

ANODIZING

Small scale anodizing
In the home shop

What is it?

The process itself is chemically complicated
But is extremely simple in actual practice

Most anodizing is more art form than science.
Industry methods are closely guarded

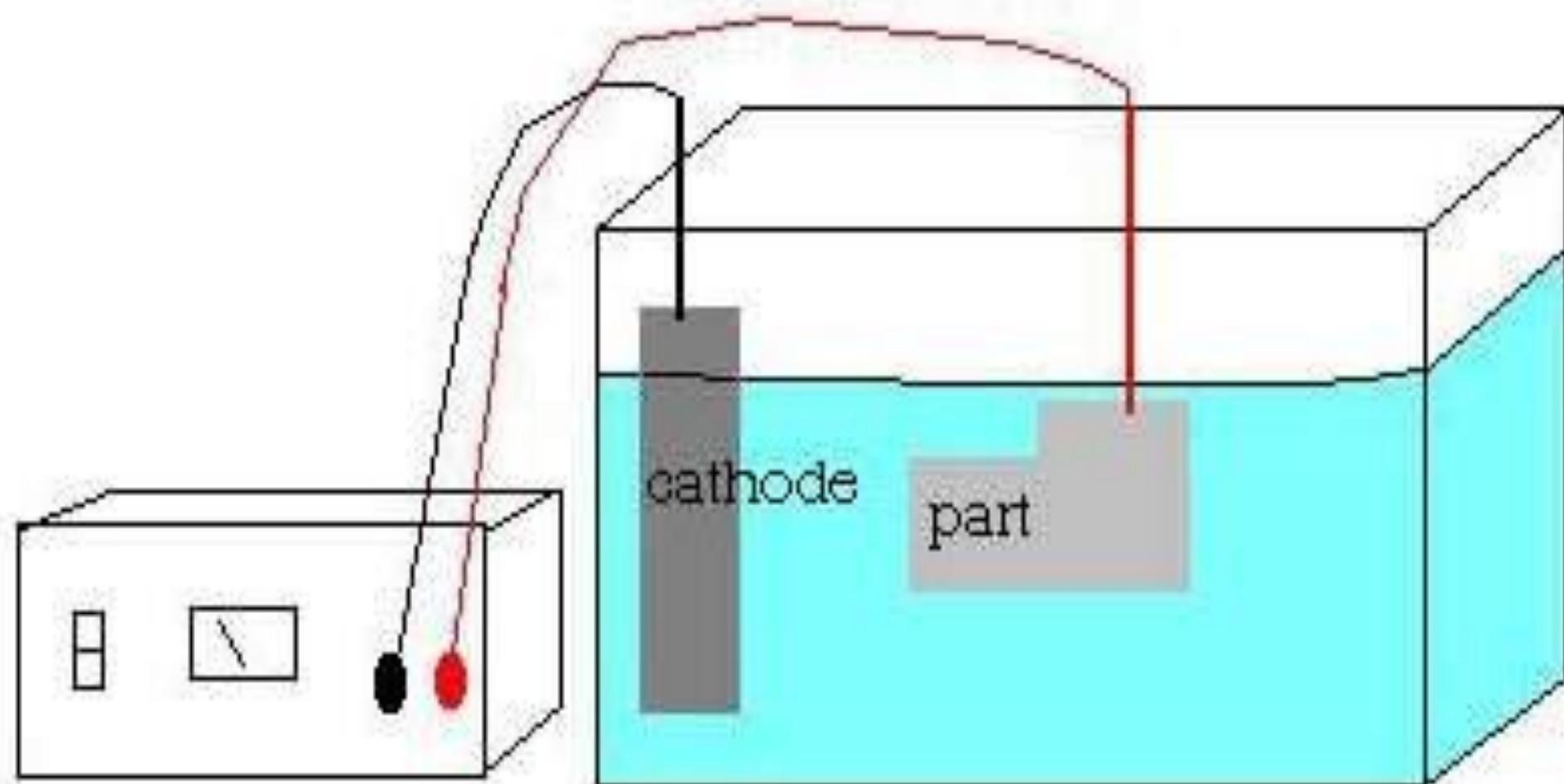
Anodizing Benefits

- Provides a hard surface
- Approximately 80 on a Rockwell scale
- Corrosion resistance
- Variety of colors available
- Repair “over machined” parts
- Relatively thin finish compared to other options

L C D Anodizing Method

- Low Current Density
- Easily repeatable results in the home shop
- Longer “bath times” than commercial methods
- Weaker (safer) chemical concentrations
- Less fumes
- Equipment cost reduction

The process involves placing the part
To be anodized into a weak
Sulfuric acid electrolyte solution.
A low voltage current is then passed thru it.



