Electroplating

## Introduction

Electroplating is an important industrial application of electrolysis. Electroplating processes often involve coating a metal object with another metal to protect or enhance the surface properties of the object.

There are various small-scale versions that can be done safely in the classroom.

## Preparation

**Plating bath**

You will need a plating ‘bath’. This can be made from a small plastic food container of you can just use a beaker. The advantage of making one from the food container is that you can drill through and make sure things are fixed in place more easily.

**Plating solution**

Make up your plating solution. There are various recipes given below for plating with different metals

**Prepare the anode**

This is the ‘donor’ electrode. Make sure the electrode is clean.

**Prepare the cathode**

This is the item to be plated. It needs to be thoroughly cleaned. Dip into dilute nitric acid for about a minute and then rinse in distilled water and dry with paper towel

## The electroplating process

1. Connect the positive (+) pole of a 6 V DC source (or use a 9 V battery) to the anode.

*The best conditions for electroplating involve using a low concentration of the hydrated metal ion required for plating and a good conductivity in the electrolyte solution (i.e. a high total concentration of ions).*

1. Connect the cleaned cathode to the negative (-) pole of the power supply/battery and it into the plating solution to complete the circuit.
2. Within a few seconds, the cathode begins to become coated with your metal. Experience will determine how long you need to leave it for.
3. Remove the now plated cathode, rinse it with clean water and dry.

## Electroplating solutions

There are many formulations for plating solutions. Some are hazardous and where they are not covered by a model (general) risk assessment, either here or elsewhere, a special risk assessment will be needed before use by teachers / technicians or students.

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| Metal to be plated |  |  |
| copper | Use 1 M copper sulphate solution  Hazards: Harmful if swallowed | \\staffserver1\esoc$\My Pictures\GHS Pictograms\GHS pictograms-small\GHS-pictogram-Warning_small.jpg |
| Nickel | Dissolve 5 g of ammonium nickel II sulphate in about 75 cm3 of water and dilute to 100 cm3.  Hazards: Skin & Respiratory sensitiser, MUtagen, Carcinogen (by inhalation) Reproductive toxin, Specific Target Organ Toxin on repeated exposure. | \\staffserver1\esoc$\My Pictures\GHS Pictograms\GHS pictograms-small\GHS-pictogram-silhouete_small.jpg |
| Silver | Dissolve 1.6 g of silver nitrate V and 32 g of potassium iodide in 100 cm3 of water. Add 3 drops of concentrated sulphuric acid. Use a carbon rod as the anode.  Hazards: Skin/eye irritant | \\staffserver1\esoc$\My Pictures\GHS Pictograms\GHS pictograms-small\GHS-pictogram-Warning_small.jpg |
| Zinc | Dissolve 33 g of zinc sulphate-7-water in about 50 cm3 of water and dilute to 100 cm3.. Add five drops of 2 M sulphuric acid and 6 g of boric acid. Stir to mix.  (The solubility of boric acid is 6 g per 100 cm3. If you have any residue, you can filter it off – of just ignore it.(  Hazards: Causes serious eye damage, Harmful if swallowed, reproductive toxin (only if Boric acid is 5.5% or over) | \\staffserver1\esoc$\My Pictures\GHS Pictograms\GHS pictograms-small\GHS-pictogram-acid-small.jpg  \\staffserver1\esoc$\My Pictures\GHS Pictograms\GHS pictograms-small\GHS-pictogram-Warning_small.jpg  \\staffserver1\esoc$\My Pictures\GHS Pictograms\GHS pictograms-small\GHS-pictogram-silhouete_small.jpg |