RHD2: Rhodium Decorative Plating Solution

Technical Data Sheet

RHD2: Brightened-Rhodium Sulfate Decorative Plating Solution 2 Grams/Liter

*Krohn Industries, Inc. is the manufacturer of the pure rhodium base solution. Krohn uses the highest quality virgin rhodium sponge along with a patented manufacturing process to produce one of the finest rhodium electroplating products in the world.

RHBW1: Whitener/Brightener Additive has been added to our pure base rhodium formula to improve whiteness and increase the reflectivity of the final plating deposition. RHBW1 is a proprietary combination of specific metal alloy and special wetting agents. The final plating result is a brilliant white rhodium deposit.

- Brilliant White Plating Deposit
- Very Good Throwing Power
- Excellent Coverage And Distribution Ability
- Flash And High Thickness Deposits Can Be Achieved
- Suitable for Rack Or Barrel Plating Operations
- Virgin Rhodium Sponge Is Used For the Manufacturing of RHD1

*Note: Technology Without Limits, Inc. Recommends the Following:
1) Please read all MSDS information before beginning.
2) Please follow al local and state regulation for waist treatment of spent solutions.
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Operating Conditions: Rack Plating

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Range</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodium content</td>
<td>g/Lt.</td>
<td>1.6-2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Sulfuric acid content</td>
<td>g/Lt.</td>
<td>27-33</td>
<td>30</td>
</tr>
<tr>
<td>Temperature</td>
<td>C° &amp; F°</td>
<td>20-50°C &amp; 68-122°F</td>
<td>44°C &amp; 110°F</td>
</tr>
<tr>
<td>PH value</td>
<td>×</td>
<td>×</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Current density</td>
<td>A/dm²</td>
<td>0.5-3.0A/dm²</td>
<td>1A/dm²</td>
</tr>
<tr>
<td>Voltage</td>
<td>V</td>
<td>2-4V</td>
<td>3V</td>
</tr>
<tr>
<td>Deposition rate</td>
<td>mg/Amin</td>
<td>7.5mg/Amin 1A/dm²</td>
<td>4.3mg/Amin 2A/dm²</td>
</tr>
<tr>
<td>Deposition speed</td>
<td>0.06 micron/min.</td>
<td>1A/dm²</td>
<td>Approx. 17 min.</td>
</tr>
<tr>
<td>Deposition speed</td>
<td>0.07 micron/min.</td>
<td>2A/dm²</td>
<td>Approx. 14 min.</td>
</tr>
<tr>
<td>Anode</td>
<td>Platinised Titanium</td>
<td>100-250 micro inches</td>
<td>Ratio 2:1</td>
</tr>
<tr>
<td>RHBW1</td>
<td>ml/Lt</td>
<td>8-12</td>
<td>10</td>
</tr>
</tbody>
</table>

Operating Conditions: Barrel Plating

| Current density         | Approx. 1A/dm² |
| Voltage                 | 6-9 Volts     |
| Temperature             | 44°C & 110°F  |
| Deposition Speed        | Approx. 0.03 micron/min. @ 1A/dm² |

*The above values are provided as a guide. Deposition speed will depend on barrel type, speed of rotation, distance between anode and cathode, and the shape & number of the items in the barrel will all vary the data provided.
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*Technical Data Sheet*

### Deposition Characteristics

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Units</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purity</td>
<td>%</td>
<td>&gt;99.9</td>
</tr>
<tr>
<td>Deposition Density</td>
<td>g/cm³</td>
<td>12.0</td>
</tr>
<tr>
<td>Hardness</td>
<td>HV(10g)</td>
<td>800-900</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td>White</td>
</tr>
<tr>
<td>Coating Thickness</td>
<td>Micron</td>
<td>0.04-0.5</td>
</tr>
</tbody>
</table>

### Equipment

- Tank: polypropylene, PTFE, glass
- Rectifier: ampere meter & volt meter producing D.C. output
- Ampere minute meter
- Platinised Titanium mesh anodes
- Filter pump with 1-5 micron polypropylene filter cartridge
- Heat source: temperature range 40°-50°C or 90°-120°F

*Note: Polypropylene filter cartridges should be wash in a 10% sulfuric acid solution before installing.*
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Plating Bath Make Up Process: Example 10 Liter Rhodium Bath

- Switch on ventilation exhaust system
- Fill tank ½ full with DI water
- Switch on filter pump system
- Add rhodium + RHBW1 concentrate solution
- Adjust solution final volume with DI water

Rhodium Replenishment:

- We recommend maintaining rhodium concentration of 80% of the original bath concentration. Operating at 2g/Lt., the replenishment must be made after a maximum consumption of 0.4g/Lt. of rhodium. As an indicator 2g/Lt. at the optimal operating condition, normally deposits about 6mg/Amin. Use regular analysis to determine exact consumption and replenishment.

