



CopperFace

Technical Note 01-15

August 3, 2015

COPPERFACE – A SIGNIFICANT CASE

One customer, to check if the CopperFace kit could be used for his work, has presented us a piece to be galvanize.

Even if apparently the piece that we want galvanize seems very simple, there are some aspects that make difficult its treatment.



We analyze in detail the piece:

- Its dimension is only 28 x 11 x 23 mm, therefore enough small.
- The upper part has shallow grooves, which must remain marked.
- The piece is made of wax, so it is very fragile and delicate.
- Since the piece is part of an assembly, the size could not to deviate too much from the original.
- The groove in the rear must squeeze into a guide and therefore also it has to maintain the initial size.
- Of course, the piece, being visible, cannot show signs in the point of contact with the cathode.

For the reasons just mentioned, it was thought to make conductive the surface using only the silver-based spray, without first creating the base with the spray of graphite, this for not having a too thick layer that may cover the upper slots, also losing resolution, besides the fact that it could decrease the size of the groove in the rear.

Note that the choice of using only the silver-based spray is also due to the fact that with the spray of graphite, since it has a resistance per cm of about 150-200 ohms, the copper plating starts from the point of contact of the cathode to expand up to the periphery with the consequence that the thickness of deposit is not very homogeneous. Instead, the silver-based spray has resistance almost nothing, consequently the copper plating starts in a homogeneous manner, over the entire surface, thus managing to obtain a constant and controlled thickness.

Since the object was realized with wax, therefore it is very fragile, it is very likely to break the object during the positioning of cathode and since the point of contact must not be visible after the metallization, it was discarded the eventual choice of attacking the cathode through the hole present in the object, because in this way it would do certainly an evident sign. It is also thought to use our cathode with clamp for external, but also this one, for the fact that it might leave marks on the surface, has been discarded.

The only alternative would have been to use the cathode with clamp for internal, but unfortunately the groove is too narrow and therefore the clamp does not enter.

Therefore it was adopted the solution to modify the clamp, reducing it in size, so that this can easily be positioned inside the groove without leaving marks on the surface.

The first step was to prepare the two contact surfaces inside the groove, spraying three light layers of silver-based spray.



Once it was prepared the lower surface, it has been necessary to adjust the clamp of the cathode, using a small cutter, to cut the stainless steel foil, until to adapt the clamp to the aim.



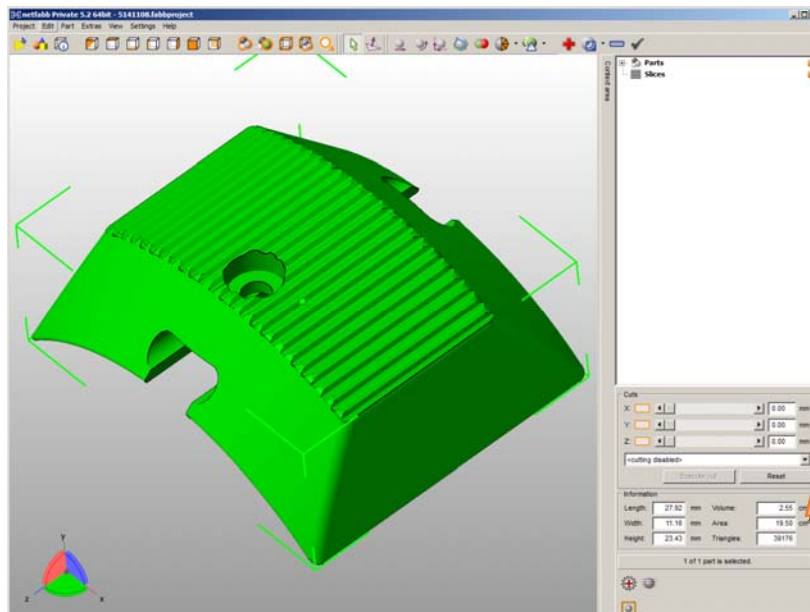
The second step was the preparation of the upper surface, also in this case with three light layers of silver-based spray.



The third phase, that is perhaps the most important, it has been to put the clamp of the cathode in the object, and to check, using a multimeter, the electrical continuity, to test the perfect electrical contact.



