

Restoring the Family Silver with the Power of Chemistry

We commonly associate certain metals with high value – the normal examples are gold, silver and platinum. As it happens the most expensive commodity metal isn't gold or platinum, it's normally rhodium, which has reached prices of \$10,000 per ounce. The reason we use the word 'normally', is that the prices of commodity metals are fluid – they change with supply and demand. Rhodium is one of the *noble metals*, which includes ruthenium, rhodium, palladium, silver, osmium, iridium, platinum, and gold. These metals are *noble* inasmuch as they are, relative to other metals, inert (unreactive) or chemically aloof. However as we shall see, some are more unreactive than others. Gold reacts with very few other elements or compounds, and the only acid in which it will dissolve is *aqua regia* (royal water). This is a concentrated mixture of nitric and sulphuric acids, and derives its regal name from the fact that it is uniquely able to dissolve gold.

Silver is more reactive than gold, and will tarnish over time because it reacts with the small amounts of sulphur-containing compounds in the air. This results in a black colouration developing and silver polish merely reacts with the tarnish to restore the shine of the silver. In this experiment we are going to use household materials to emulate silver polish and restore the shine to an item of tarnished silver.

MATERIALS

You will need:

- a tarnished piece of silver (often you may have silver cutlery but ask the owner before using it). For this experiment we will assume we are using a tarnished spoon;
- a large casserole dish in which completely immerse the silver;
- aluminium foil;
- two litres of water;
- a saucepan;
- safety glasses, oven gloves and a laboratory coat/apron.

HEALTH & SAFETY

This experiment involves hot water. You need to use oven gloves when handling vessels containing hot water have your sleeves rolled down and safety glasses on during the experiment.

METHOD

Line the bottom of the casserole dish with the aluminium foil. Put the tarnished spoon on top of the foil ensuring that the as much of the surface of the spoon touches the aluminium.



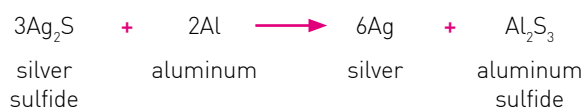
Heat the water in the saucepan to boiling and then place the saucepan in the sink. To the water CAREFULLY add about one quarter cup of baking soda for each two litres of water. The mixture may boil over the edge of the saucepan which is why you are exercising extra care.

Pour the hot baking soda and water mixture into the casserole dish, so it completely covers the silver.

Almost immediately, the tarnish will begin to disappear. If the silver is only lightly tarnished, all of the tarnish will disappear within several minutes. If the silver is badly tarnished, you may need to reheat the baking soda and water mixture, and give the silver several treatments to remove all of the tarnish.

EXPLANATION

The equation for this reaction is:



The more reactive aluminium has reduced the silver sulfide back to silver, hence chemically restoring its lustre. This is the method by which most corrosion-removers work, they remove whatever oxidant has oxidized the base metal. Tarnish is the silver equivalent of rust. You may notice yellow flakes of aluminium on the bottom of the pan.