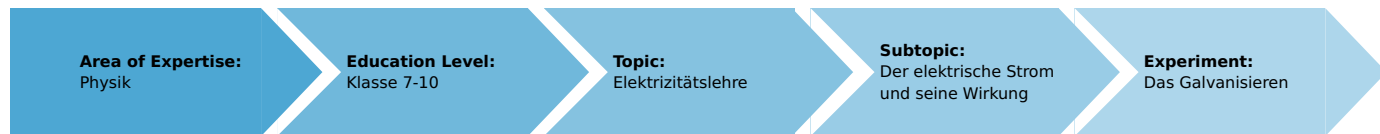


Galvanisation (Item No.: P1375200)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Cloth or absorbent paper

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

Items of practical use are frequently coated with a layer of nickel, chromium, silver or gold, for aesthetical reasons or as protection against corrosion. The coating process is carried out electrochemically, and is called galvanisation. The students are to coat a part of a sheet of iron with a layer of metallic copper in a model experiment.

Safety measures



R: 11/22-36/38-50/53

S: 7-16/26/22-60-61

Methylated spirit is highly flammable.

Copper(II) sulphate is harmful to health. Do not swallow it! Irritating to eyes and skin. Do not inhale vapours or dusts. Sulphuric acid solution is very corrosive to skin. Wear protective glasses and protective gloves!

Waste disposal

Dilute acid remains with water, neutralise (pH 6-8) and rinse to drain.

Collect solutions containing heavy metal ions or salts in an appropriately labelled container and subject them to proper disposal

Notes on setup and procedure

Diluted sulphuric acid (approx. 10 %) should be prepared in advance.

The limitation of the current to, e.g., 150 mA ensures, with a well prepared cathode surface, a copper coating which adheres relatively well, but is not wipe-resistant.

It is also important in this experiment that the teacher centrally organises and superintends the waste disposal of the aqueous solutions, and also ensures that the necessary safety precautions are maintained during the whole of the experiment.

Remarks

Ascending bubbles result because an electrolysis of water occurs during galvanisation.

This experiment is purposely simply designed as a model experiment. A much larger expenditure is required to obtain a wipe-resistant metallic electrocoating (refer to the corresponding literature).

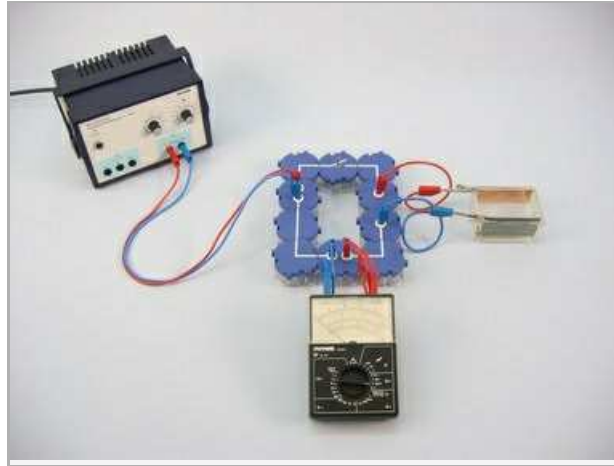
Galvanisation (Item No.: P1375200)

Task and equipment

Task

How can the surface of a base metal be made more noble?

Demonstrate, in a model experiment, how a sheet of iron can be coated with a layer of copper.



Equipment



Position No.	Material	Order No.	Quantity
1	Straight connector module, SB	05601-01	1
2	Angled connector module, SB	05601-02	4
3	Interrupted connector module, SB	05601-04	2
4	Junction module, SB	05601-10	2
5	On-off switch module, SB	05602-01	1
6	Trough, grooved, w/o lid	34568-01	1
7	Copper electrode, 76 mm x 40 mm	45212-00	2
8	Iron electrode, 76 x 40 mm	45216-00	2
9	Alligator clips, bare, 10 pcs	07274-03	(2)
10	Connecting cord, 32 A, 250 mm, red	07360-01	2
11	Connecting cord, 32 A, 250 mm, blue	07360-04	2
12	Connecting cord, 32 A, 500 mm, red	07361-01	1
13	Connecting cord, 32 A, 500 mm, blue	07361-04	1
14	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
15	Multi-range meter, analogue	07028-01	1
16	Sulphuric acid, 10%, tech.gr., 1000 ml	31828-70	1
17	Water, distilled 5 l	31246-81	1
18	Emery paper, medium, 5 sheets	01605-02	(1)
19	Copper-II sulphate,cryst. 250 g	30126-25	1
20	Denaturated alcohol (spirit for burning), 1000 ml	31150-70	1
	Spoon, w.spatula end, 18 cm, plastic	38833-00	1
Additional material			
	Cloth or absorbent paper		

Set-up and procedure

Set-up

Safety measures



R: 11/22-36/38-50/53

S: 7-16/26/22-60-61

Methylated spirits is highly flammable.