To find the correct value of the galvanic current to be used, the STL file is loaded into Netfabb program, where we can read (bottom right) the size of the surface (area) 19.5 cm^2 .



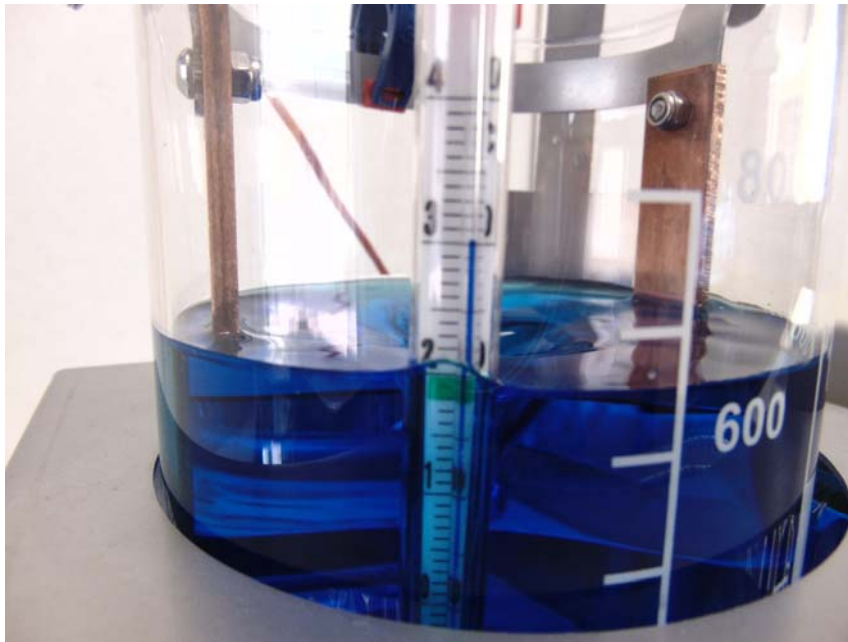
Then the value obtained was insert into the Excel sheet included in the CD supplied with the CopperFace kit.

Galvanic current				
Nominal current	A dm ²	A dm ²	A dm ²	A dm ²
	1	1.5	2	2.5
Workpiece size	cm ²	cm ²	cm ²	cm ²
	19.5	19.5	19.5	19.5
Current required < 100 cm ²	0.29	0.44	0.59	0.73
Current required > 100 cm ²	0.20	0.29	0.39	0.49

Since we know that the growth of copper with our galvanic bath is about 1 micron every 2 minutes and we want to create a layer of about 30µm, the required immersion time will be about 1 hour.

For obtain the best surface quality, it should reach the right current in two steps, so we will begin with 0,3A for the first 30 minutes, then we will increase up to 0.4A for the remaining time (we can see these values in the first two columns to the left, in the first yellow row).

Now we have to solve the last problem, which is related to the temperature of the bath, because in our lab these days we have more than 30 degrees of temperature, and we know that the bath should have a temperature of about 23-24 degrees, we must cool the bath.



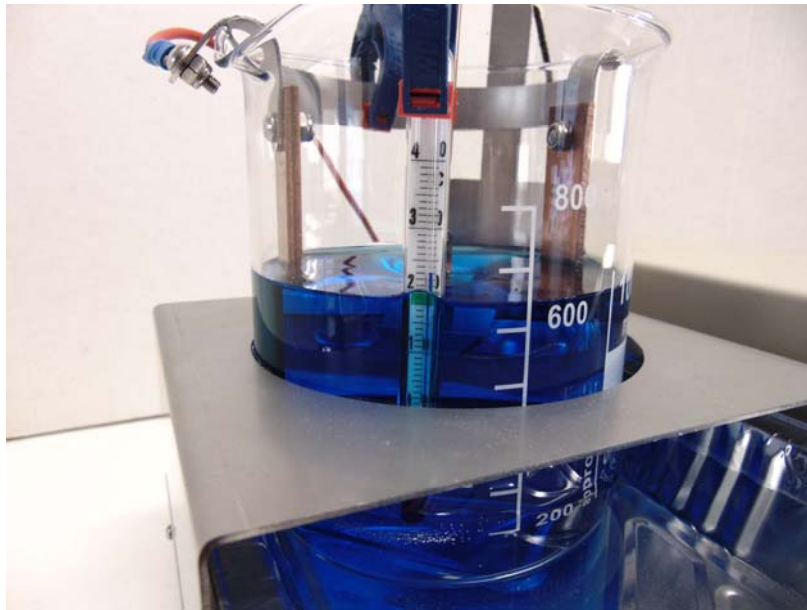
The solution has been to take an aluminum pan, one of those normally used for cooking food



