

Carbon foil floating cookbook

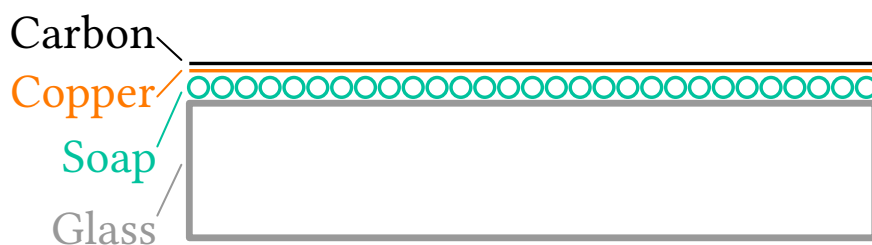
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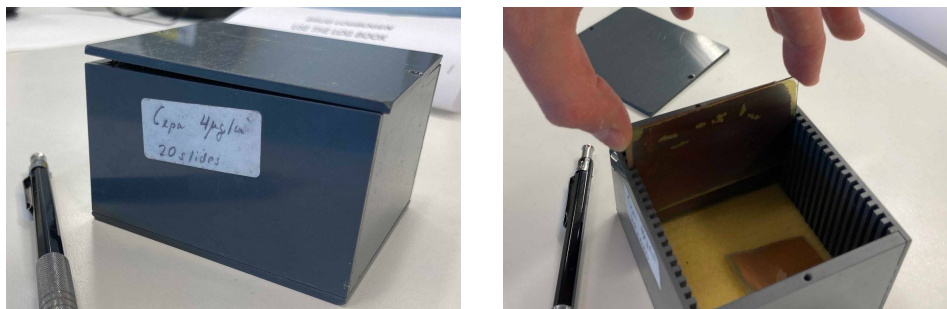
This picture guide details how to attach thin (of order 1-100 nm) carbon foils onto small circular target holders.



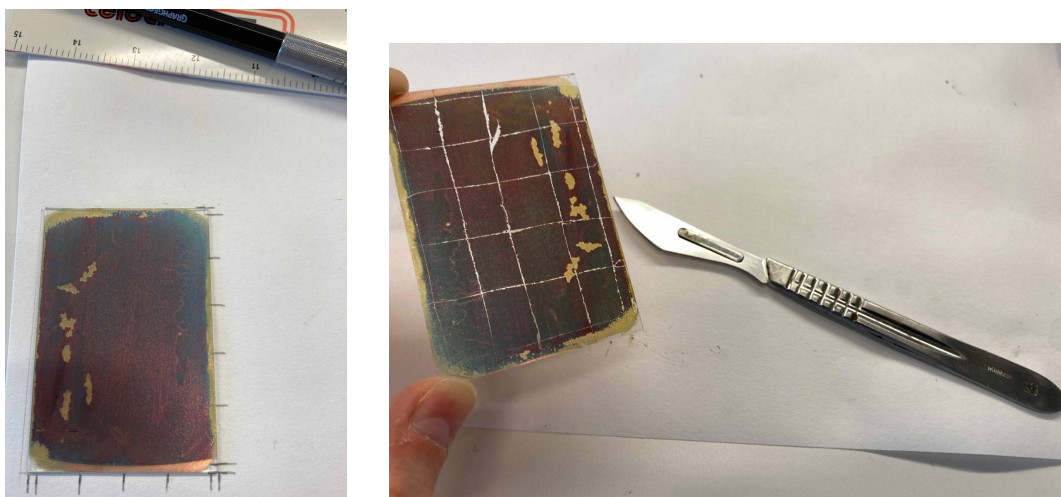
The process mostly consists of detaching a thin sheet of carbon from a glass slide. The sheet of carbon (which can, in principle, yield 20 carbon foils) is stretched across a thin layer of copper, which in turn sticks to the glass slide through a thin layer of soap; this is schematically depicted below.



Step 1) Procure a carbon sheet slide, avoiding contact with the face of the slide.



