ELECTRONIC MATERIALS
PACKAGING AND FINISHING TECHNOLOGIES

EVERON™ BP

For Advanced Packaging Applications

Regional Product Availability			
N. America	Japan/Korea	Asia	Europe
✔	✔	✔	✔

DESCRIPTION

The Everon BP process is designed to autocatalytically deposit semi-bright nickel-phosphorous alloys, containing 8–10% phosphorous, onto catalyzed copper and aluminum surfaces on silicon wafers. The Everon BP process is uniquely formulated to minimize reaction by-product buildup and, as a result, this process has a dramatically longer bath life compared to conventional systems. This process also features an advanced stabilizer system that provides excellent solution stability throughout the life of the solution.

ADVANTAGES

- Extremely long solution life
- Flat deposit profile
- Consistently high deposition rate
- Exceptional chemical stability
- Consistent deposit appearance
- High tolerance to metallic contamination
- Deposits on copper and aluminum substrates

BATH MAKE-UP

Chemicals Required	Metric	(U.S.)
Deionized Water	600.0 ml/l	(65.0% v/v)
Everon BP Makeup Solution	150.0 ml/l	(15.0% v/v)
Everon BP Replenisher I	200.0 ml/l	(20.0% v/v)

DEPOSIT PROPERTIES

Phosphorous Content:	8–10% by weight
Hardness:	48 Rockwell as deposited
Melting Point:	890°C (1,634°F)
Electrical Resistivity:	75 microhm-cm
Density:	7.9 g/cm^3
Corrosion Resistance:	Approx. 200 hours per ASTM B 117

Deposits meet ASTM B 733, Mil-C-26074E and AMS 2404D specifications.

MAKE-UP PROCEDURE

1. Add deionized water to process tank.
2. Add Everon BP Make-up Solution and mix thoroughly.
3. Add Everon BP Replenisher I and mix thoroughly.
4. Dilute to volume with deionized water.
5. Start pump(s) and allow solution to recirculate for 15 minutes.
6. Analyze nickel content (see Bath Maintenance section) and adjust to 6.0 g/l (0.8 oz./gal.) with Everon Replenisher I according to the calculations in Solution Maintenance section.
7. Analyze hypophosphite concentration and adjust if necessary according to the instructions in Bath Maintenance section.
8. Measure pH and adjust to 4.75 (see section on pH Control).
9. Heat solution to operating temperature.

Operating Parameters—Metric		
Component	**Range**	**Recommended**
Nickel Metal	5.4–6.5 g/l	6.0 g/l
Hypophosphite	25–35 g/l	30.0 g/l
Temperature	82–85°C	84°C
pH	4.6–4.9	4.75
Loading Factor	0.25–0.87 dm^2/l	0.5 dm^2/l
Stability Index	10–30	20
Agitation	Continuous laminar flow	
Deposition Rate	12–15 microns per hour	

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Operating Parameters—U.S.		
Component	**Range**	**Recommended**
Nickel Metal	0.72–0.85 oz./gal.	0.8 oz./gal.
Hypophosphite	3.7–4.6 oz./gal.	4.0 oz./gal.
Temperature	180–186°F	183°F
pH	4.6–4.9	4.75
Loading Factor	0.10–0.35 ft^2/gal.	0.2 ft^2/gal.
Stability Index	10–30	20
Agitation	Continuous laminar flow	
Deposition Rate	480–600 microinches per hour	

BATH MAINTENANCE

Replenishment

To ensure correct operation of the Everon BP electroless nickel process, the solution concentration should be maintained between 90 and 105% activity. For production operations processing significant surface area through the Everon BP solution, the use of Rohm and Haas Electronic Materials' Ronalyser NI-pH Mk II is strongly recommended. This is a two channel electroless nickel controller that analyses and maintains the metal content and pH values at preset levels. See Rohm and Haas Electronic Materials Technical Sales Representative for the setup and operation of the controller.

The following analytical procedure is essential for controlling the Everon Electroless Nickel bath components.

