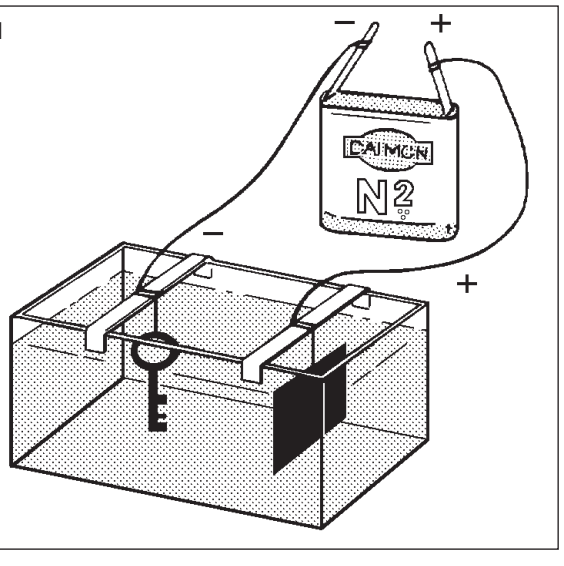
SELVA
Expert's Tips

The Basic Electro-Plating Set

– how does it work? The following sketch shows a basic set-up to roughly explain electro-plating. A metallic object, such as a key, is placed in a glass container filled with an electrolyte (e.g. copper electrolyte) opposite a piece of copper material. Both parts are attached to wires. The electrolyte, a so-called galvanic bath, contains copper, albeit in a chemical solution that makes the metal invisible. If the copper material is connected to the positive pole of a DC source – such as a battery – and the key to the negative pole, current will flow through the bath and invisible copper ions will travel to the key and settle on it as a visible copper coating. Without explaining the physical details, this is a simple way of showing the electro-plating process.

The SELVA Electro-Plating Set is based upon the same principles and the similarities can quickly be recognized.

Illus. 1



The Tampon Method (Basic Set)

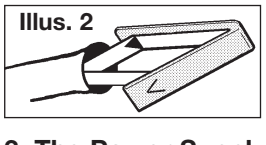
1. Cleaning and Polishing

The object must be completely clean and highly polished. Use the metal cleaner that is included or a similar cleaning agent together with a cloth or paper towel to polish the object until it shows a high gloss without blemishes. The better the surface, the better the plating will be. The plating will not equalize a rough surface or cover scratches! If the plating is just meant for protection (e.g. nickel against rust), a high-gloss finish is not necessary.

2. The Electro-Plating Unit

Choose the proper applicator tip and sponge (see table above right). Soak the sponge in water and squeeze it to remove excess moisture. Place the sponge over the tip and hook it on both sides (Illus. 2). Fit the applicator tip to the tube of the plating unit.

Illus. 2



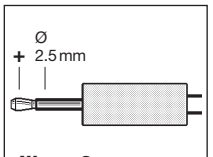
All sponges are identical, but have different colors so that they can be identified and re-used with the same electrolytes. If different electrolytes are allowed to come in contact with each other, they may become inactive.

3. The Power Supply

Use a 3V DC power supply with a diam. 2.5mm plug, approx. 250–300 mAmps.

Please do not use a higher current!

Guide the plug into the plating unit so that it engages easily. The tip of the plug must be connect to the positive pole.



Illus. 3

	Elektrolyte	Applicator Tip	Sponges
Gold-Plating	Gold	Stainless Steel (no markings)	Yellow
Silver-Plating	Silver	Stainless Steel (no markings)	Red
Copper-Plating	Copper I Copper II	Copper Copper	Blue Violet
Nickel-Plating	Nickel	Nickel (marked with small, round dimple close to the hook)	Green
Zinc-Plating	Zinc	Zinc (marked with 2 dimples close to the hook	Black

For a first try, batteries can be used (2 fresh 1.5V C alkaline batteries), positive poles up.
For serious plating, always use a power supply. When using the latter, do not leave batteries in the plating unit.

