Electroplating

Electroplating is a plating process that uses direct current in order to deposit thin layers of the desired metals from a solution of their salts on electrically conductive objects.

Before the electroplating can begin, various preparatory, mainly cleaning, techniques must be applied to the surfaces of the electroplated objects in order to ensure quality plating. These techniques are as follows:

- Degreasing
- Pickling (activating - dissolving thin oxide layers on the objects' surfaces, using mostly acids)

GENERAL RULES AND RECOMMENDATIONS FOR ELECTROLYTIC FINISHES

For decades, fashion jewellery stones by Preciosa have been regarded as the most resistant on the world market. By constantly improving the formula for the foil's composition, Preciosa ensures that the foil's resistance abilities are continuously raised, thus keeping ahead of its competitors.
A quality foil helps to rectify some of the faults caused by the electroplating process' instability, contributing to the product's perfect appearance, and guaranteeing the fashion jewellery producers the highest possible manufacturing productivity.

To ensure high labour productivity and to avoid excessive costs resulting from the necessity of replacing (resetting) huge numbers of damaged stones, use either quality stones or, better still, complete fashion jewellery components by Preciosa. Either choice guarantees excellent resistance values of the stones' foil layer.

Besides using top-quality stones or components by Preciosa, you can raise labour productivity still higher by creating optimum manufacturing conditions, ranging from using the best semi-finished products and appropriate tools to applying these well-tested procedures.

You can avoid irreversible damage to Preciosa stones used by observing the recommended parameters of the electroplating process given below.

Warning:

- Long exposure times in highly alkaline and cyanide baths in combination with high current densities may result in chemical or mechanical damage to the reflexive layer on the bottom of the stones, thus destroying it totally.
- **It is, therefore, strongly recommended to avoid using cyanide brass or bronzing baths.**
- The utmost caution must be exercised when using cyanide copper bath.
- All operations that follow after the fashion jewellery components have been soldered together must be carried out quickly, one after another, so as to avoid undue time delays.

SETTING STONES IN CUP CHAINS

Setting stones in cup chains must be done cautiously and carefully so as not to crush the stones' edges.
It is also undesirable to damage the protective lacquer, especially at the point of contact between the stone and cup, to such an extent that the electrically conductive material of the cup comes into contact with the reflexive layer under the protective lacquer.

DEGREASING

It is advisable to degrease the fashion jewellery components shortly after they have been soldered together. If postponed until a later time (by a few hours, or even until the next day), degreasing may not be as effective as required.

1. Hot Degreasing

A warm alkaline electroless bath is used as the first stage of degreasing. This removes most of the impurities and soldering residues.

Bath parameters: T < 60°C/140°F; pH < 12,5; t < 5min.

Rinsing the product after the degreasing process in room temperature water for 30 seconds is quite sufficient.

It is possible to markedly accelerate this process by using ultrasound. In that case, the time necessary for degreasing does not exceed two minutes.

Warning:

If the ultrasound used is too strong and the degreasing time too long, the protective lacquer applied to the reflexive layer may become damaged.

2. Electrolytic Degreasing

Electrolytic degreasing is suitable as the second stage of final degreasing, primarily for fashion jewellery formed from cup chains of brass and other nonferrous metals. Cathodic degreasing is used only.

Bath parameters: T < 45°C/113°F; pH < 12; t < 20 sec., with the current density lower than 3A/dm^2.

Rinsing the product after the degreasing process in room temperature water for 30 seconds is quite sufficient.

Warning:

The recommended current density and degreasing times must not be exceeded; otherwise the stones' reflexive layer may become damaged.

PICKLING

To remove oxides and soldering residues, pickling is carried out in dilute acids (ca 5% HCl or H_2SO_4).

Bath parameters: T < 30°C/85°F; pH < 1; t < 20 sec.

Rinsing the product after the pickling process in room temperature water for 30 seconds is quite sufficient

Warning:

Never use nitric acid (HNO_3) for pickling as it etches and passivates tin solder.

CYANIDE COPPER PLATING

This technique helps improve the adhesion of the copper deposit to the product's surface. Under certain conditions, copper deposits do not adhere well to the solder used.

Bath parameters: T < 60°C/140°F; pH < 10,5; t < 60 sec.; with the current density lower than 2A/dm^2.

Rinsing the product after the cyanide copper plating process in room temperature water for 30 seconds is quite sufficient.

Warning:

The current density and degreasing times must not be exceeded; otherwise the stones' reflexive layer may become damaged.

BRIGHT COPPER PLATING

A glossy sulphurous copper bath is highly recommended because it is able to smooth the unevenness of the product's surface, adding a high gloss to it.

Bath parameters: T < 30°C/85°F; pH < 1; t < 10 min.; with the current density lower than 3A/dm^2.

Rinsing the product after the bright copper plating process in room temperature water for 30 seconds is quite sufficient.

Warning:

The stones' AB layer, if used, may become unintentionally plated as well, and thus damaged if the recommended plating times were exceeded.

NICKEL PLATING

As nickel (Ni) is an allergen, nickel plating is not used for hygienic reasons. The Ni layer is usually substituted with palladium or silver.

If it is possible or necessary to use nickel plating, the usual chloride nickel bath is recommended. This bath does not damage fashion jewellery stones.

Bath parameters: T < 60°C/140°F; pH = 4-5; t < 20 min.

Rinsing the product after the nickel plating process in room temperature water for 30 seconds is quite sufficient.

