

**OPERATING INSTRUCTIONS  
NIMUDEN NPR-4 ELECTROLESS NICKEL**

**INTRODUCTION**

**Nimuden NPR-4** is an acid electroless nickel plating bath that has been specially formulated for electronic and PCB applications where fine line circuitry (fine lines and spaces) is encountered. The special bath formulation allows the deposition of electroless nickel without bridging. This process operates at lower temperatures, which allows for improved resist tolerance. The bath is very stable, easy to use and is optimized for automatic solution control using the Uyemura STARLINE Ni controller.

**PROPERTIES**

Phosphorus Content	6 - 8 % as plated
Melting Point	890 °C (1630 °F)
Coefficient of Thermal Expansion	12 -14 $\mu$ /m/°C
Magnetic Properties	Essentially non magnetic as plated
Electrical Resistivity	60 $\mu$ ohm/cm/cm <sup>2</sup>
Hardness	570 Hv (100) (as plated) 1050 Hv (100) (after heat treatment)
Corrosion Resistance	100 Hour Salt Spray (ASTM B 117)
Adhesion	Greater than electroplated Nickel

**BATH COMPONENTS**

Nimuden NPR-4-M	Reducing agent, chelator & stabilizer
Nimuden NPR-4-A	Nickel metal solution, chelator
Nimuden NPR-4-B	Reducing agent
Nimuden NPR-4-C	Stabilizer and pH adjustment
Nimuden NPR-4-D	Special additive

### MAKE-UP PROCEDURES

Nimuden NPR-4-M	15 % by volume (150 mls / liter)
Nimuden NPR-4-A	4.5 % by volume (45 mls / liter)
Nimuden NPR-4-D	0.3% by volume (3 mls / liter)
DI water	80.0 % by volume

1. Fill clean tank to 50% of bath volume.
2. Add required amount of Nimuden NPR-4-M and Nimuden NPR-4-A and Nimuden NPR-4-D with stirring. Add DI water to bring bath to final volume.
3. Analyze bath for nickel content and pH. Nickel should be 4.5 gm/l and pH should be 4.6 . If necessary adjust nickel with additional Nimuden NPR-4-A and pH with either dilute (10%) sulfuric acid or dilute (10%) NaOH solution.
4. Heat solution to 80 °C (176<sup>0</sup> F). Bath is now ready to plate.

OPERATING CONDITIONS		
	Optimum	Range
Temperature	80 °C 176 °F	79 - 81 °C 174 - 178 °F
pH	4.5	4.5 - 4.7
Bath Loading	0.5 dm <sup>2</sup> /l 0.2 ft <sup>2</sup> /gal	0.3 - 1.0 dm <sup>2</sup> /l 0.1 - 0.4 ft <sup>2</sup> /gal
Nickel Content	4.5 g/l 0.60 oz/gal	4.3 - 4.6 g/l 0.57 - 0.62 oz/gal
Deposition Rate		Approx. 12 μm/hr. Approx. 480 μ"/hr.

Plating is accomplished by immersing the properly cleaned parts in the bath. Manual measurement of thickness is the control method.

## REPLENISHMENT

Replenishment is maintained through the use of four replenishment additives. Refer to the chart below for replenishment requirements. All quantities listed are for 1 gram of metal deposited as a function of metal turnovers.

MTO	Ni Conc. (g/l)	NPR-4-A	NPR-4-B	NPR-4-C	NPR-4-D
0.0-0.5 MTO	4.5	10 ml	10 ml	10 ml	4 ml
0.5-1.0 MTO	4.6	10 ml	10 ml	10 ml	4 ml
1.0-1.5 MTO	4.7	10 ml	10 ml	10 ml	4 ml
1.5-2.0 MTO	4.8	10 ml	10 ml	10 ml	4 ml
2.0-2.5 MTO	4.9	10 ml	10 ml	10 ml	4 ml
2.5-3.0 MTO	5.0	10 ml	10 ml	10 ml	4 ml
3.0-3.5 MTO	5.0	10 ml	10 ml	10 ml	4 ml
3.5-4.0 MTO	5.0	10 ml	10 ml	10 ml	4 ml

It is recommended to add replenishment chemicals in small quantities in order to maintain plating rate and bath stability. As a general rule, it is advised to add replenishment chemicals when the nickel metal concentration has dropped 0.1 g/l below the recommended concentration. The STARLINE Nickel Controller is especially useful for precision control.

Analysis of component NPR-4-D is performed by HPLC. The NPR-4-D component will decompose gradually once the solution has been heated to operating temperature. As a result, the consumption rate per hour can be calculated when in production.

It is recommended to avoid mixing NPR-4-A and NPR-4-C outside the bath.

## EQUIPMENT

### Tank

Recommended tank materials are stainless steel (316) with inner face polished or polypropylene or halar coated walls. The tank should be constructed with an overflow.

### Heating

It is recommended to avoid localized hot areas in the tank. As a result, a jacketed tank is recommended. Optionally, a heating coil or immersion heater may be used provided that adequate agitation is provided.

### Agitation

Solution circulation should be provided with pump and sparger. Pumps are to be non metallic contact magnetic drive.

**Filtration**

It is recommended to use polypropylene filters with a retention rating of 1 to 2  $\mu\text{m}$ .

**Rocking**

The rocker should be provided with speeds in the range of 0 to 1.0 meter/min.

**SAFETY AND HANDLING**

Nimuden NPR-4 contains nickel salts and are acidic. Nickel may cause an allergic dermatitis. Protective rubber gloves, safety goggles, apron and boots should be worn while handling chemicals to avoid contact with skin, eyes and clothing. If ingested, get medical attention immediately. Store at moderate temperatures and in tightly closed containers. Avoid breathing vapors, nickel containing salts may be harmful to nasal cavities and lungs. Wash promptly when skin becomes contaminated. Promptly remove clothing that becomes contaminated. In case of eye contact, flush with large amounts of water for 15 minutes lifting eyelids and get medical attention. If inhaled, move individual to fresh air. Aid in breathing if necessary.

**WARRANTY AND DISCLAIMER**

The information herein is believed to be reliable. However, no warranty, express or implied, is made as to its accuracy or completeness and none is made as to the fitness of this material for any purpose. UIC shall not be liable for damages, loss or expense to persons or property resulting from its use. Suitability and merchantability are solely the responsible of the user. The only obligation of the seller or manufacturer is to replace the product if defective in material or workmanship at the time sold. Nothing herein shall be construed as a recommendation for use in violation of any patent.

Rev.2/98, A

**UIC – Corporate**  
**3633 Inland Empire Blvd., Suite 575**  
**Ontario, CA 91764**  
**909-466-5635**

**UIC Technical Center**  
**240 Town Line Road**  
**Southington, CT 06489**  
**860-793-4011**