4. Electro-Plating

Hook the object to be plated to the crocodile clamp of the plating unit. Pour a small amount of electrolyte into a plastic or glass dish. Start with little liquid and add as required since used electrolytes should not be saved. Electrolytes can be used until metal is no longer deposited: The electrolyte is then spent and has to be replaced.

The applicator tip with sponge is dipped into the electrolyte, then the object is held over the electrolyte dish and treated with slow and steady motions of the applicator tip.

Please note: Electrolytes are not applied to an object as paint would be. Electro-plating does not add a layer, the applied current causes metal ions to be transferred to the object's surface. This process takes time and a good contact between sponge and object is required. Do not set the sponge on edge. Applying the electrolyte »like paint« interrupts the flow of current and the result will be poor. Ergo: Rest the sponge on the object and move it back and forth. Dip the sponge every now and then to keep it soaking wet.

5. Finishing

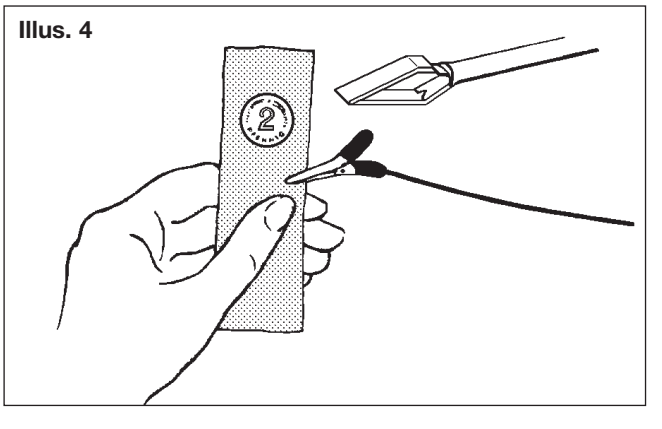
As soon as the plating has reached the desired strength, wash the object under running water and dry it off. Polish it with a polishing cloth, a paper napkin or a soft rag until all mat areas disappear and a high polish is achieved. If necessary, repeat the polishing action. The metal polish is not meant for final finishing, however, if a good polish cannot be obtained, it can be used as follows: Apply a thin coat of metal polish with a finger. Let it dry completely (grayish appearance), then polish carefully.

The First Try

Take a copper coin and thoroughly clean it with a cloth, paper towel and metal polish. Rinse it well. After polishing, the coin should look as new.

Take a strip of aluminum foil and hook the crocodile clamp of the

Illus. 4



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plating unit to it (Illus. 4). Place the coin onto the strip for a good contact. Pour a few milliliters of silver electrolyte into a small dish. Soak the sponge of the applicator tip well, then rub the coin slowly and steadily without interruption. The coin will almost immediately change to a bluish-black color. After approx. 1 minute, rinse the coin in water and polish it with a cloth. A blank silver finish will appear from under the dark coating.

Pour the almost unused silver electrolyte back into its bottle, then plate the other side of the coin with gold electrolyte. This plating, too, will need to be polished.

In between the two plating processes, do not forget to change the sponge and rinse out the dish! After finishing, rinse all parts with water. Corroded applicator tips need to be cleaned up.

Before doing any further plating work, please read these instructions to the end.

Facts to Know

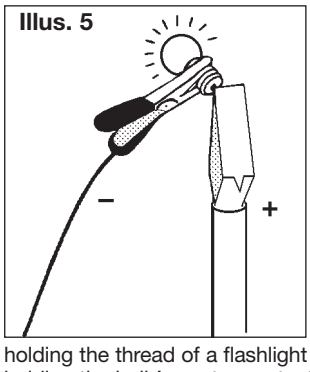
● In normal use, electrolytes do no harm. They should, however, be kept out of the reach of children and away from foods. Eyes should be protected since electrolytes can be caustic (immediately rinse with clear water).