Power supply

Sulfuric acid tank

Anodizing does not hide surface
Imperfections.

In most cases it greatly enhances any
imperfections.

Part preparation

- CLEANLINESS is mandatory
- Surface preparation defines final outcome
- As machined parts will magnify any machining marks left behind
- Part must be clean and free of oils or other surface contaminants



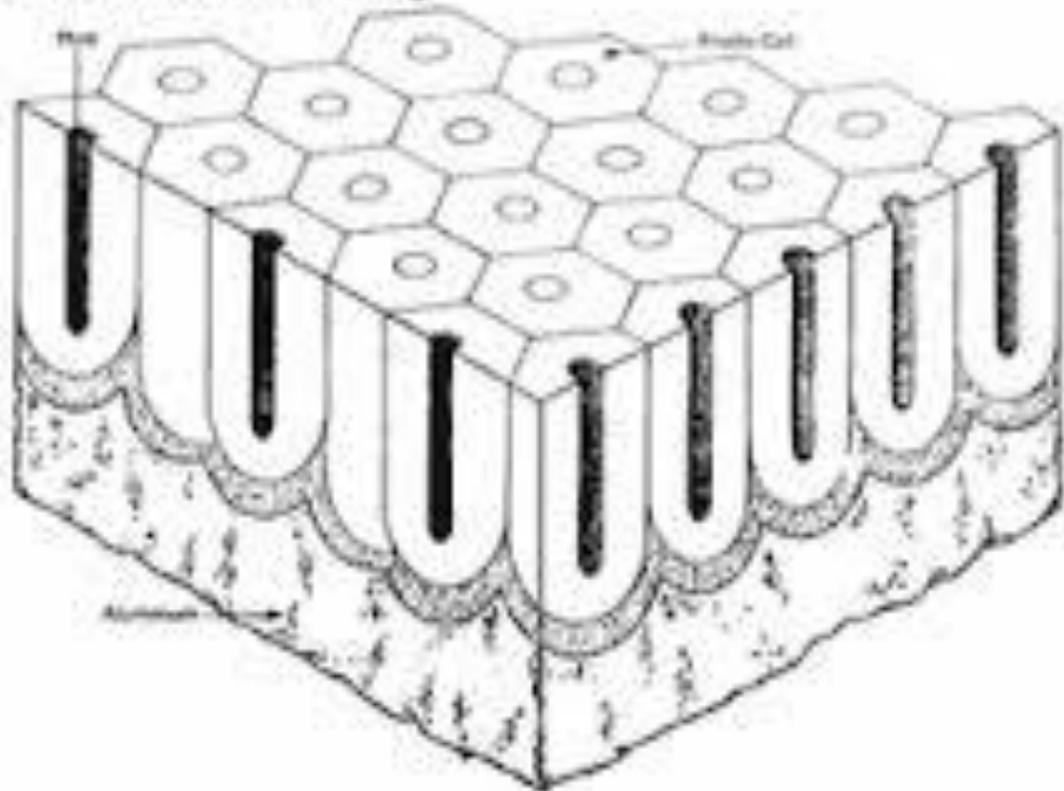
What happens in the tank?

The aluminum surface GROWS a layer of aluminum oxide, which transforms into aluminum hydroxide (anodize) and finally into hydroxide monohydrate.

This layer is the equivalent to “rust” on steel.
It is non conductive.

(I am no chemist. This is just what I have learned about how the process works)

