CHEMICALLY BLACKENING BRASS

By: Pat Majewski and ed. by NRG Staff

There is a wealth of information about this subject to be found on the internet; however, to the novice much of it is confusing. Considerable discussion has been transacted in the various ship modeling forums, and some very useful information can be obtained from the manufacture's product fact sheets.

The following is a collection of thoughts and ideas resulting from some basic research I have conducted in trying to find brass blackening products here in Australia. I hope it is of some value to fellow modeling shipwrights.

CAUTION

A word of Warning! Consistently and emphatically, the product makers and suppliers, as well as the various sources of information, stressed the same words of warning and caution.

"The chemical ingredients used in these products are dangerous."

Even though they are safer than most industrial agents, these products and chemicals must be used with caution! Wear rubber gloves, a face shield, and a mask. Open the window and put on the fan. Follow the manufacturer's instructions to the letter. Make sure you keep these agents in a well secured, safe lockable cabinet; and keep away from kids and pets. In other words, use your common sense!

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INTRODUCTION

Firstly, what are we trying to achieve?

Some ship model makers buy brass fittings, others scratch make them, but most of us then need to blacken these pieces to achieve a realistic look. Some modellers choose to paint the brass, while others prefer to use chemicals to oxidise the surface of the brass in order to give it an authentic 'blackened' iron or weathered / aged appearance.

Either method can achieve satisfactory results. However, paint will tend to fill some of the minute details of the brass pieces, whereas a chemical blackening process won't.

The chemical blackening of metal involves the replacement of a surface skin of base metal with a selenium based compound (oxidant). There are many types of metal blackening agents; each works on a particular metal to produce a black, green or brown patina. A patina is defined as:

> *"A surface appearance of something grown beautiful especially with age or use. Usually used in reference to copper, but also applicable to bronze, steel, and other materials."*

On a commercial scale, metal can be blackened using Parkerizing, or hot or cold Bluing processes. Some of these methods, previously the exclusive domain of gunsmiths, engravers and metal shops, are readily adapted for home use with some solutions now supplied commercially in kit form – it is a matter of finding the appropriate product or chemicals, and applying the appropriate techniques.

The Hot-Bluing and Parkerizing processes only work on steel or stainless steel parts to provide corrosion protection for the metal. These processes are expensive; therefore, modellers need a cheaper, easier to use solution that will work on brass. Some of these commercial products are now sold in small quantities for the cold-bluing touch-up of firearms. These products are also extensively used by railroad modellers for blackening metal surfaces.

Although these agents are generally named after the base metal for which they are designed to react with; some work better than others on different metals. Be aware that different alloys used within the same base metals often react differently to the same blackening agent; **there are at least 12 varieties of brass**.

BLACKENING PRODUCTS

Gun Blue Gels and Cremes: They are used extensively by gun enthusiasts for touching-up metal parts of weapons. These products appear to be replacing similar liquid products.
http://www.g96.com/products/gun-blue-creme/#

JAX Black – Brass, Copper and Bronze Darkening product. This manufacturer sells blackeners for various metals as well as a patina maker.
www.jaxchemical.com

Brass Black: These products are manufactured by Birchwood Casey in Eden Prarie MN. This is a fast-acting liquid with the resulting effect and depth of color dependent on the alloy content of the brass and amount of time the brass is exposed to the blackening agent. It may not color all types of solder.
www.birchwoodcasey.com

Brass Black and Pewter Black: Available from BlueJacket Ship Crafters. www.bluejacketinc.com/fittings/toners.htm

Modern Master's Metal Effects: These products, manufactured by Modern Masters, are not blackening agents. They produce various colors on metal by applying metal-containing paint and then applying a patina solution. It can also be used directly on bare metal. It can be painted or sprayed onto the brass without further dilution.
http://www.modernmastersinc.com/metaleffects.asp

HOME BREW / ALTERNATE CHEMICAL AGENTS

Caution: Some of the methods discussed below involve caustic or poisonous liquids and fumes that may permeate an entire house. Plastic gloves and adequate ventilation are mandatory. The work area and you should be well protected from possible damage or contact.