NICKEL METAL

I. Equipment

a) 10 ml Class A transfer pipette

b) 250 ml Erlenmeyer flask

c) 25 ml graduated cylinder

d) 25 or 50 ml burette

II. Reagents

a) Concentrated ammonium hydroxide

b) Murexide indicator (0.2g Murexide ground with 100g sodium chloride)

c) 0.05M EDTA solution

III. Procedure

a) Pipette a 10 ml sample of cooled electroless nickel working solution into a 250 ml Erlenmeyer flask.

b) Add 100 ml of deionized water.

c) Add 15 ml of ammonium hydroxide.

d) Add two spatula tips of murexide indicator. The solution should change to a yellow-brown color. Excessive amounts of indicator can obscure the endpoint.

e) Titrate immediately with 0.05M EDTA until the solution changes from brown to a blue-violet endpoint.

IV. Calculation

g/l Nickel metal = ml Titre x 0.293

Target = 6.0 g/l

Upon determination of the nickel concentration, replenishment of the solution may be accomplished by using the following formulas:

Metric

ml/l addition of

Everon BP Replenisher I required =

(6.0 - Nickel Concentration in g/l) x 33.48

ml/l addition of

Everon BP Replenisher II required =

(6.0 - Nickel Concentration in g/l) x 16.74

U.S.

fl. oz./gal. of

Everon BP Replenisher I required =

(0.8 - Nickel Concentration in oz./gal.) x 32.0

fl. oz./gal. of

Everon BP Replenisher II required =

(0.8 - Nickel Concentration in oz./gal.) x 16.0

Everon BP Replenishers I and II should always be added in a ratio of 2:1. Replenishment materials may be added to the solution at operating temperature according to the following guidelines:

1. Always add replenishers slowly with vigorous agitation.
2. Never add replenishers to the bath directly over heaters or parts being processed.
3. Do not make additions of more than 20% of the total solution volume at one time. If a larger addition is required, add the replenishers in increments of 10% while plating work in the solution.

For ease of calculation the following charts can be used to determine the quantities of replenishers required.

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Replenishment Schedule (100 liter bath)—Metric			
% Activity	Nickel Conc.	Replenisher I	Replenisher II
105%	6.3 g/l	0	0
100%	6.0 g/l	0	0
95%	5.7 g/l	1.0 liters	0.5 liters
90%	5.4 g/l	2.0 liters	1.0 liters
85%	5.1 g/l	3.0 liters	1.5 liters
80%	4.8 g/l	4.0 liters	2.0 liters
75%	4.5 g/l	4.0 liters	2.0 liters

Replenishment Schedule (100 gallon bath)—U.S.			
% Activity	Nickel Conc.	Replenisher I	Replenisher II
105%	0.84 oz./gal.	0	0
100%	0.80 oz./gal.	0	0
95%	0.76 oz./gal.	4 qts.	4 qts.
90%	0.72 oz./gal.	8 qts.	4 qts.
85%	0.68 oz./gal.	12 qts.	6 qts.
80%	0.64 oz./gal.	16 qts.	8 qts.
75%	0.60 oz./gal.	16 qts.	8 qts.

YIELD AND REPLENISHMENT BY WORKLOAD

If workload surface area is accurately known, replenishments can be made at a rate of 615 ml (20.8 fl. oz.) of Replenisher I and 307.5 ml (10.4 fl. oz.) of Replenisher II per mil. ft² plated. If the Everon BP nickel metal content falls below 3.6 g/l (0.48 oz./gal.), readjustment of the chemical balance of the solution is required. Please consult your Rohm and Haas Electronic Materials Service Engineer for specific recommendations about this procedure.

HYPOPHOSPHITE

Sodium hypophosphite is maintained by additions of Everon BP Replenisher I according to nickel metal analysis. A weekly analytical check of hypophosphite concentration should be made using the method described below. Everon BP Reducer is used to make any required supplemental additions of hypophosphite based on the analytical results. A 1 ml/l addition will raise the concentration by 0.2 g/l.