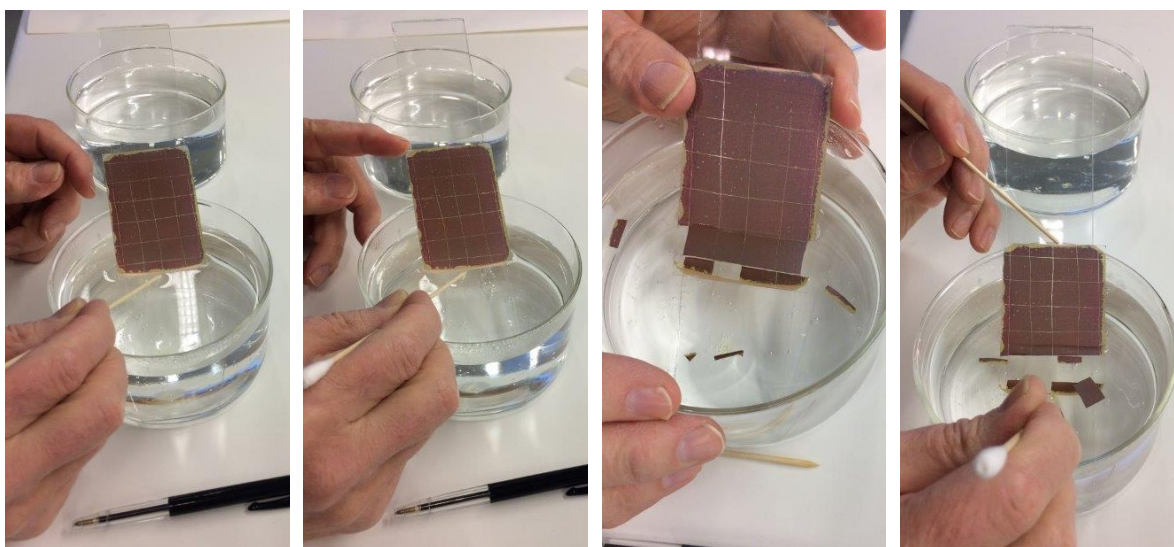
Step 2) Cut straight lines across the carbon side of the slide. Drawing some marks on a piece of paper for reference might be helpful. Each square/rectangular section of the sheet can potentially become a carbon foil. The layer of soap should now be exposed along all of the cuts.



Step 3) Half-fill a medium-sized crystallising dish with demineralised water, and heat it until it starts giving off steam; the process cannot continue if the water outright boils.



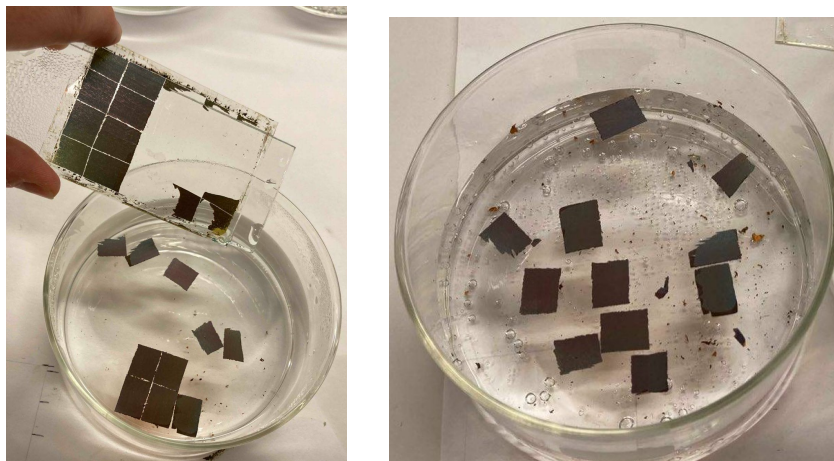
Step 4) *Note: This is the most critical and arduous part of the process – be careful and have patience.* Place a long rectangular glass slide at approximately 45° into the warm demineralised water and position the carbon sheet slide on top of it with the carbon side facing up. Then slowly, steadily and carefully submerge the carbon slide into the demineralised water. The water is to make contact with the layer of soap without spilling on top of the sheet of carbon, such that the soap dissolves and the sheet of carbon floats on top of the water, staying completely dry on top. Using a couple of cotton swabs to guide the carbon slide is highly recommended; use a scalpel to make the wooden end of one of the swabs pointy. Having some tissues handy is also recommended.



