



C. UYEMURA CO. LTD

### **EPITHAS® ANP 1012 Electroless Nickel** **For Wafer and Die Applications**

EPITHAS ANP 1012 is a mildly acidic, electroless nickel plating bath that has been specially formulated for fine line circuitry encountered in silicon wafer plating. The special bath formulation allows the deposition of electroless nickel without bridging.

EPITHAS ANP 1012 is an environmentally friendly plating process. The bath chemistry is formulated without hazardous additives such as mercury, arsenic, lead and cadmium.

#### **ADVANTAGES**

- Environmentally friendly
- Semi-Bright deposit
- Wide operating window
- Easy to control
- Uniform deposit
- Excellent adhesion on zincated aluminum

## DEPOSIT PROPERTIES

Property	Typical
Phosphorus Content	10.5 – 12% by weight
Density	7.4 – 7.7 g/cc
Melting Point	1630°F (890°C)
Coefficient of Thermal Expansion	12-14 micron/M/C
Magnetic Properties	Nonmagnetic as plated.
Electrical Resistivity	40 – 80 micro ohm/cm/cm <sup>2</sup> as plated. Contact resistance increases with plate age and thin layer oxide development common to nickel and SUS alloys.
Micro-Hardness	350 – 450 Knoop (100g load on 1 mil cross section) as plated. Baking increases hardness.
Elongation	2 – 4% as plated. Heat treating for hardness reduces elongation properties.
Phase Transition Temp. (to Ni <sub>3</sub> P)	572 – 753° F (300 – 400° C)

## BATH COMPONENTS

Product	Use
EPITHAS ANP N	Bath make-up & maintenance – Contains nickel
EPITHAS ANP M	Bath make-up component – Contains reducing agent, complexing agents and pH buffers
EPITHAS ANP R	Bath maintenance component - Contains reducing agent, complexing agents and pH buffers
EPITHAS ANP Brightener	Concentrated deposit brightener / stabilizer
EPITHAS ANP pH	Alkali for maintaining bath pH with use

## MAKE-UP PROCEDURE

DI Water	76.5% by volume
EPITHAS ANP M	20% by volume
EPITHAS ANP N	3.4% by volume
EPITHAS ANP Brightener	0.1% by volume (optional depending on work load)

1. Add DI water to a clean tank
2. Start filtration and agitation
3. Add ANP M to the tank and mix
4. Add ANP N to the tank and mix
5. Add ANP Brightener and mix
6. Heat the solution to 176-185°F (80-85°C)
7. Bath is now ready for plating

## OPERATING CONDITIONS

	Optimum	Range
Temperature	181° F (83° C)	176 - 185°F (80 - 85°C)
pH	4.8	4.4 – 5.0
Bath Loading	0.2 ft <sup>2</sup> /gal (0.49 dm <sup>2</sup> /l)	0.05 – 0.4 ft <sup>2</sup> /gal (0.12 – 0.98 dm <sup>2</sup> /l)
Nickel Concentration	4.5 g/l	4 – 5 g/l
Plating Rate	300 uinches/hr (7.5 um/hr)	200 – 400 uinches/hr (5 – 10 um/hr)
Bath Life	3 Metal Turn Overs	2.5 – 3.5 MTO's

## ANALYSIS & REPLENISHMENT

- The ANP bath is replenished and maintained by adding 0.75ml/l ANP N for every 0.1g/l nickel plated.
- The reducer concentration is maintained by adding 1.5 ml/l of ANP R for every 0.1g/l nickel plated (a 2X volume ratio to ANP N).
- The brightener component is maintained by adding one fifth (1/5) of the volume of ANP N replenished. (Optional depending on work load requirements.)
- Continuous operation is best maintained using the StarLine Dash Controller.