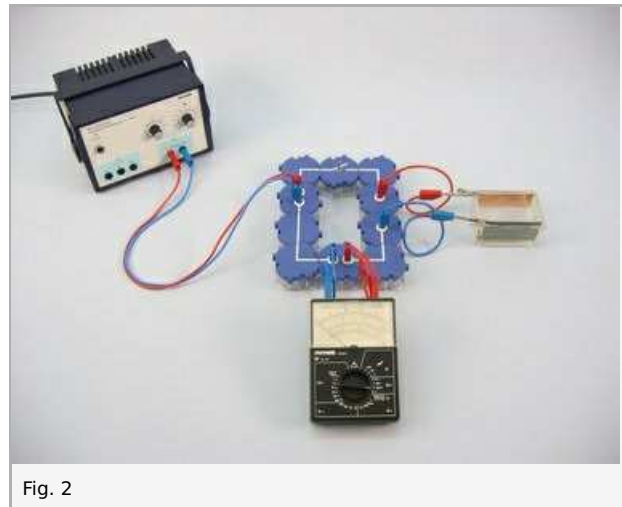
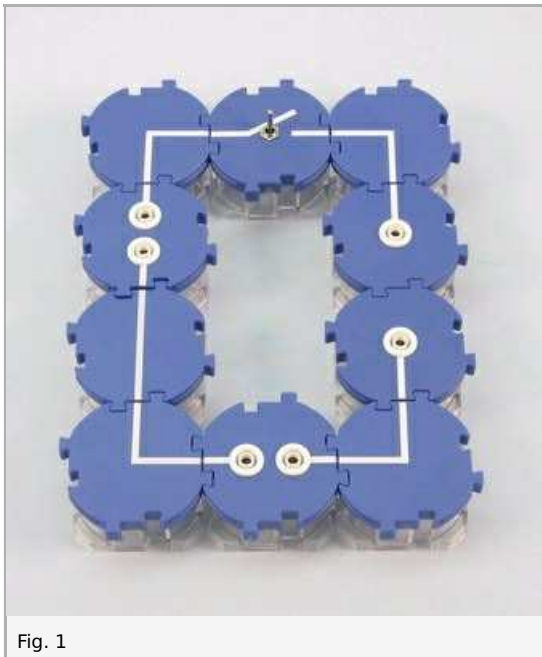
Copper(II) sulphate is harmful to health. Do not swallow it! Irritating to eyes and skin. Do not inhale vapours or dusts. Sulphuric acid solution is very corrosive to skin. Wear protective glasses and protective gloves!

Set-up

Preparatory work:

- Clean the trough; thoroughly rub down the electrodes with emery cloth; wipe the iron electrodes with methylated spirits, then avoid touching them with your fingers (so that they remain fat-free).
- Fill the trough to about two thirds with distilled water; add about 2 spoonfuls of copper sulphate, under stirring, until the solution is saturated.

Set up the experiment as shown in Fig. 1 and Fig. 2, with the switch first open. Plug the electrodes in the trough and connect them with crocodile clips and short connecting cables in such a way that the iron electrode is connected to the negative pole, i.e. is the cathode. Pour a little diluted sulphuric acid in the solution and stir.



Procedure

- Select the 300 mA- measurement range, set the power supply to 0 V and switch it on.
- Close the switch and increase the power supply voltage until about 150 mA have been reached.
- Observe the processes at the electrodes and note your observations in the report.
- After about 3 minutes, open the switch, set the power supply to 0 V and switch it off.
- Rinse the iron electrode with water and take a close look at the part which was immersed; note what you see in the report.
- Dry the copper electrode, properly dispose of the aqueous solution; clean the trough and wash your hands with soap and water.

Report: Galvanisation

Result - Observations 1

Note down your observations during the flow of current:

a) at the anode:

b) at the cathode:

.....

.....

.....

.....

Result - Observations 2

Note down your observations about condition of the iron electrode at the end of the experiment:

.....

.....

.....

.....

Evaluation - Question 1

How can the coating of the immersed part of the iron electrode with a layer of copper be explained?

.....

.....

.....

.....

Evaluation - Question 2

The process by which the surfaces of conducting materials can be coated with a metallic layer by the passage of electric current through a salt solution is called galvanisation. Name examples of galvanised products.

.....

.....

.....

.....