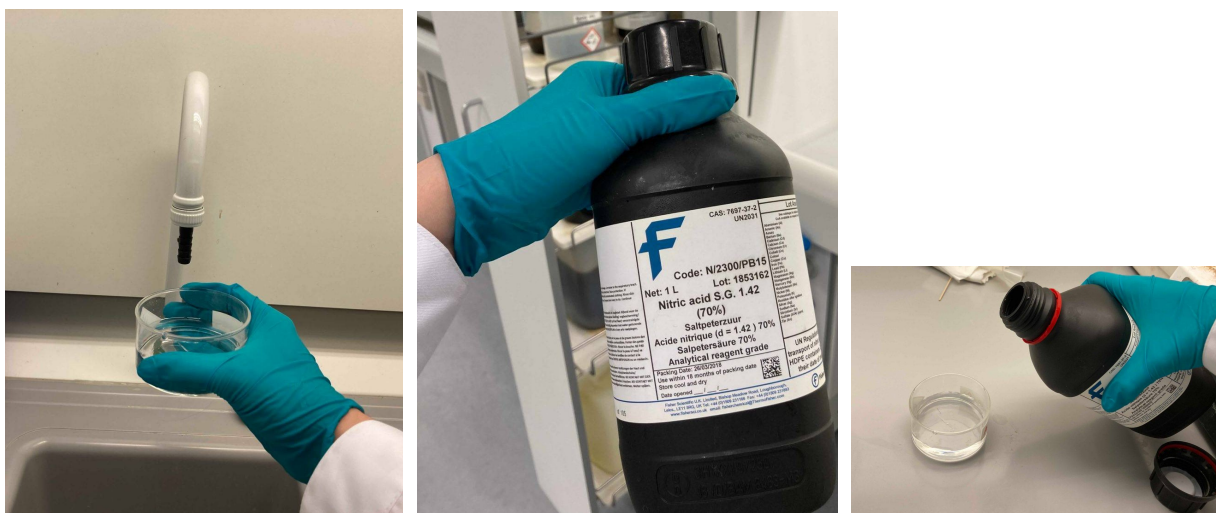
Tips for step 4:

- At the very beginning of contact between carbon slide and water, if the carbon sheet does not seem to loosen, the layer of soap may not have been exposed properly. Carefully remove the carbon slide from the dish and make a new cut right next to the cut which does not loosen – the scalpel and the area the scalpel makes contact with must be dry.
- If some water does get on top of the carbon sheet, carefully pull the slide out of the water and carefully blow on it – the water being warm speeds up the evaporation.
- If too much water gets on top of a carbon foil segment, do not fret. Try your best to ensure that the next foil segment in line will float on top instead, destroying the wet carbon foil segment if you have to.

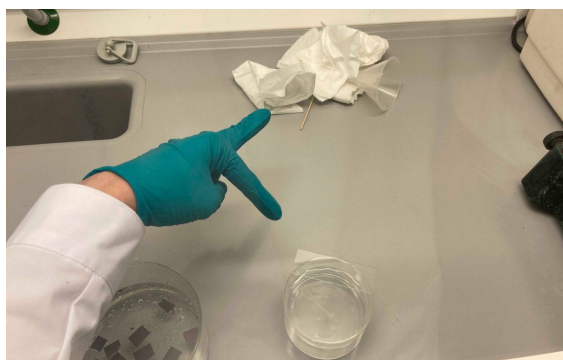
Step 5) In order to separate the carbon foil segments from each other, once they float on top of the water, one can squirt a drop of ethanol on the tip of the wooden end of a cotton swab and carefully stick it into the cuts between the segments; this will push the segments away from each other. The four segments sticking together in the first of the following two pictures were separated in this way.