Parameter	Range	Optimum	Analytical Procedure
Nickel Concentration	4-5 g/l	4.5 g/l	Titration
pH	4.4 – 5.0	4.8	pH Meter

### Nickel Analysis Concentration by Titration

#### Preparation

5 ml pipette  
250 ml conical beaker  
50% by volume Ammonium Hydroxide  
Murexide indicator  
0.05 M EDTA (0.1 N EDTA) solution

#### Preparation of Murexide indicator

1. 0.1 g Murexide
2. 50 g Sodium Chloride
3. Grind and mix with Mortar and Pestle

**Nickel Analysis Procedure:** (Used to analyze the bath routinely)

1. Pipette 5 ml of the bath into a 250 ml conical flask.
2. Add 50 ml of DI water and 50 ml of 50% by volume ammonium hydroxide.
3. Add a "pinch" of murexide indicator developing a light amber color.
4. Allow the solution to stand for 1 to 5 minutes.
5. Titrate with 0.05 M EDTA to a violet end point.

$$\text{Nickel metal concentration} = \text{ml titrated} \times 0.587$$

**ANP 1012 Nickel Analysis and Replenishment Chart**

EDTA ml	Nickel g/l	ANP N ml/l (ml/gal)	ANP R ml/l (ml/gal)	ANP Brightener ml/l (ml/gal)
8	4.7	0	0	0
7	4.1	3 (11.3)	6 (22.6)	0.6 (2.2)
6	3.5	7.5 (28.4)	15 (56.8)	1.5 (11.4)
5	2.9	11.9 (45.2)	23.8 (90.4)	2.4 (9.0)

**Reducer Analysis Concentration by Titration****Preparation**

- 5 ml pipette
- 250 ml stoppered conical beaker
- 6N Hydrochloric Acid solution (HCl)
- 0.1N Iodine solution
- 0.1N Sodium Thiosulfate solution

**Reducer Analysis Procedure:** (Used to check reducer concentration periodically)

1. Pipette 5ml of the bath into a 250 ml stoppered conical flask.
2. Add 25ml 6N HCl and 50mls 0.1N Iodine solution.
3. Allow the sample to stand in darkness for one hour.
4. Titrate sample to a clear end point with 0.1N Thiosulfate solution.

$$\text{Reducer concentration (g/L)} = (50 - \text{mls of thiosulfate required}) \times 1.06$$

Reducer target is 30 g/L

Reducer concentration range is 25 – 40g/L

3.3ml/l R raises the reducer concentration by 1g/l.

### **pH Analysis by pH Meter**

Check pH at least once per shift.

#### **Preparation**

pH 7 Buffer solution  
pH 4 Buffer solution  
pH Meter

#### **Bath pH Analysis Procedure:**

1. Calibrate the pH meter using a two point calibration.
2. Buffer the meter to pH 7 and adjust calibration to 7.
3. Buffer the meter to pH 4 and adjust the slope to 4.
4. Measure the pH of the bath in the tank or bath sample at room temperature.  
Adjustments to bath pH should be accompanied by continuous pH measurement.

Target pH on make-up = 4.8                      (pH range = 4.4 – 5.0)

Use the ANP pH to raise the bath pH and 20% by volume sulfuric acid to lower the bath pH.

## **EQUIPMENT**

**Tank** - Polypropylene Tank. Polypropylene or Teflon lined structurally suitable tanks are acceptable.

**Heating** - Jacketed double boiler heating or Teflon lined coil heat. High area low BTU density is desired. Quick change heating and cooling capability is best.

**Agitation** - Low volume filtered air and/or bath liquid sparging. Sparging pumps are non-metallic magnetic drive. Plumbing is heat stable CPVC or PP.

**Filtration** – 0.2 - 1 micron polypropylene media. Target five volume tank turnovers per hour.

**Cathode Rocking, Bumping, and Vibration** - Useful for plating defect free deposits when plating thickness greater than 400 uinches.

**Ventilation** – Required

## **SAFETY AND HANDLING**

EPITHAS ANP products contain both alkaline and acidic components. The EPITHAS ANP N and M are acidic. The EPITHAS ANP R, ANP Brightener and ANP pH are alkaline. Avoid contact with skin, eyes, and clothing. Wear rubber gloves, protective clothing, and safety goggles while handling. In case of contact, flush skin or eyes with water. Store at moderate temperatures and in tightly closed containers.

Avoid breathing plating bath vapors which contain nickel. Nickel-containing salts may be harmful to nasal cavities and lungs. For contact with eyes or if swallowed, contact a physician immediately.

SDS sheets are available from Uyemura.

### **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.

**UIC – Corporate**  
3990 Concourses, Suite 425  
Ontario, CA 91764  
909-466-5635  
Fax: 909-466-5177

**UIC Technical Center**  
240 Town Line Road  
Southington, CT 06489  
860-793-4011  
Fax: 860-793-4020

[www.uyemura.com](http://www.uyemura.com)