Warning:

When stones with the AB layer are used, their surface is often unintentionally plated in quite a short time. If this is the case, the plating time should not exceed three minutes.

PALLADIUM PLATING

Palladium is used instead of nickel as a white interlayer. Bronze used as a substitute for nickel is unacceptable because of the bronzing baths' aggressiveness that damages fashion jewellery stones.
Bath parameters: T < 30°C/85°F; pH < 8-9; t < 2 min.; with the current density lower than 1A/dm^2.
Rinsing the product after the palladium plating process in room temperature water for 30 seconds is quite sufficient.

SILVER PLATING

Even though silvering baths have a high cyanide content and are highly alkaline, they work at a room temperature and therefore do not damage the stones.
Bath parameters: T < 30°C/85°F, pH < 12; t < 1 min.; with the current density lower than A/dm^2.
Rinsing the product after the silver plating process in room temperature water for 30 seconds is quite sufficient.

RHODIUM PLATING

Rhodium baths based on sulphates or phosphates deposit highly glossy layers. The baths' chemical properties are not hostile to fashion jewellery stones.
Bath parameters: T < 50°C/121°F, pH < 1; t < 1 min.; with the current density lower than 1A/dm^2.
Rinsing the product after the final rhodium plating process must be done in two stages:

a) In room temperature water for 30 seconds
b) Final rinsing in water 60°C/140°F warm for 30 seconds

Rinsing is then followed by drying the product in a dryer at a temperature of T < 90°C/194°F

GOLD PLATING

For gold plating, two types of gilding baths are used: either the alkaline one (pH 9-10), or the acid one (pH 3-4).
The gilding baths' chemical properties are not hostile to fashion jewellery stones.
Alkaline baths deposit layers of < 0,2 µm thickness. If thicker gold layers are required (up to 1µm), it is necessary to use an acid gilding bath.
Bath parameters: T < 60°C/140°F; t < 1 min., with the current density lower than 1A/dm^2.
Rinsing the product after the final cold plating process must be done in two stages:

a) in room temperature water for 30 seconds
b) final rinsing in water 60°C/140°F warm for 30 seconds

Rinsing is then followed by drying the product in a dryer at a temperature of T < 90°C/194°F.

TARNISH PROTECTION

To protect cup fashion jewellery's metal parts, electrophoretic coating (cataphoresis) is commonly used. This technique enables organic lacquers to be deposited, mostly based on acrylates, evenly on electrically conductive fashion jewellery parts, allowing the glass stones to remain uncoated.
The lacquers' chemical properties are not hostile to fashion jewellery stones.

Following the above rules and recommendations and using fashion jewellery stones and components by Preciosa guarantees excellent results.

Troubleshooting

Fault	Remedy
Imperfect appearance of the product's surface before electroplating	Clean the product thoroughly; first mechanically, then chemically, using a degreasing bath, and finally rinse the product thoroughly.
Rough surface after electroplating, a so-called "orange peel" texture	Polish the surface better next time, or perhaps check the technological properties of the electroplating bath used.
Tarnished surfaces	Rinse the product with pure water only - demineralized water (electric conductivity <15µS/cm) is strongly recommended. Always minimize time delays between individual successive operations.

BASIC PARAMETERS OF ELECTROPLATING BATHS

Operation/ Plating	Bath description	Temperature		Acidity/ alkalinity	Time		Current density	Rinsing		Drying
		°C	°F	pH	Ultrasound Yes / No		A/dm^2	1st Stage T= 20°C 68°F	2nd Stage T= 60°C 140°F	T= 90°C 194°F
Hot Degreasing	Alkaline electroless bath	< 60°C	< 140°F	< 12,5	yes<2mi	no<5m		30 sec.	no	no
Electrolytic Degreasing	Alkaline bath for cathodic degreasing	< 45°C	< 113°F	< 12,0	no < 20 sec.		< 3 A/dm^2	30 sec	no	no
Pickling	Dilute acids 5% HCl or 5-10% H_2SO_4	< 30°C	< 85°F	< 1	no < 20 sec.			30 sec.	no	no
Cyanide Copper Plating	Warm cyanide copper bath	< 60°C	< 140°F	< 10,5	no < 30 sec.		< 2 A/dm^2	30 sec.	no	no
Bright Copper Plating	Glossy acid sulphurous copper bath	< 30°C	< 85°F	< 1	no < 10 min.		< 3 A/dm^2	30 sec.	no	no
Nickel Plating	Chloride or sulphurous nickel bath	< 60°C	< 140°F	4 - 5	no < 20 min.		< 9 A/dm^2	30 sec.	no	no
Palladium Plating	Cold, weakly alkaline bath	< 30°C	< 85°F	< 8 - 9	no < 2 min.		< 1 A/dm^2	30 sec.	no	no
Silver Plating	Cold cyanide bath	< 30°C	< 85°F	< 12,0	no < 1 min.		< 2 A/dm^2	30 sec.	no	no
Rhodium Plating	Sulphate- or phosphate-based baths	< 50°C	< 121°F	< 1	no < 1 min.		< 1 A/dm^2	30 sec.	30 sec.	yes
Gold Plating I	Acid gilding bath	< 60°C	< 140°F	2 - 5	no < 1 min.		< 1 A/dm^2	30 sec.	30 sec.	yes
Gold Plating II	Alkaline cyanide gilding bath	< 60°C	< 140°F	9 - 10	no< 1 min.		< 1 A/dm^2	30 sec.	30 sec.	yes

For more information, please visit www.preciosa.com or contact us at info@preciosa.com