I. Equipment

a) 5 ml pipette

b) 50 ml pipette

c) 250 glass stoppered iodine flask

d) 25 ml graduated cylinder

II. Reagents

a) Hydrochloric acid solution , (50% v/v)

b) Iodine solution, 0.1N

c) Sodium thiosulfate solution, 0.1N

d) Standard starch indicator (optional)

III. Procedure

a) Pipette 5 ml of plating solution into glass-stoppered iodine flask.

b) Add 30 ml hydrochloric acid solution into the flask.

c) Pipette 50 ml of 0.1N iodine solution. Immediately stopper flask and mix thoroughly. Place flask in a cool dark place for 30 ±1 minutes.

d) Titrate with 0.1N sodium thiosulfate solution until pale yellow color is observed.

e) Add 2 ml starch indicator to solution flask (optional).

f) Continue to carefully titrate with sodium thiosulfate solution until the color changes from blue-purple to a colorless endpoint.

Note: The endpoint appears slowly so care must be taken to avoid overtitrating. Sample temperatures out of range (72 ±3°F) will produce inaccurate results.

IV. Calculation

[5.0 - (ml Titrant x 0.1)] x 10.58 =
Sodium Hypophosphite (g/l)

Target = 30 g/l when Ni is at 6.0 g/l.
Otherwise, Hypo to Ni ratio should be 5:1.

Everon Reducer Concentrate is used to make any required supplemental additions of sodium hypophosphite based on the analytical results. A 1 ml/l addition will raise the concentration by 0.2 g/l.

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PH CONTROL

The pH of the solution should be maintained between 4.6 and 4.9. Always measure pH at room temperature. To raise the pH of the solution, use either a 50% (v/v) ammonium hydroxide solution or a 240 g/l solution of potassium carbonate. Exercise caution when adding potassium carbonate to the bath as carbon dioxide will evolve. To lower the pH of the solution, use a 10% (v/v) solution of sulfuric acid.

When making pH adjustments at operating temperature, add small, frequent amounts of pH adjuster. Use extreme caution when mixing and handling sulfuric acid solutions as the reaction is always exothermic (heat producing) and temperature may exceed 70°C (158°F). Always add acid to water and mix thoroughly during addition. Allow this mixture to cool to room temperature before making additions to the plating solution.

I. Equipment

pH meter (multiple point calibration capability, preferably with automatic temperature compensation)

II. Reagents

a) Buffer solution, pH = 4.0

b) Buffer solution, pH = 7.0

III. Procedure

a) Rinse electrodes with DI water.

b) Buffer pH meter with a 2 point calibration with the reagents listed above.

c) Rinse electrodes with DI water.

d) If there is no temperature compensation for the pH meter, cool the sample to exactly 25°C or to the temperature of the buffer solutions used to standardize the meter. If temperature compensation is available, cool the sample such that the temperature is within the range of 25–30°C (77–86°F).

e) After rinsing off the electrodes with DI water, insert the pH probe into the working bath solution. Allow the solution to stabilize (when pH drift is minimal, that is no change in a 5–10 sec. time frame).

f) Record value in chart

g) Rinse electrodes with DI water, and return the probe set tot he cup partially filled with 7.0 buffer standard.

Target = pH 4.60–2.90

BATH TEMPERATURE

Operating temperature of the electroless nickel solution should be maintained at 82–85°C (180–186°F). Temperatures below 82°C (180°F) will result in reduced plating rate while temperatures above 93°C (200°F) may result in accelerated tank plate out and/or decomposition of certain bath constituents. If the solution is maintained at operating temperature during extended periods when no work is being processed, thermal decomposition of the reducing agent may occur, resulting in excessive consumption of chemicals and an unnecessary loss in economy of operation.

LOADING FACTOR

Rohm and Haas Electronic Materials recommends for the optimum performance of the Everon BP solution a consistent workload surface area per volume of solution. Consistent loading will result in the uniform operation of the Ronalyser, effective solution control and uniform deposit quality.