The cautions advised at the start of this article also apply here.

The products listed below may also blacken metal parts and you don't have to be a chemist to use them. Many of the products are available in powdered or granular form that will need to be mixed with other commercial chemicals or distilled/mineralized water.

I have found that this doesn't necessarily translate to a cheaper alternative. It does allow the modeler to buy bulk, provides a longer shelf-life, and you can mix as much as you need when you need it. However, you will need to experiment to find the best chemical mix ratios, time of immersion, etc. to achieve the desired effect. This has largely been eliminated in commercial off-the-shelf products as the manufacturer often provides tables of times or recommendations to achieve a desired effect.

Some of these alternate solutions include:

1. Selenium Dioxide (selenium acid): This is a good chemical for blackening copper and brass and is the first choice of many chemical trophy engravers for laminating brass plaque to make the lettering black (the lettering cuts through the lacquer). It's totally jet black and very hard. One product brand they use is called Gravoxide. It's advertised as a blue/black oxide finish for steel but it is reputably effective on brass/copper also.
2. Copper Carbonate: Normally, this chemical is used to create a green patina similar to weathered copper on metals. However, it can also produce a black / dark finish on brass. Most scientific chemical suppliers only sell the pure version of the chemical in bulk, and it is expensive. Nonetheless, industrial grades of Copper Carbonate are available from pottery supplies outlets quite cheaply in small bags.
   Available in a granular form, copper carbonate can be mixed with warm water or ammonia (either ammonia 800 – better but more expensive; or cloudy ammonia); all solutions will work. The ammonia solutions clean the brass as they blacken; however, some brass preparation is still recommended. A teaspoon or so of the granules mixed in a glass jar of water or ammonia solution usually works. Leave the brass in the solution from anywhere between 10 to 30 minutes, depending on how black you want to make it. Leave it out in the sun while it is working for better results.
3. Keep the solution; the carbonate will settle to the bottom, but a vigorous shake will soon have it ready for the next batch of blackening.
4. Note: **this solution will not blacken solder!**

CLEANING & PREPARATION TECHNIQUES

I cannot emphasize strongly enough the importance of proper cleaning and de-oxidization of the brass prior to blackening. This is the 'make or break' of a good result. Any residue from finger oils, contaminants, glue, flux etc produced unsatisfactory blackening results.

There are two types of contamination to a metal surface; organic, which is oil, grease and dirt, and inorganic, which is oxidation. Sometimes both types of contamination will be present on the metal. Most cleaning methods will only take care of one type, so they need to be taken care of as separate processes. The organic contamination will always be on top. So attack the grease first, then the oxidation.

Once the oils and grease are removed, the oxides can be removed. Ensure the removal of all grease and foreign substances from the surface using a good solvent and scrubbing. Keep your fingers off the brass after the initial cleaning. Handle only on the edges if you must, preferably with tweezers or powder free disposable gloves .

This work should, wherever possible be done outside. Not only do we have the odor/ventilation issues to consider but also damage to any metal sink. Even using diluted solutions, the acid can corrode the metal and the blackening agents will definitely stain them. Use an old sink or wash basin jury-rigged on a stand and connect it to the garden tap or outdoor plumbing.

Cleaners

Organic - The cleaners that will handle oil and grease are the solvents and detergents. It is important that you determine the best cleaner for each application.

