

Firescale on Silver

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What is Firescale?

Firescale (a.k.a.: firestain, stain) is that grey/black/purple stain that appears on the surface of sterling silver after it has been heated. When sterling silver is heated in the air, the oxygen in the flame and in the atmosphere attacks some of the copper alloy near the surface. This forms a copper oxide on the surface of the metal. The firescale layer deepens with prolonged heating, over heating or repeated heating. After the piece is pickled and copper is etched from the surface, a thin layer of fine silver often hides the firescale. The firescale will usually re-appear during the buffing and finishing process when the fine silver is removed. On a piece of silver that has been lightly polished, firescale will appear as a dark shadow. Firescale can most plainly be seen in a shaded light. Silver on which the firescale is allowed to remain will tarnish very rapidly.

If the piece is heated to very high temperatures, the crystalline grain of the metal is opened and the oxide enters and reinforces the thickness of the oxidation.

Hammering can drive the firescale further into the surface.

For a strong solder joint, firescale MUST be cleaned off before soldering.

Preventing Firescale

Preventing firescale requires controlling the oxygen reaching the surface of the metal. One method is to coat the metal with a barrier. The entire piece needs to be coated in order to prevent oxygen from reaching the surface. Prips Flux, Cupronil and Stop-Ox are thin solutions that can be sprayed on the work. The usual technique with these is to spray the work, heat slightly (until the water is gone from the surface of the piece), spray again, heat again and repeat until the piece is completely covered with a frosty layer of the spray material. These barriers do break down and firescale will form where they do not cover completely. A second method is to create a reducing atmosphere so there is no oxygen in the air surrounding the piece to create a firescale layer.

Coating Barrier:

- White paste flux
- Yellow Ocher / Boric Acid mixed with Water
- Prips Flux
- Cupronil
- Stop-Ox

Atmospheric Barrier:

- A reducing flame will decrease firescale. When the gas/oxygen mixture becomes too rich in oxygen, no amount of flux will protect the metal completely.
- Working on a charcoal block will decrease the firescale. The charcoal present burns forming CO₂ and removes the oxygen from the vicinity of the metal surface.

Getting Rid of Firescale

There are several remedial techniques for dealing with firescale. The design of the piece determines which path is most beneficial. Firescale is considerably harder than the parent silver. Therefore, abrasive techniques will have to be aggressive. Delicate designs may be lost with acid etching.

Several methods that can be used are:

1. Abrasion

Filing will remove firescale. So will sanding, pumicing or buffing with an abrasive compound. Buffing poses a danger of over polishing, thus rounding edges and obliterating details.

2. Electro-polishing

Electro-stripping may be used to strip the surface of the metal. This technique is a reverse plating process and requires expensive equipment and must be done skillfully to strip the surface evenly.

3. Acid Etching

A cold solution of 50% water and 50% nitric acid (be sure to add acid to water – never the other way around) can be used to etch the surface of the metal and remove the firescale. The acid etches copper faster than silver, but does etch both. Care must be taken on the solder joints, as they will etch faster than the sterling. A ground can protect them if necessary.

Attach a string or use photography tongs to dip the piece in the acid solution. The piece is dipped for a few seconds – until it changes to a cream/black color. The black indicates firescale. The cream indicates sterling. As soon as the piece has changed colors, pull it out and dip it into a bowl of water with baking soda in it. This will neutralize the acid. Then rinse the piece in running water and burnish with a brass brush. Repeat this process until only the cream color appears. Watch that the details are not being destroyed.

4. Building Up the Fine Silver (Depletion Gilding)

Work which is highly decorated or which has intricate surface details may be polished completely, irrespective of whether there are patches where the firestain has been broken through. The piece should then be carefully heated by an air/gas torch until it just begins to change from black to red heat (approximately 900°F to 1000°F). Let the piece cool, pickle it and burnish it with a brass brush or steel wool under running water. Repeat the process 6 – 8 times.

This process builds an even layer of the fine silver. It is a thin layer of metal and care should be taken to not break through that layer in the finishing process as it also deepens the firescale layer. This technique is not recommended for pieces with stones or pieces that could not be reheated for repair of the surface.

5. Plating

Completely polish the piece and electroplate silver over it to cover the firescale. This process is only effective as long as the plating lasts, but can be re-plated if necessary. If the piece will be used a lot, the plating should be a heavy one. Many commercial pieces are plated. Pieces that have many prolonged solder joints, such as teapots, are often plated. Jewelry is often rhodium plated.