(table salt) or NaNO₃ (part of some weedkillers) and then pass a current through the solution, the positive electrode is "de-plated" or dissolved. Not much use in machining but imagine you make the negative electrode out of some tubing and insulate the outside of the tube so that only the tip of the tube can conduct. As you bring the tip of this electrode towards the positive electrode (the workpiece) the current takes the easiest path and becomes more and more concentrated. When the electrode is very close the dissolution is very localized. To ensure that the material removed is flushed away you can then pump the electrolyte through the tube (at high pressure in industry).

What you now have is an ECM drill capable of machining hard materials with no forces (other than the pressure of the pumped salt water).

The other key thing is that for basic operation all that is required is a DC power supply. I decided to put the theory to the test last night and using my adjustable 24v power supply with a built in 1.5A current limit (essential for occasional short circuits) I managed to put a 1mm hole through 2mm of steel on my engineers square. All I did was to put some salty water in a plastic tub. Attach the positive crock clip to the square and the negative to one end of a piece of enameled copper wire. I do have some thin tube but no pump so I decided to try without. The enameled wire is obviously insulated apart from at the tip so seemed a simple solution. As soon as it was lowered into the salt water it started to bubble. When

brought towards the square the surface began to blacken over a reasonably large area (3mm dia) but if the tip was put close to the square and the power turned on the blackening would be more localized. Using the noise of the bubbles produced as feedback I managed to get the tip very close to the square and the rate of material removal was pretty high. I was holding the wire almost freehand so it was tricky and I shorted it a few times but it had made a noticeable crater in a few minutes. The hole took about 30min but I removed more material than required and started a few other holes by accident (remember free hand and the bubbles make it hard to see)

The first modification to the test rig will be a micrometer stage to hold the electrode and an ammeter. Plus I will try to find a pump capable of pumping through small diameter tubing (any suggestions appreciated !).

After than CNC on the Z should be straight forwardish (need to control the gap and prevent shorts). Not only can you drill as I did but also sink to make moulds and even wire cut to a certain extent.

Another even more interesting idea is the use of a hemispherical electrode under 3-axis control, the lack of electrode wear (as per EDM) means you can effectively do 3 axis "milling" in hard materials.

Drilling long holes (stem drilling) is another application where they seem to use glass capillary tube with a thin wire down it as the electrode.

Bottom line is, Friday I found out ECM existed, Sunday I found this website:

<http://www.unl.edu/nmrc/ECMoutline.htm>

And the same day I did my first bit of ECM machining.

El-cheapo and safe tap remover anyone?

Cheers,

Graham Stabler Nottingham England