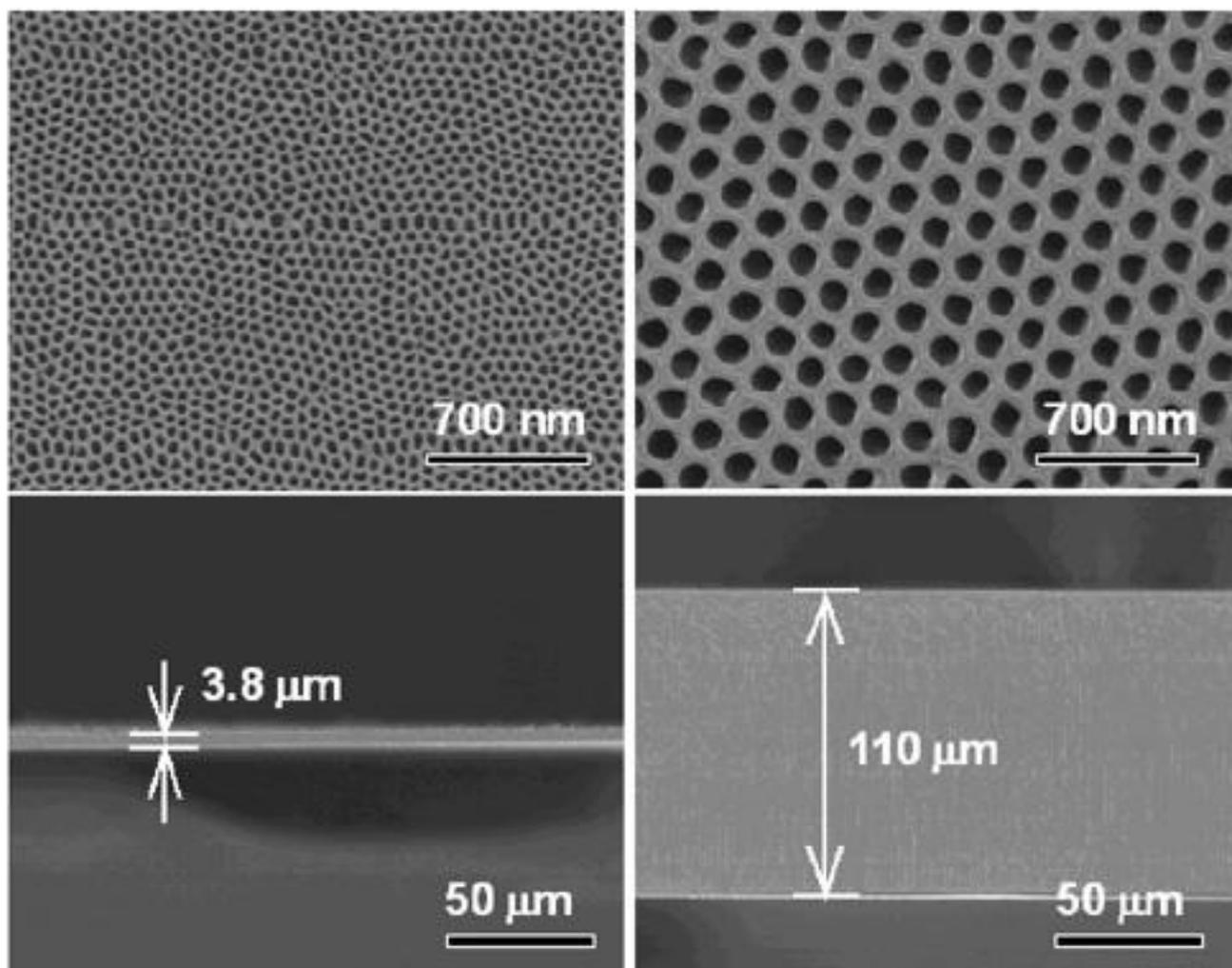
The Anodic Coating



(a)

mild anodization

hard anodization



Major Steps in the Process

- Obtain the part to be anodized. 6061 aluminum is a very popular alloy to be used.
- Put the desired surface finish on the part. This can be raw machined finish, various media blasting, brushed, polished or anything in between
- Thoroughly clean the part. Boiling water and detergent, degreaser works great.
- Test the parts cleanliness using the “water break” test
- Etch the part in caustic bath (optional, not

The anodizing setup



preparation



- Parts are washed in hot soapy water on left
- Right side parts have been thru degreaser and are mounted on racks

Putting parts in the tank

- Only aluminum or titanium should be in the tank
- A strong electrical connection is required
- As the part anodizes, this connection often fails as it is stressed. Its the most common cause of anodizing failures.
- Aluminum wire or rod works great.
- It can be forced into threaded holes
- Its possible to spot weld the wire in aplace not visible.
- The spot where the connection is made will not

Calculations

The LCD method uses a solution of 3 parts distilled water to one part sulfuric acid.

The current used is from 3 Amps square foot to 6 Amps a square foot.

The lower end of the amp range favors dyeing quality and final color depth.

The upper end of the range favors surface hardness.

The size of the pores is directly related to current flow.

Larger pores are easier to dye, but too large and the dye bleeds out during the finishing process.

Smaller pores make for better surface hardness, but can be hard to get the dye into.

The 720 rule

1 mil over 1 square foot will take 720 amp minutes.

