

RHODUNA® TD

Operating Instructions

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Brilliant-white rhodium for decorative and technical applications

- ultra-bright coatings with previously unattained lightness
- high deposition capacity
- good covering speed
- excellent throwing power
- for rack and barrel operation

Bath Characteristics

RHODUNA® TD deposits brilliant-white, ultra-bright coatings up to a thickness of approx. 0.5 µm. It is additionally characterized by high covering speed and excellent throwing power.

Rhodium can be directly deposited on silver, gold, copper and copper alloys, nickel and nickel alloys. When plating tin, lead, zinc, cadmium, aluminium and iron, intermediate nickel coatings of some µm thickness are absolutely essential. Pre-nickel plating is advantageous with all substrates.

Rhodium content:	2 g/l	(1 – 3 g/l)
pH-value:	< 1	
Temperature:	40 °C	(RT – 65 °C)
Current density:	1 - 2 A/dm ²	(0,5 – 10 A/dm ²)
Deposition speed:	7.5 mg Rhodium/Amin at 1 A/dm ² , 0.1 µm in approx. 1.7 minutes (at 40 °C)	

Coating Characteristics

Coating:	Rhodium
Colour:	Brilliant white
Hardness:	Approx. 800 - 900 HV
Density of coating:	Approx. 12 g/cm ³
Max. coating thickness:	Approx. 0.5 µm

Form of Supply

Bath makeup:	a) RHODUNA® TD Initial Concentrate (containing acid) 200 ml packages with 2 g rhodium content 200 ml for 1 litre of bath with 2 g/l of Rh. Storage stability: min. 2 years
Bath replenishment:	b) RHODUNA® TD Replenisher Solution (containing acid) 100 ml packages with 5 g rhodium content Storage stability: min. 3 years

Bath Makeup

Makeup sequence:	for 1 litre of RHODUNA® TD bath with 2 g/l of Rh: Slowly stir 200 ml of RHODUNA® TD Initial Concentrate into 800 ml of deionized water.
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Operating Conditions

Rhodium content:	2 g/l (1 - 3 g/l)
Sulphuric acid content:	30 g/l after bath makeup with 2 g/l of Rh. For further details, see "Bath Replenishment".
Operating temperature:	40 °C (RT - 65 °C)
pH-value:	< 1, no monitoring required.
Bath density:	1.023 g/cm ³ when newly made up with 2 g/l of Rh, slowly rising.
Product agitation:	Optional . Mechanical tapping to dislodge adhering hydrogen bubbles is recommended.
Voltage and current density:	2 volts (2 - 4 volts) 1 A/dm ² (0.5 - 10 A/dm ²) For thin deposits a significantly higher current density & voltage is advantageous to achieve the best brightness (see under "Special Operating Conditions/Cost saving conditions for thin ultrabright deposits").
Current efficiency:	35 % at 1 A/dm ² 20 % at 2 A/dm ²
Deposition rate:	7.5 mg/Amin at 1 A/dm ² 4.3 mg/Amin at 2 A/dm ²
Deposition speed:	0.06 µm/min at 1 A/dm ² , i.e. 1 µm in approx. 17 minutes 0.07 µm/min at 2 A/dm ² , i.e. 1 µm in approx. 14 minutes. All data refer to 40 °C and should be considered as standard values only. The deposition speed will slowly decrease due to the increasing content of sulphuric acid.

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At room temperature deposition rate, efficiency and deposition speed will be reduced to about half of the stated values.

Barrel plating: RHODUNA® TD is also excellently suited to barrel plating.

Recommended standard values:
 Current density: approx. 1 A/dm²
 Voltage: 6 - 9 volts
 Temperature: 40 °C
 Deposition speed: approx. 0.03 µm/min

This value is given as a rough guide only since the deposition speed depends on type and rotation of the barrel as well as shape and number of parts in the barrel.

Loading per litre: Max. 1 A/l

Calculation of Coating Thickness and Plating Time

Coating weight in mg = $\frac{\text{surface in cm}^2 \times 1.2 \times \text{coating thickness in } \mu\text{m}}{\text{deposition rate in mg/Amin} \times \text{current in amperes}}$

Plating time in minutes = $\frac{\text{required coating weight in mg}}{\text{deposition rate in mg/Amin} \times \text{current in amperes}}$

Bath Replenishment

The rhodium content of the bath should be constantly kept at a level of 2 g/l. Replenish at the latest when 20 % of the rhodium content (= 0.4 g/l Rh) have been consumed.