Recommended Control Schedule

Analysis of	Procedure	Frequency
Nickel Metal	Volumetric AP 72059	Hourly
Hypophosphite	Volumetric AP 72059	Weekly
Orthophosphite	Volumetric	Hourly
pH	Electrometric	Hourly
Metallic Contamination	Atomic Absorption	As Required
Deposition Rate	X-ray, micrometer	Daily
Deposit Thickness	X-ray, Beta backscatter, Cross section	Daily
Stability Index	Volumetric	Daily

METALLIC IMPURITIES

The maximum tolerable level of metallic contaminants are listed below:

As	0.3 ppm
Cd	2 ppm
Cr	2 ppm
Cr (+3)	20 ppm
Cu	10 ppm
Fe	100 ppm
Pb	2 ppm
Pd	3 ppm
Sb	2 ppm
Sn (+2)	5 ppm
Zn	120 ppm

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PRE-TREATMENT

Preparation of the substrate for electroless nickel plating is essential in achieving the benefits of the coating. Inadequate cleaning and/or poorly designed pretreatment procedures may result in poor adhesion, discoloration, roughness or porosity of the deposit and premature failure of the coating. The Rohm and Haas Electronic Materials Everon BP process is designed to plate nickel onto palladium catalyzed copper surfaces, or zincate conditioned Aluminum surfaces of silicon wafers. For plating on copper Everon BP Catalyst is used to provide the initial palladium layer and promote the complete and uniform initiation of nickel. For plating on aluminum, AluPrep BP Zincate or DuraPrep™ Z-20 is used to catalyze the nickel reaction on the aluminum substrate.

In order to maximize solution life span and deposit integrity, it is important to provide thorough rinsing prior to entry into the electroless nickel solution. Please contact your Rohm and Haas Electronic Materials Service Engineer for rinsing and cleaning recommendations for specific methods of operation.

PRODUCT DATA (TYPICAL PROPERTIES)

Everon BP Make-up Solution

Appearance:	Colorless
pH:	6.0
Specific Gravity:	1.217

Everon BP Replenisher I

Appearance:	Green
pH:	<2
Specific Gravity:	1.085

Everon BP Replenisher II

Appearance:	Colorless
pH:	11.0
Specific Gravity:	1.0

EQUIPMENT

Tanks: Suitable heat-resistant, stress-relieved natural polypropylene or stainless steel (17/11/2.5 Cr-Ni-Mo stainless) with anodic protection.

Heaters: Immersion heaters (glass, porcelain, PTFE or anodically protected stainless steel) or external stainless steel steam heat exchangers may be used (10 watts/sq. inch). Temperature controllers with ±1°C capability should be employed.

Filtration: Continuous solution filtration is essential. All filtration system components that contact the plating solution should be constructed of heat-resistant plastic. Pressurized chambers containing 3m polypropylene membrane filters are preferred. Bag filters may also be used.

Agitation: Gentle solution agitation is recommended for optimum results. Solution turnover should be 8–12 times per hour.

Exhaust: All plating tanks should be equipped with an exhaust system to remove spray and steam. Plating tanks should be covered when not in use to avoid contamination and evaporation losses.

HANDLING PRECAUTIONS

Before using this product, consult the Material Safety Data Sheet for details on product hazards, recommended handling precautions and product storage.

CAUTION! When using immersion heaters, failure to maintain proper volume level can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

STORAGE

Store all Everon BP products in tightly closed containers at temperatures above 10–32°C (50–90°F). For specific and complete recommendations involving precautionary handling procedures of Everon BP materials, please refer to the appropriate Hazardous Material Labels and Material Safety Data Sheets supplied with these products.

FLUSH EMPTY CONTAINERS THOROUGHLY WITH WATER BEFORE DISCARDING.

WASTE TREATMENT

It is the user's responsibility to verify that treatment procedures comply with federal, state and local regulations. Contact your Rohm and Haas Electronic Materials Technical Representative for more information.

Due to the nature of Everon BP disposal of it, or residues therefrom, should be made in compliance with federal, state and local environmental laws.

Everon plating solutions are acidic and contain complexed nickel salts which must be removed in accordance with federal, state and municipal effluent guidelines. Rohm and Haas Electronic Materials has developed a process for treatment of spent electroless nickel solutions (Permatreat 5000) without generation of metal-bearing sludge. Please consult your Rohm and Haas Electronic Materials Service Engineer for details of this process or alternative waste treatment options.

ELECTRONIC MATERIALS

Circuit Board Technologies

CMP Technologies

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For locations and information please visit; http://electronicmaterials.rohmhaas.com

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