● If a small child accidentally swallows some electrolyte, please contact a physician for advice.

● Never mix electrolytes! Always observe cleanliness. Preparatory work, such as cleaning the metal, should be done very carefully. If the plating results are not satisfactory, it may be due to insufficient preparation.

● Do not stop the plating process too soon. It is better to plate longer to achieve better coverage. This is particularly important when nickel- or copper-plating for rust protection. An excellent rust protection can be achieved by first copper- and then nickel-plating the object.
A rinsing during the process can be of advantage.

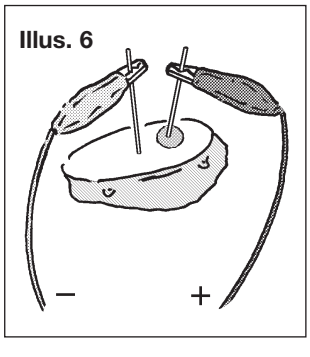
● During plating, touch the object with the wet sponge tip only. Avoid direct contact with the metal applicator tip since this would cause very high energy consumption.



● Please make sure that the crocodile clamp (-) does not touch the tube of the applicator unit or the applicator tip (+). This short-circuits the batteries causing them to discharge or the power supply could be overloaded. This is particularly important when packing the unit away with the batteries installed.

● If the plating process with silver or copper does not begin within seconds, first check the flow of current. That can be done by holding the thread of a flashlight bulb to the crocodile clamp while holding the bulb's center contact against the applicator tip. The bulb should now light up (Illus. 5).

● If you are not entirely sure if the applicator tip is connected to »+«, you can do the following experiment:



Take half of a potato. Stick two copper wires into the cut surface with a gap of approx. 0.5–1 mm between the wires. Connect the wires to the crocodile clamp and the applicator tip. After approx. 2 to 5 minutes, a bluish green ring will form around the positive pole (Illus. 6).

● Some metal objects are protected by invisible coats of lacquer. These have to be completely removed with solvents. Anodized objects cannot be plated at all.

● If unused electrolytes show sediments of crystals or flakes (caused by cold storage conditions), these will disappear after heating the electrolyte to 25 to 40 °C and shaking it.

● If, during plating, the sponges discolor, e.g., dark blue during gold-plating, this is a normal process. The discoloration can be partially washed out and the sponges re-used.

Electro-Plating Characteristics

● Gold electrolyte contains pure 24-carat gold. The concentration is less than in, e.g., copper electrolytes – making the plating process slower.

● If Copper II electrolyte is used with the tampon process, it needs to be diluted with water (1:1).

● **Tin- and zinc-plated objects** (screws are often zinc-plated) cannot be plated directly with Copper II. The copper transfer will be poor and there might be black discoloration. In such cases, plate with Copper I electrolyte.

● When plating with silver, a bluish discoloration may occur but will disappear during polishing.

● Before copper- or silver-plating stainless steel or chrome, a coat of nickel has to be applied first. A base nickel coat can also be advantageous before gold-plating. It is best to perform a test. If batteries are used, a nickel base coat is mandatory. When nickel-plating, apply the electrolyte with circular motions to avoid edges in the plated surface. Keep the applicator sponge wet at all times.

To electro-plate chrome parts, a power supply should be used since the unstable current from batteries can cause unsatisfactory results. The nickel plating on stainless steel or chrome does not have to be particularly heavy since it is only used as a base. It does, however, have to cover the entire surface.

● Brass, copper, nickel and iron can be plated directly. On iron, use Copper I first.

● To gold- or silver-plate tin or lead, proceed as follows: After preparing the object, first plate with Copper I (not too thin), then apply a heavy coat of nickel and polish. Now, other applications, such as gold, can follow. If no base coat is applied, the gold-plating can disappear in the relatively soft base metal. This is particularly true if the surface is relatively rough and does not have a good polish. The disappearance can even happen at a later time making it very important to carefully apply the two base coats.