Per 1 g of Rh deposited, add to the bath:

20 ml/l RHODUNA® TD Replenisher Solution (5 g Rh/100 ml)

At 1 A/dm² (35 % current efficiency), 1 g of rhodium is plated after a charge transfer of 134 ampere minutes, at 2 A/dm² after 233 ampere minutes (values for 40 °C).

The content of sulphuric acid, which is adjusted to 30 g/l when making up the bath, will slowly rise during operation of the bath. This will not adversely affect the rhodium coatings. However, the deposition speed will drop with the content of sulphuric acid rising.

When reaching a content of 100 g/l of sulphuric acid, a new bath should be made up.

Bath Monitoring and Correction

Keep the bath clean. Cover when not in use and remove the platinized titanium anodes from the bath. Store in a closed bottle when not in use for a longer period of time. Filter turbid baths.

Always correct the **rhodium content** with RHODUNA® TD Replenisher Solution (5 g Rh/100 ml).

An **active carbon treatment**, e.g. for removing organic contaminants, can be carried out without any significant loss of rhodium. Add 2 g of Active Carbon 1 per litre of bath in a separate tank, stir for 2 hours at operating temperature and then filter.

Avoid any **metallic contaminants** (silver and copper in particular) and drag-in of cyanide!

Special Process Hints

Cost saving conditions for thin ultra-bright deposits: For thin deposits a significantly higher current density & voltage is advantageous to achieve the best brightness. For excellent results with a very short plating time we recommend the following

Operating Conditions:

4 volts (10 A/dm²)
 10 - 20 s plating time
 65 °C
 no movement required

Pre-treatment: Etch, grind, polish etc. the base metal to achieve the desired initial surface condition. Preliminary degreasing should be effected with e.g. an alkaline cleaning solution, or an ultrasonic bath. Rinse, then degrease electrolytically, rinse under running water, and finally with deionized water.

Pre-nickel plating: Rhodium can be directly deposited on silver, gold, copper and copper alloys, nickel and nickel alloys. When plating tin, lead, zinc, cadmium, aluminium and iron, intermediate nickel coatings of some micrometres thickness are absolutely essential.

When nickel plating is completed, rinse thoroughly. Each rinsing operation before rhodium plating should consist of rinsing under running water followed by rinsing with deionized water.

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Acid dip: After degreasing or pre-nickel plating, dip the workpieces in 5 vol.% sulphuric acid (chemically pure) at room temperature before hanging them into the rhodium bath to ensure that no alkalis are dragged into the rhodium bath.

If particularly great difficulties are encountered in wetting after pre-nickel plating, repeat the electrolytic degreasing and acid dip treatments. The last step before rhodium plating should always be an acid dip treatment.

Rhodium plating: After the acid dip, drain the workpieces quickly, **connect to current** and hang into the rhodium bath without intermediate rinsing. Any adhering hydrogen bubbles should be continually removed.

Post-treatment: Allow the bath fluid to drain off thoroughly. Rinse in deionized water, then in running water and - if possible - also in hot water. Dry immediately. Use the first recovery rinse water for topping up the rhodium bath.

Equipment

Bath tanks: Tanks of acid-proof materials, preferably polypropylene.

Accessories: All plastic parts coming into contact with the bath, e.g. bath tanks, rack insulations, barrels, pumps and hoses, prior to use must be acidified in 5 - 10 % cold sulphuric acid for approx. 24 hours.

Very important:

Prior to use, filter cartridges must be boiled in 10 % sulphuric acid for approx. 3 hours. Then they are inserted into the pump and thoroughly rinsed with water. It is essential to change the water several times.

Product agitation: Optional. Mechanical tapping to dislodge adhering hydrogen bubbles is recommended.

Anodes: Platinized titanium. We recommend PLATINODE® coated with 2.5 µm of platinum. We recommend removing the anodes from the bath during non-plating periods (during the night).

Ratio of anode area to parts area at least 1 : 1.

Current source: Infinitely variable, with current display and ampere-hour meter; residual ripple < 5 %.

Exhaust system: Required for large baths (strongly acidic bath mists entrained by evolution of hydrogen).

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.

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Umicore Galvanotechnik GmbH

P.O. Box 12 40 • D-73502 Schwaebisch Gmuend

Delivery address:

Klarenbergstraße 53-79 • D-73525 Schwaebisch Gmuend
GERMANY

Telephone +49 (0) 71 71 / 6 07 - 01

Fax +49 (0) 71 71 / 6 07 - 2 88

e-mail: galvano@eu.umicore.com

www.umicore-galvano.com