and insert it in magnetic stirrer through the support of the glass.

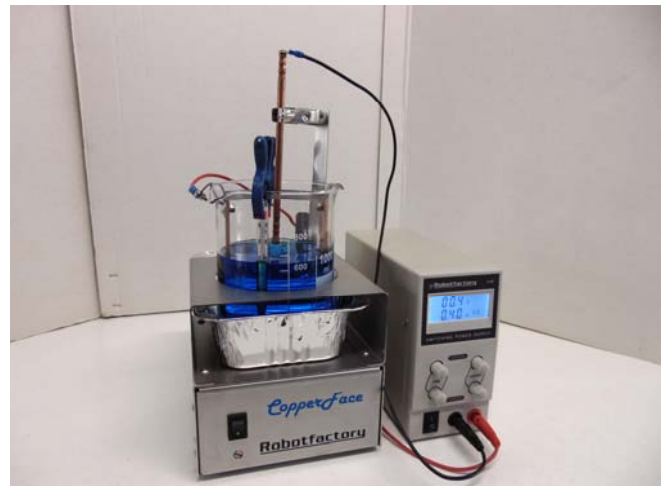
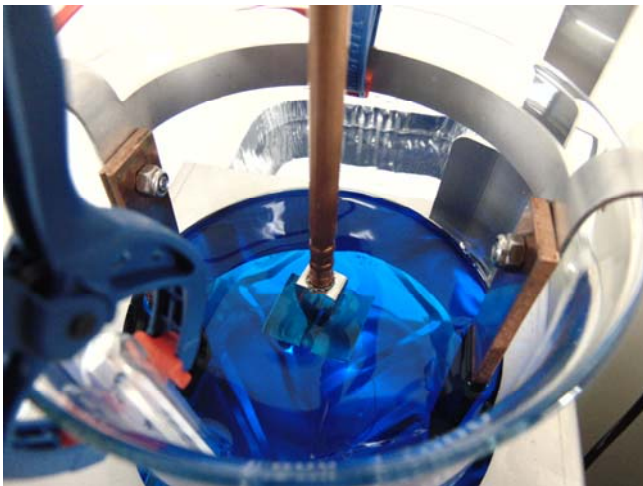
The aluminum pan has been filled with water and ice until to lower the temperature to the desired value of 24 degrees.

To facilitate the process, it was started up the magnetic stirrer, so that in galvanic bath, in moving, the heat was faster dissipated.



Once reached temperature of 24 degrees, it was possible to start the galvanic deposition by immersing the piece into the galvanic bath.

The details of the process are given in chapter 11 (Working Procedure) on manual '**Instructions for installation, use and maintenance**', of CopperFace kit.



Of course, to prevent formation of small bubbles on the surface, once the piece was immersed in the bath, it was stirred several times (by hand).

After about 1 hours of work, when the desired thickness was reached, we removed the piece from the bath and we proceeded to wash it in plenty of running water.

This is the achieved result:

**Final remarks:**

As it is evident from the case described above, the technique of electroplating, even if with CopperFace Kit is easy to use, in any case it can not be taken lightly.

Before beginning it is always necessary to study the piece and make an assessment on what is the optimal way to proceed.

With simple technical evaluations and a bit of experience, we can achieve excellent results, as we seen.

Also remember that, to achieve a good result, the maximum size of the pieces that can be galvanized, using the standard anodes (supplied with the kit), is $35 \div 40 \text{ cm}^2$, instead, using double anodes (available on request), the maximum size is $75 \div 80 \text{ cm}^2$.



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