● Aluminum, too, can be electro-plated. First, thoroughly clean the object with a scouring powder (e.g. Ajax) and a damp cloth. The scouring powder has to remove the top layer (i.e. the oxidation) from the aluminum surface. Rinse and dry, then clean with metal polish and rinse again. Now apply a base coat of Copper II. With aluminum, the plating process will be slower than usual.

Partial Electro-Plating

If parts of an object are masked, these parts will not be plated. Highly unusal effects can be created by having different metallic finishes right next to each other. The masking can be done with lacquer (e.g. nailpolish) that can afterwards be removed with nail-polish remover or solvent.

Example: Using diluted nailpolish, draw initials onto a copper bracelet. Silver-plate the bracelet, then remove the nailpolish. The initials now appear copper-colored on a silver-plated background.

The Supplementary Electro-Plating Set

There are, of course, many more interesting possibilties to try!

Further plating projects can be realized with the SELVA Electro-Plating Supplementary Set No. 547-421-1 (immersion plating).

1. Electro-Plating Small Parts

If the object to be plated is very small or filigreed, e.g., a chain, pour enough electrolyte liquid into the tub to completely cover the object. Move the applicator tip (with sponge) around the object at a close distance. To silver- or gold-plate, use a stainless steel tip, to nickel-plate a nickel tip. The current flows from the applicator tip through the electrolyte to the object, which is connected to the negative pole of the power source. When plating chains, please make sure that there is sufficient contact between the individual links! In most cases, it is best not to hook up the object itself, but to use a short piece of wire with which the immersed object is then contacted. This is an excellent method to plate coins, for example.

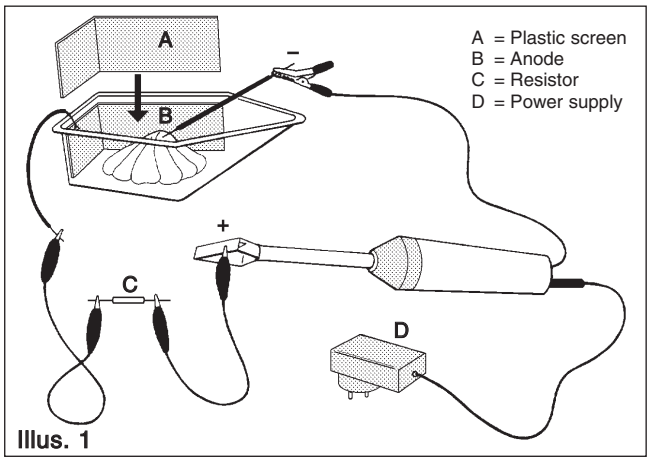
Little used, clean electrolytes can be poured back into their bottles for later use.

2. Electro-Plating Non-Metallic Objects

While it is possible to use batteries in tampon plating, an AC/DC power supply is indispensable for immersion plating. A suitable unit can be found in the SELVA program.

Since non-metallic objects do not conduct current – which is absolutely essential for plating – the surface has to be made conductive with a special lacquer (SELVA Order No. 549-161-1). Apply the lacquer to the object with a soft paintbrush and let it dry thoroughly before beginning with the electro-plating. Hook up the lacquered object the same as a metallic object and electro-plate in the tub. Since the lacquer coating is very sensitive, the contacts have to be very soft (e.g. aluminum foil) so that the lacquer coat is not injured. Also, it is best to begin with a low current and several points of contact until a first coating of copper is built up, then increase the current level to normal. If the slow start-up procedure is not followed, the lacquer coating can be burned off at the contact points.

Prepare the plating bath while the lacquer is drying. Remove the insulation from both ends of a 15cm wire and connect the latter to



Illus. 1

the angled copper anode. Place anode (B) in the tub so that it rest against two vertical sides. Place plastic screen (A) in front of the anode so that the plating object cannot touch the anode and thus is protected from short-circuiting.

