Chemical Oxidation of Art Clay - Silver

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Oxidation is a natural process in which the metal reacts with the atmosphere to color the metal. The term oxidation is often applied to the planned chemical coloring of metal, which is not actually an oxidation process at all, but is more accurately a chemical coloring of the metal. Chemical "oxidation" is a process in which the metal is introduced to chemicals that color its surface. There are many chemicals commonly used to color silver. Each has its own properties and characteristics. For this discussion, we will use **Liver of Sulfur** (potassium sulfide).

Since the Art Clay – Silver results in a fine silver piece rather than a sterling silver piece, more typically used in jewelry making, the results of the chemical coloration process are slightly different than on sterling. There is a range of colors that can be achieved. They will appear in this order:

Yellow ⇨ Brown ⇨ Red ⇨ Blue ⇨ Gray ⇨ Black

The colors may go by so quickly that they are difficult to see. A small amount of clear (not sudsy) ammonia added to the solution will enhance the blue colors. A little baking soda added to the solution will enhance the browns.
The work should be colored after all soldering and finish work is complete. The piece should be free of oil, grease, and dirt.

Distilled water or r/o water can be used to make the solution, but tap water works well, too. Add a small to medium chunk of the liver of sulfur. Work near a sink with running water or have a bowl of clear water next to the liver of sulfur solution to rinse the work.

There are several variables that control the results of the coloring process:

- Concentration of the Solution
  The stronger the solution, the quicker the piece will go to black. If the solution is too weak, it will not color the piece or will only go to a weak yellow color.

- Application Method
  1. Pieces can be dipped into the solution or the solution can be painted onto the piece. Wear gloves for dipping – the sulfur is not good for skin. It is best if possible to dangle the piece from a piece of dental floss or heavy string for dipping. If fingers or tweezers are used to hold the piece, the liver of sulfur cannot reach the piece in those areas and it will not color in those areas. Dip the piece – then remove the work quickly and rinse immediately. The piece will continue to color until the liver of sulfur is rinsed off. Check the progress and re-dip if desired.

  2. The solution can also be painted on the surface. This can be used for localized areas to be colored with greater control.

3. Place a few crystals of the Liver of Sulfur in a jar or can. Place the piece to be colored in the jar, *but not touching the Liver of Sulfur.* Place a loose fitting lid or piece of cardboard over the mouth of the jar. The fumes will color the piece. Be sure to check the piece often to stop it at the desired color.

- Heat

  Heating speeds up the process, but also contributes to some of the more brilliant colors. The water can range from warm to hot, but short of boiling, to room temperature. Hot tap water works well.

  Another approach is to heat the piece rather than the solution. Use a torch and gently heat the piece (a large tip with a very soft flame). The liver of sulfur solution can be painted on during the heating process.

Once the desired color is achieved, rinse, dry and, if desired, polish highlights. Highlights may be achieved after the coloring process by using a brass brush, a steel brush, emery paper, steel wool, pumice on a buff or rubbed with fingers, white diamond compound on a buff, or other abrasive measures. The coloring should be removed from easy to reach places, as it will get worn off in those areas anyway. Protected areas will retail the color well. The coloring can be burnished to hold well even on exposed surfaces by tumble polishing the piece after coloring. Textured areas hold color well because the color remains in each small indentation.

Coloring can be entirely removed by abrasion (in some cases) or by heating with a torch or in the kiln. If the piece has not been soldered on, it can be re-fired in the kiln just as if it were going through another firing cycle. It will come out with all of the coloring gone. If the piece has been soldered on, the solder will flow at the temperatures of the firing cycle, so the piece should be heated gently (a large tip with a soft flame) until the coloring is gone. Then cool the piece, pickle and rinse. It may take two or three times to remove all of the coloring especially if the colored area is very textured.

