Palladium 459

Operating Instructions

Edition: 30 January 2006

- **weakly alkaline palladium electrolyte**
- **deposits bright, decorative, light palladium layers up to 0.5 µm**
- **as pre-palladium layer and diffusion barrier**
- **as final layer up to 0.5 µm in the jewellery and spectacle frame industry**

Bath Characteristics

Palladium 459 is a weakly alkaline electrolyte for the deposition of bright, decorative, light palladium layers up to 0.5 µm thickness.
Palladium 459 can be used as a pre-palladium and as a diffusion barrier, or as a final layer up to 0.5 µm for decorative applications, e.g. in the jewellery and spectacle frame industry.

Bath type:	ammoniacal	
Palladium content:	1.5 - 2 g/l	
pH-value:	as pre-palladium:	7 - 7.2
	as final layer:	8.5 - 9
Temperature:	25 - 30 °C	
Current density:	approx. 0.5 A/dm²	
Deposition speed:	up to 0.07 µm/min	

Coating Characteristics

Coating:	approx. 99.9 % palladium
Density of the coating:	approx. 11.8 g/cm³
Colour:	white, light/bright
Hardness:	approx. 230 - 250 HV
Contact resistance:	approx. 1.1 mΩ

Form of Supply

Bath makeup: for 1 l of bath

a) Palladium 459 Initial Concentrate
free of precious metal, 700 ml
storage stability: min. 2 years

b) Palladium Solution 460
100 g/l of palladium,
20 ml containing 2 g of palladium
storage stability: min. 2 years

Bath replenishment: for 100 g of Pd

c) Palladium Solution 460
(as item b)
1000 ml containing 100 g of Pd
storage stability: min. 2 years

d) Palladium 459 Replenisher Solution 1
free of precious metal, 250 ml
storage stability: min. 2 years

e) Palladium 459 Replenisher Solution 2
free of precious metal, 250 ml
storage stability: min. 2 years

Correction chemicals:

f) Palladium Density Correction Salt 1
approx. 18 g/l per 0.01 g/cm³
storage stability: unlimited

g) for adjustment of the pH-value
ammonia solution or phosphoric acid
(both p.a. quality)

Bath Makeup

To make up 1 l of bath, add 20 ml of Palladium Solution 460 (2 g Pd) to 700 ml of Palladium 459 Initial Concentrate and fill up to 1000 ml with deionized water. Filter the solution (continuously) and adjust the pH-value to the desired specified value with ammonia solution or phosphoric acid (both p.a. quality).

Palladium 459

Operating Conditions

Palladium content:	1.5 - 2 g/l
Operating temperature:	25 - 30 °C
pH-value:	as pre-palladium: 7 - 7.2 as final layer: 8.5 - 9
Current density:	approx. 0.5 A/dm²
Deposition speed:	0.07 µm/min (at 0.5 A/dm², pH 9) depends on pH and current density (see deposition rate)
Deposition rate:	2.5 mg/Amin at 0.5 A/dm², pH 7 15.6 mg/Amin at 0.5 A/dm², pH 9 1.5 mg/Amin at 1.0 A/dm², pH 7 10.8 mg/Amin at 1.0 A/dm², pH 9 all data are a guide only
Movement of parts:	required, at least 4 cm/sec
Bath agitation:	required, air agitation is not permitted!
Bath density:	1.08 - 1.09 g/cm³ (11 - 12 °Bé)

Bath Replenishment

The palladium content should be kept at the recommended concentration of 1.5 - 2 g/l.

To replenish 1 g of palladium, add:

10 ml of Palladium Solution 460
2.5 ml of Palladium 459 Replenisher Solution 1
2.5 ml of Palladium 459 Replenisher Solution 2.

The stated amount covers the normal electrolytic consumption. Higher drag-out losses are not taken into consideration and may necessitate addition of palladium as well as of replenisher solutions.

An automatic replenishment should be carried out only after measurement of the deposition rate. See "Operating conditions/Deposition rate".