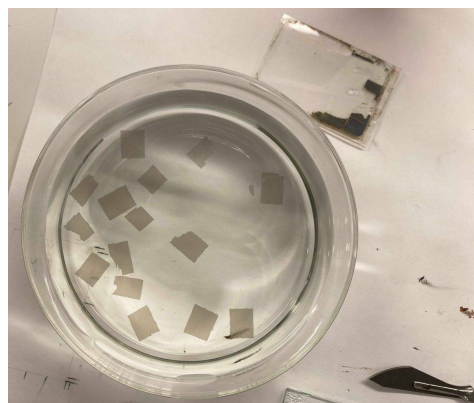
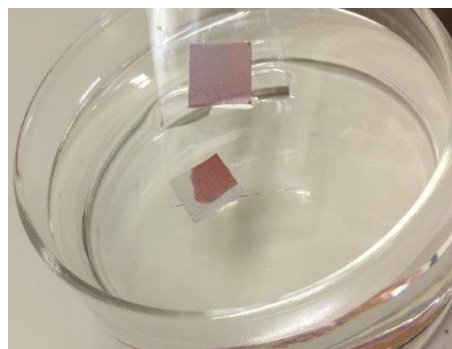
Step 6) Fill a small crystallising dish with 1/3 demineralised water and 1/3 nitric acid, such that the water to nitric acid ratio is roughly 1:1. **Note: The acid must be poured into the water; not the other way around. All of this takes place inside the fume hood.**



Step 7) Procure a microscope slide and rinse it in isopropanol. Leave the tissue used for this inside the hood.



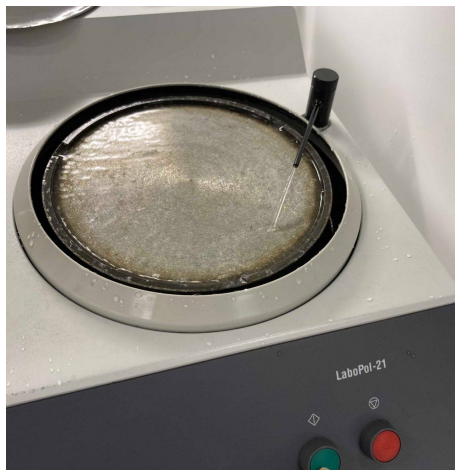
Step 8) With the hood lowered, leaving enough room to let your arms reach inside the hood, scoop up one or a couple of foils at a time from the water dish using the microscope slide and float them on top of the acidic solution, thus dissolving the layer of copper. Then transfer the foils into a large crystallising dish half-filled with demineralised water. Note: It is possible to adjust the height of the table of the fume hood via a panel on the outside.



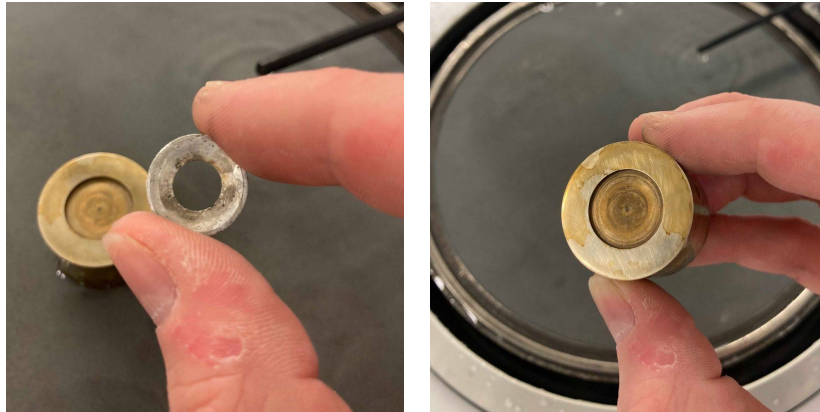
Step 9) Inside the hood, pour the nitric acid solution into an appropriate acid waste container. If there is no container for nitric acid, a container for sulfuric acid will do.



Step 10) Pour some water onto the plate of a polishing machine, give it a quick spin and then place a sheet of silicon carbide paper on the plate followed by a gasket, securing the paper. Add more water.