Rule of 720:

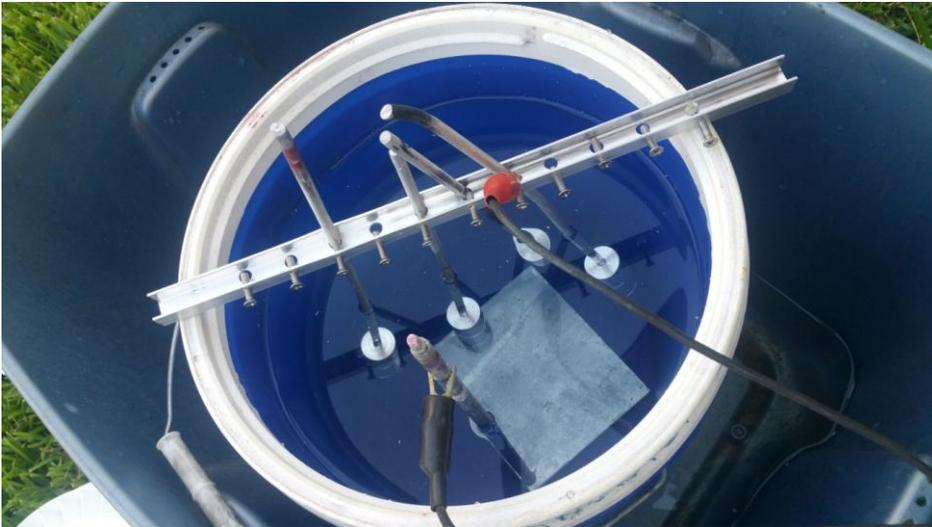
Minutes to anodize = (mils of coating desired × 720) / Amps per ft²

The metric equivalent

Rule of 312:

Minutes to anodize = (microns of coating desired × 3.12) / Amps per dm²

The tank.



- The anode is in the bottom of the tank/bucket
- Its approximately a 6x6 inch piece of aluminum plate, with a round bar welded to it that reaches out of the solution.
- The negative lead gets hooked to this.
- The positive is

The parts are in the tank

- What now?
- Plan your next step
- You have 90 to 120 minutes on average
- Prepare the dye bath
- Prepare the sealing bath
- Have all this ready, it is imperative that the parts not be allowed to dry out between steps from this point.

Dye



Weighing commercial dye



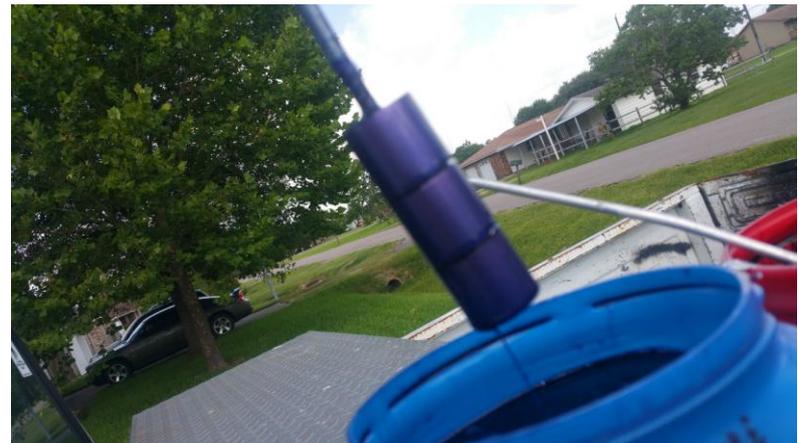
Out of the anodizing tank

- You should notice a gold / bronze tint to the parts
- If not, the anodizing most likely did not take
- Immediately out of the tank rinse the parts thoroughly in distilled water.
- All the pores that have been created



Adding color

- Commercial dyes are available
- Rit brand dye works great in the homeshop
- I have found the liquid dyes for synthetics give a more consistent finish
- The parts can skip this process, if color is not needed



Coloring parts

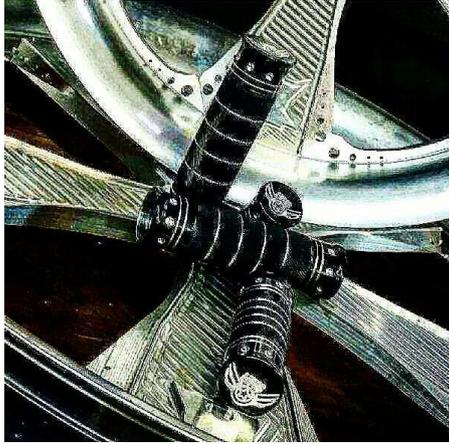


Sealing the parts

- Once dyed, the parts need sealed to keep out contaminants and keep the dye in the pores.
- Boiling in water is the easiest and cheapest for the home shop.
- Commercial nickel acetate sealants can be used at lower temps. and less



Finished Parts



parts



Commercial part vs shop part



The image features a classic hypnotic spiral background, consisting of concentric circles in shades of red and black that create a strong sense of depth and motion. In the center of the spiral, the phrase "That's all Folks!" is written in a white, elegant cursive script. The text is positioned diagonally across the frame, starting from the lower-left and ending at the upper-right, with the exclamation point at the far right. The white color of the text contrasts sharply with the dark red and black tones of the spiral, making it the central focus of the image.

That's all Folks!