Bath Monitoring and Correction

The **palladium content** should be monitored by regular analysis and if required it should be corrected to specified value with Palladium Solution 460.

The **pH-value** should be monitored daily and adjusted to the specified value by adding ammonia solution or phosphoric acid (both p.a. quality). See remarks at "Special Process Hints/pH-value".

Correction of the density
By additions of Palladium Density Correction Salt 1. To increase the density by 0.01 g/cm³ approx. 18 g/l Palladium Density Correction Salt 1 is required.

Influence of **contaminants**:

Very important: The bath is very sensitive to **cyanide** contamination! Any drag-in of cyanide must be avoided. The parts must be rinsed very well before placing them in the palladium bath, particularly in the case of a preceding gold strike bath or a cyanide containing process step. Any rinse water must be cyanide-free! Placing the palladium bath next to or in the vicinity of cyanide baths must be avoided. Cyanide contamination shows in the formation of cracks and unsightly coatings (hazy, matt).

Metallic impurities like copper, nickel and zinc >10 mg/l (sum of metallic impurities) interfere with the plating and result in dark/hazy matt coatings, especially in low current density areas. See "Special Process Hints/Metallic impurities".

Organic impurities e.g. by drag-in from bright nickel baths are sometimes shown by a small amount of a whitish-yellow precipitation in the bath. This precipitation can be filtered off without loss of function. Further drag-in must be avoided by appropriate rinsing processes. See "Special Process Hints/Active carbon treatment".

Special Process Hints

Pre-treatment:	Cleaning and degreasing of the parts can be carried out using the usual processes. Palladium 459 is predominantly deposited on copper and copper alloys.
Post-treatment:	The coatings can be lightened by a post-treatment in hot water. Water temperature >90 °C. Immersion time 1 Minute.
Removal of metallic impurities:	Copper and nickel can be almost completely removed by a treatment with Ion Exchange Resin 1. Zinc is removed only partially. Application: apply approximately 10 ml resin for 100 mg of impurities under continuous stirring max. 4 hours. Palladium will not be bound.

Palladium 459

Active carbon treatment:	In case of brittleness or lack in brilliance caused by organic contamination an active carbon purification is necessary. For this, stir 6 g/l Active Carbon 1 for one hour into the bath, allow to settle and filter off subsequently. By this active carbon treatment also important components are removed. Therefore after such an active carbon purification the electrolyte must be analysed and adjusted. Palladium is hardly removed.
pH-value:	With continuous high bath load the volume of the bath can increase. In this case the pH-value can be adjusted by blowing in ammonia gas. The blow in should be performed via a distributor with a stop valve.

Equipment

Bath tanks:	plastic tanks, preferably PVC or polypropylene unpigmented
Heating:	immersion heaters made of quartz, porcelain, or Teflon with temperature control
Bath agitation:	required, air agitation is not permitted!
Filtration:	via magnetically coupled pumps with polypropylene filter cartridges. The filter capacity should be at least twice the bath volume per hour.
Anodes:	We recommend to use our PLATINODE® 167 as anode material. **Important:** Stainless steel or platinized titanium must not be used under any circumstances. The use of such materials causes permanently considerable problems and result in new make up of the bath. Ratio of anode area : product area at least 2:1 The anode current density should be max. 1 A/dm².
Holding devices for parts:	titanium
Racks:	coated with alkali-resistant plastic
Rectifier:	continuously adjustable, with current display; residual ripple ≤ 5 %
Exhaust system:	required to remove ammonia fumes that are a nasal nuisance

Note

Our information relating to the storage stability refers to storage in closed original storage containers under the conditions stated on the label.

Precautionary Measures/Safety Hints

For information on safety, please see the corresponding Material Safety Data Sheets! The valid accident prevention regulations and safety information must be observed.

Reference to

Analytical control:	available upon request
Ion Exchange Resin 1:	available upon request

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