A light coating of oil (vegetable oil works well) will darken the coloring. A coating of oil or wax (Renaissance Wax is one used by museums and works well) will help prevent ongoing oxidation and change in color of the piece once the desired color is achieved. For heavy-duty retention of color, the piece may be sprayed with a clear acrylic spray. A semi-gloss usually best matches the metal finish. There are downsides to any protective coating:

1. The protective finish - especially in high areas - may wear leaving exposed patina and resulting in an uneven finish.

2. If the protective coating is a hard one, it can crack or chip.

3. Many of the protective sprays will discolor over time.

Iridescent Patina
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http://www.rocksmyth.com/patina/

This is the basic recipe for the iridescent patina. This patina is most effective on highly textured pieces, such as torch texture, rollerprinted and reticulation. It has a slight color interference pattern, similar to oil on water. It has a high natural luster, similar to the nacre on pearls, if done correctly with many repeated dips in a weak solution. It is durable, the colors remain stable to a high degree, and very slow (years) to darken or further oxidize. Further oxidation can be prevented entirely by applying Renaissance Wax when the patina is dry. It is effective on silver, brass and copper, to a lesser degree with gold. This makes it an excellent patina for keum-boo applications, since the 24 kt. gold content remains bright.

Your metal should be thoroughly clean. Wash, or use an ultrasonic, to cleanse off surface dirt and oil, then rinse with clean water. Brass brushing the surface is perfectly acceptable, and provides more surface tooth. The big secret is the addition of two mordants to enhance and stabilize the colors. I usually use salt and ammonia. The recipe I use most frequently is:

1 small piece of liver of sulfur, about 1/4 inch in diameter
2 C. hot water
1 Tbsp. clear household ammonia
1 tsp. salt

Your solution should be a very pale straw yellow color. If the solution is too strong, the colors will work too fast. Add additional water if you need it. Iodized salt gives a different effect than kosher salt, each intensifying certain colors the other doesn't.

Now you need to set up your dipping station, lined up in a row, so you can progress from one step to the next, quickly and efficiently. You need a pot of very hot water and bowl of very, very cold water. Your dipping station will be lined up in a row, from left to right: pot of very hot water, hot liver-of-sulfur solution, bowl of very ice-cold water. First dip your metal into the hot plain water to warm up the metal. The warmer the metal is, the more intense the effect and the more quickly the liver-of-sulfur solution works. Then quickly swish it through the liver-of-sulfur solution, then quickly put it in the cold water to stop the action. Do not leave the piece in the liver-of-sulfur solution for any time waiting for the colors to develop. The color will finish developing in the cold water. Repeat until you get the colors you want. The color range is predictable. First yellow, then green, red, blue, purple, and black. You can have several different colors in one piece by selectively dipping just one part of the piece.

Caution must be used with pieces that have heat sensitive stones, or stones which cannot take thermal shock well, such as opals. However, I've been successful, even with delicate stones, by not getting the metal quite as hot when dipping and working more slowly. I have used this process with pearls, turquoise, fire agates, malachite, rhodonite, corundums and beryls, with no ill effect to the stones. However, I would be reluctant to use the process with say, a heavily included emerald, simply because the thermal shock could cause the emerald to fracture.

After you have achieved the colors you want, wipe the metal dry with a soft cloth. Allow to continue drying for several hours. If you wish at this point, you can "knock-back" the patina on the high points with a little rouge on a felt buff, so you have the contrast of the bright silver against the color. Clean the metal again, and apply a high quality wax, such as Renaissance Wax, or cabinet-grade lacquer. Wax will dull down the colors a bit, and lacquer will brighten the colors a bit. For things that will be subjected to a high degree of wear, such as bracelets or rings, you may want to incorporate guard wires during the fabrication of the piece to protect the patina from abrasion. However, on something like reticulation, where there are natural hills and valleys, the valleys naturally retain the patina, while the high points become bright and shiny with abrasion, providing a very lovely contrast.

Hope you have fun playing!

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