First fill the tub with Copper II electrolyte.

Hook up a current supply as shown in Illus. 1.

Attach a wire or strip of aluminum foil to the object to be plated and to the negative pole of the plating unit (included in the Basic Plating Set). Connect anode (B) – with one or more inline resistors – to the applicator tip (positive pole). Use resistors on the positive side only. Usually, aluminum foil is better suited than wire to make contact with sensitive objects, e.g., wrap one end of a leaf with foil and extend the latter from the tub for hook up to the positive wire. After a time, reposition the contact area.
Please make sure that the clamps do not come in contact with the electrolyte. They corrode quickly.

3. Voltage, Current Strength, Resistance

These three parameters must be properly adjusted when electro-plating.

a) **Voltage:** A 3V current is needed – the same as in tampon plating.

b) The proper **current strength** depends on two factors. For one, standard power supplies are designed to provide approx. 200–300 mAmps. If more current flows, e.g., when short-circuiting, the power supply may be damaged. To ensure that this does not happen, a 4.7-ohm resistor has to be connected (see sketch). This resistor is marked with 4R7 or the following color bands: Yellow, violet, gold/yellow, gold/yellow (from the left).

On the other hand, the current strength in relation to the object's plating area should neither be too high nor too low. If an object has an area of just 2 cm^2, this will theoretically result in 140 mAmps/cm^2, which is too high – a more powerful resistor has to be used (e.g. 10 ohms). More details are found in the chart below. The 10-ohm resistor is marked 10R or with these color bands: Brown, black, black, gold/yellow, gold/yellow (from the left).

c) The correct **resistance**

Basic Rule: If the plating at the outer edges of the object becomes rough, mat or reddish brown, the current strength is too high.

If the plating is rough and mat at the center of the object, the current strength is too low for the plating area. Since the power supply should not be loaded beyond its rating, the area of the object in the

Current (V)	Total surface area of the object (cm^2)	Resistor(s) Ohms (R)
3 Volts	approx. 8 and larger approx. 8–6 approx. 6–4 approx. 4–3 below 3	4.7 10 14.7 20–24.7 24.7–34.7

bath has to be reduced. This is done by partially removing the object from the bath. Use plenty of motion to avoid visible edges on the plated surface.

4,7 – 10 – 10 = 24,7 Ohms (R)

Guide for selecting resistors:

The resistors can be hooked up in series to add up as follows:

Since the shape of the object matters, it is not possible to preselect a resistor for any given plating area. For example, a flat and multi-corned object will require values different from a smooth, ball-shaped object.

4. Plating Time

If an object is solid, e.g., a walnut, and is only to be covered with a copper plating, approx. 3 hours are required. However, the time strongly depends on the size of the object. After this time – or even in between – check to see if the plating is even and heavy enough. If unplated areas are found, they need to be corrected. Repair the lacquer coat and plate again.

If – in contrast to a solid object – a leaf, for example, is to be copper-plated so that it can be used as jewelry, approx. 10 hours plating time – depending on size – are required. The copper coat has to be strong enough to give the object stability. Here, only guide values can be given – the hobbyist has to judge wether the plating thickness is sufficient for the purpose. If the object is to be gold-plated afterwards, the surface has to be carefully checked to see if the copper plating is pervious in any area. If this is the case, it can have a negative influence on the quality of the gold-plating. It is, therefore, best to use an eyeloupe for a thorough examination!

Along with chosing the proper resistor(s), **it is very important** to keep the object in motion (at least once per hour or more) and to change its position from time to time so that the contact wire does not attach itself to the object.

If a check-up shows mat areas in the plating, correct the current strength according to § 3c. Correct mat areas by polishing them with a soft cloth in between or at the end of plating.

If the object is coated with a sufficiently strong and even layer, rinse it well under running water. After drying, a final polish can add additional luster.