RHBW1 Replenishment:

- RHBW1 plates out at a rate in direct proportion to the rhodium metal. Analysis is not needed for this component. RHBW1 is pre-installed in the rhodium replenish formula. The concentration of the RHBW1 is 10ml/g of rhodium in the plating bath.

*Note: Products contain strong acids. Protective devices should be used and MSDS should be read carefully before beginning make up process
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**Rhodium Concentration** is determined based on the thickness requirement. For thickness of up to 0.5 micron 2g/Lt is recommended. For thickness of above 0.5 micron or for increase deposition rate 3g-4g/Lt. is recommended.

*Note: When plating hollow items that drag out larger volumes of solution we recommend 1.5g/Lt. this will reduce the drag out loss factor.

**RHBW1 Concentration** is 10ml/g of rhodium metal.

**PH** is not usually needed because the addition of the rhodium replenish contains sulfuric acid.

**Solution Specific Weight** can be tested with a hydrometer 3.7-4.2 is recommended at 60°F

**Sulfuric Acid** should be added only when Be’ is below 3.7 or is determined by specific analysis. Use technical grade sulfuric acid only.

**DI or Distilled Water** is recommended to avoid polluting the rhodium plating solution with metallic or organic contaminants.

**Temperature** range is from room temperature up to 50°C -122°F. We recommend 40°-50°C for increased plating speed and whiter deposition color.

**Agitation** through the use of vibration or micro-agitation is recommended for increased plating speed, equality, and reflectivity of the plating deposition. It has also been noted that the use of micro-agitation reduces porosity, plating time, consumption of metals, and labor.

**Analytical Control** should be used regularly to maintain the rhodium and sulfuric acid content levels.
Rhodium Recovery From Spent Plating Solution & Drag Out Rinse Water

Proper ventilation & safety equipment is needed for the following process. 25% container space is recommended in reduction holding tank for reaction.

1) Mix solution to be recovered well. While mixing, slowly adjust PH value to 3.5-4.0 using caustic solution dosing. PH should be maintained below 8.0 throughout reduction process.
2) Heat the solution to be recovered in beaker, using the hot plate (100F)
3) Put heat resistant pad in the bottom of the 5-gallon bucket and put beaker with heated solution to be recovered on top of the heat resistant pad.
4) Calculate the amount of RHR916 (5ML of RHR916 recovers 1g rhodium)
5) Dilute reduction chemical using DI water. 4 parts DI water to 1 part RHR916
6) CAUTION THIS PORTION OF THE PROCESS CAUSES A REACTION! Mix solution to be recovered well. While mixing, slowly add RHR916 by dosing a few ML each time. Caution! Hydrogen Reaction will take place! Continue mixing after the initial reaction takes place to insure a complete reduction of the rhodium. Reaction time period is about 30 minutes.
7) Stop mixing and allow rhodium solids to drop to the bottom of the process tank. Drop out time is about 4-8 hours. Reduction time is relative to the following: solution concentration, quantity, temperature, PH value, and contaminant metal content. (Under well-controlled conditions the reduction time is reduced).
8) Sample solutions from the top of process tank after the solids have settled. Analysis will determine complete reduction of rhodium. The color of the top solution is relative to rhodium contents, if the solution is clear, rhodium is dropped out of solution, and if solution is yellow-brown this indicates rhodium in solution.
9) Remove top solution by very slowly pouring the solution into the glass beaker through the funnel with filter paper (1 micron).
10) Dry Remaining rhodium black sludge or slurry in the crucible on the hot plate.
11) Remove dry black rhodium powder from crucible and paper filter after drying. Mix the dry black rhodium powder well, and take a small sample for an assay test. This will determine purity of rhodium powder & total content.
12) Send rhodium black powder and assay to refiner for a monetary return.

* Note: Remaining solution after treatment should be properly handled according to your local laws and regulation.