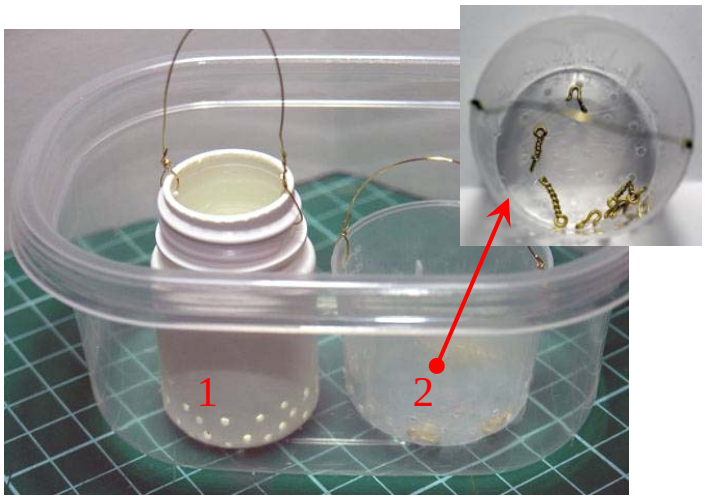
Inorganic - The acidic cleaners will attack oxidation. Hydrochloric acid is the most common acid used to clean brass. Abrasive methods also work great. You can use a fiberglass or wire brush. Another method uses a slurry of ground pumice and water and scrub on with an old toothbrush.

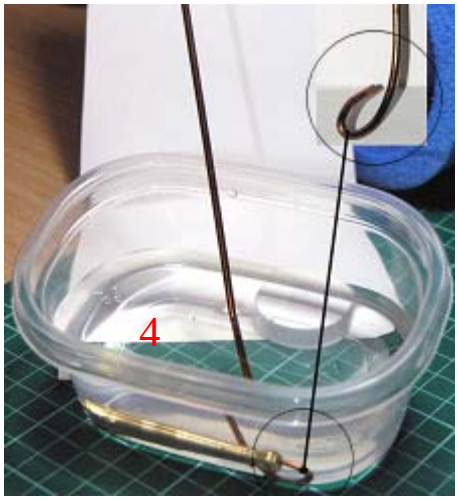
Rinsing - Rinsing is important to remove all traces of the cleaning solution. Distilled water is a good idea. It won't leave any mineral deposits that may come from tap water. It is also important to blacken immediately after cleaning. As soon as you rinse the acid off the part, that part is as clean as it will ever be. Depending on temperature and humidity, oxidation may start very quickly.

Cleaning Devices:

A few ideas for the rinsing/dipping baskets are shown below. All should be drilled with sufficient small holes to allow rapid drainage but prevent smaller parts escaping. Use brass wire or wood as the handle to ensure no contamination due to dissimilar metal reactions when dipping into the blackening agents or acids.

- small plastic container (e.g. yogurt cup)
- small pill bottles (retain the lid for added parts security) **(below: Picture point 1)**
- medicine dose measuring cups **(below: Picture point 2)**
- plastic /nylon tea strainers (see following)
- plastic lids from screw on bottles (deeper sided ones) **(below: Picture point 3)**
- use larger gauge brass wire with a curl shape bent into it to control larger pieces such as canon barrels **(below: Picture point 4)**





Cleaning Techniques:

1: One of the most basic cleaning processes is a vigorous scrubbing with soap and water or a slurry of ground pumice and water. Use a stiff brush, powered toothbrush or similar to assist the scrubbing process. If the pieces are very dirty, consider using a hair dryer to heat the metal to open the pores before degreasing. Ensure you rinse all soap and residues from the pieces.

2: Wash the parts in a degreasing/cleaning solution agitating them vigorously and then scrubbing them. Some recommendations for degreasing solutions include:

- muriatic acid (hydrochloric acid) (between 35 - 10% solution),
- nitric acid (between 35 - 10% solution),
- mineral spirits,
- ammonia (ventilate well or wear breathing apparatus),
- acetone,
- vinegar (did not work that well in our trials),
- isopropanol

CAUTION

All acids are dangerous – read the safety precautions on the package!

Dilute acids with plain tap water and store in a well marked plastic container; preferably one with a child-proof cap.

When mixing acid solutions, always add the acid to the water, not the other way, to avoid explosions (adverse chemical reaction ☺)

Thoroughly rinse the brass with distilled or plain water, and wipe them dry with a clean cloth or paper towel, before proceeding with the blackening process. It is very important that all traces of any chemical cleaner are removed, especially acid based solutions, as they may cause flaking of the patina fin the future.