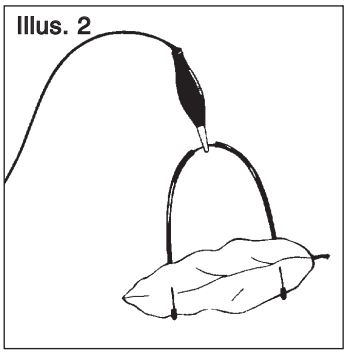
Polish small crevices with a toothbrush and metal cleaner. Apply the latter in a thin layer and let dry before brushing.

First Test with Conducting Lacquer

For this test, use, e.g., a laurel leaf coated on both sides with conducting lacquer. After drying, wrap a strip of aluminum foil around one end of the leaf. The strip should be long enough to attach a clamp to it outside of the tub.

Use a 4.7-ohm resistor for a medium-size leaf and immerse the leaf into the bath. While it will almost immediately become pink, it will take some time before a glossy copper coating is obtained. After approx. 15 minutes, move the contact area to the opposite side of the leaf.
It is left to the individual hobbyist's skills to make up fixtures, e.g.,

If, during an intermediate check, mat russet areas show along the edges, the current strength is too high – please correct accordingly. If the mat areas are more toward the center of the object, the current is too weak. Reduce the size of the immersed area of the object and let some of it protrude from the bath.



If an object has a good copper surface, it can be gold- or silver-plated using the tampon process. It is, however, recommended to apply a thin coat of nickel beforehand. Without this, it is possible that the gold-plating will »sink in«, e.g., when heated or under sunlight. The nickel-plating can be considered a »primer«.

Non-conducting objects that swell up in a bath (e.g. wood) must be insulated before the conductive lacquer is applied. This can be done with enamel lacquers.

Lengthy plating will cause residue in the bath, which then has to be filtered (coffee filter). Clean the anodes in between and after plating.

The copper anode slowly disintegrates during plating and then has to be replaced. This disintegration has the advantage that the copper concentration in the electrolyte remains constant.

Electro-Plating Tin Figures

The surface of the figure must be blank. It is best to prefinish with a rotating brush and a polishing compound without anti-oxidants (e.g., SELVA Metal Cleaner No. 548-900-2). On soft metals, the final finish is achieved by polishing without compounds.

Please note: The finish of the electro-plated surface will only be as good as the preparation of the blank surface!

The best method for plating irregular shapes is a combination of manual application and immersion plating.

The first step is copper-plating: Pour alkaline Copper I electrolyte into the tub of the Supplementary Plating Set. The plating, however, is done with the plating rod. Connect the figure to the negative end of the plating rod and dip it into the electrolyte in the tub (rubber gloves recommended!) while brushing the figure in the tub with the sponge-covered copper anode of the plating rod. The figure does not actually need to be touched by the sponge, it is sufficient to just circle around the object to ensure that the copper plating on the entire surface will be perfectly even. In the end, there has to be a visible layer of copper. After rinsing, polish this layer.

Before silver- or gold-plating, we recommend the application of a nickel layer. The method of application is identical to copper-plating except for the use of nickel electrolyte, a nickel anode (marked with a dimple) and a nickel sponge (green).

After polishing this intermediate layer, the surface can be silver- or gold-plated – using the corresponding supplies – as described above.

In all phases, it is clearly recognizable that a brilliant plated surface is achieved only in areas that had previously been properly polished. Cracks and crevices in the surface will remain mat or dark, which – in most cases – will result in a desirable patina effect.

A Few Suggestions

If something does not function properly, please thoroughly re-read these instructions.

Where does the problem lie? Are the proper applicator tips and sponges being used? Is the correct electrolyte in use?

Has all preparatory work been done meticulously? Is the current strength correct?

If none of these points lead to an improvement, start over and alter the parameters step by step. E.g., try another material (brass or copper are best) to test if plating is then possible.

When trying to eliminate or correct problem areas, please change one parameter at a time.

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