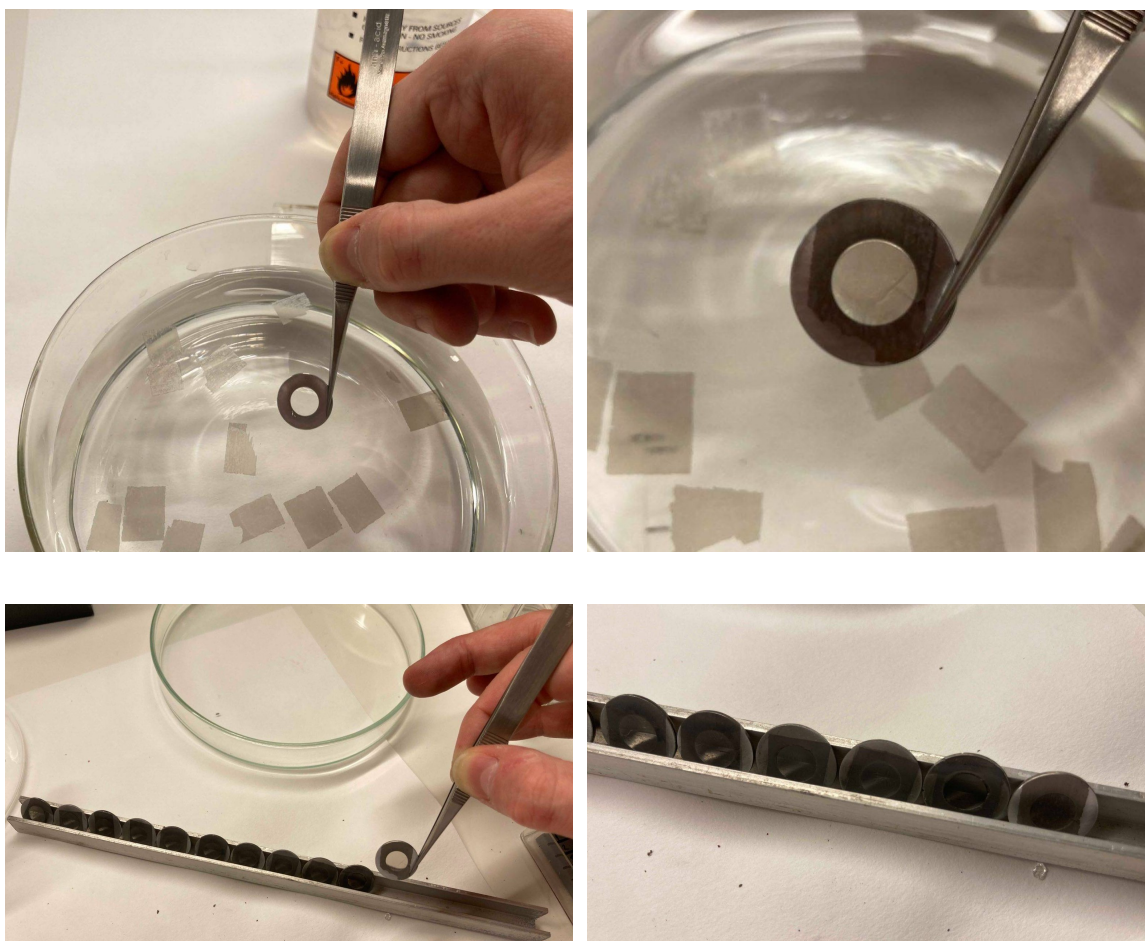
Step 11) Procure a target frame, made of aluminium, and a target frame holder and place the target frame in the holder with the flat side facing up. Flip the holder around and grind the surface of the frame and the holder, pushing gently down on the paper and drawing “8”s with your hand. The flat surface of the target frame should neither be ground too much nor too little.



Step 12) Rinse the target frame in demineralised water.



Step 13) Hold the target frame with a set of tweezers as shown. Submerge the target frame into the dish with floating carbon foils and carefully scoop up one of the carbon foils, centering the foil on the frame and stretching the foil across the frame. Keep holding the tweezers as shown and transfer the target frame with carbon foil to a stand in which it can dry. There will be droplets of water on the foil and frame, and these droplets can break the foil with their weight, so it is very important that the frame is never tilted after it leaves the dish.



Step 14) Repeat steps 11-13 until there are no more carbon foils to float.