Note: *If after applying the blackening agent, you see spotting, or light areas, try changing to another degreaser/cleanser.*

3: Vigorously clean the items with a stiff brush. The brass should be scrubbed until it shines; this will also remove any oils/grease left on the surface. A toothbrush or Q-tip is also useful in applying the solution directly to small pieces (if not using the immersion method) to work the agent into all the small nooks and crannies.

4. Several brands of domestic (hobby) ultrasonic cleaners are now available at very reasonable cost. With the right cleaning solution, this is reported to be the ideal cleaner as it will remove all traces of dirt, oils and corrosion etc; and you don't need to muck around with messy and/or dangerous solutions. Just place the pieces into the solution (in a basket), wait the required time (device dependent), usually only for a minute or two, then dry (don't touch with fingers). I figure at this price, you could talk the 'ship's purser' into it by explaining that it will clean her jewellery to boot.

BLACKENING TECHNIQUES

There are as many opinions on the best techniques for blackening as there are products; you will need to experiment a little to determine which works best for the type of brass you are blackening.

Many of the following blackening solutions have a long shelf life, even after dilution. Do not throw the solution out after every use; you will probably get several uses from it as long as you do not contaminate the agent. Therefore, small bottles should last quite some time.

Blackening Techniques

1: The most prevalent recommendation is to immerse the materials in a dilute blackening solution. By using a weak solution, the oxidizing agent works slowly and penetrates thoroughly.

The rate at which the brass will blacken depends not only on its composition (alloy content), but whether it has been worked (turned etc.), whether it is a casting, the presence of impurities, and whether the brass has been soldered.

If immersed into full strength solution, the pieces will darken rapidly but then will often start to flake. Should this happen, further dilute the metal blackener with distilled water. My experience suggests that a dilution or between 30% and 50% works best for larger pieces; and between 15% and 30% for very small pieces.

Simply pour a little blackening solution into a small container (non-metallic), dilute it to preference, immerse the parts and agitate them until the desired depth of color has been achieved (this may need several dips), remove the parts to drain and then rinse thoroughly in water to neutralize the oxidizing process.

If you choose to use a full strength blackening solution, keep a close eye on the process, as the reaction is slow initially but accelerates rapidly. There will usually be a gray/black powder residue formed on the brass which must be cleaned off. Buff the pieces with lint free cloth to enhance the effect and then seal it. If you do not seal it, there is a risk that continued reaction may occur.

2: An alternate method of blackening recommends not immersing the parts in the solution, but rather to brush or rub the full strength solution onto the pieces using a small stiff (cheap) nylon brush to work it in. Have a Q-tip soaked with the solution nearby to assist those parts not blackening as fast as others. Use this technique on smaller parts such as eyebolts or blackening parts already installed on the ship, doing each individually.

After the oxidation is complete, be sure to neutralize the coating by washing thoroughly with water. An improperly rinsed item will continue oxidizing until the part is a crumbling mass of mineral salts.

Blackening Britannia Metal

Britannia metal is a tin/antimony/copper alloy so most blackening products should work. However, there are products available (Pewter Black from BlueJacket for example) that are designed specifically to blacken pewter. Again, the most important aspect is a thorough clean/degrease of the part before using the blackening agent.

FINISHING TECHNIQUES

The finish of the blackened brass can often be improved by a light buffing of the oxidized surface. This polished surface that sometimes enhances the depth of color.

Some realistic weathered and rusted finishes can be achieved by using different reactants after the base, patina has been prepared. Subsequent treatment with alternative metal blacks can produce other useful effects, including the appearance of rust.

As we are creating a patina, it is important to seal the finish. A low sheen or matte finish provides the most realistic appearance.

PRODUCT SOURCES:

Potential sources for blackening agents include:

- Hobby suppliers (e.g. MicroMark etc.)
- Model railroad specialist hobby stores
- Gunsmiths
- Jewellery suppliers
- Engravers and their suppliers
- Chemical/Scientific equipment suppliers
- Pottery suppliers
- Stained glass window suppliers