MICROFAB EVF NiBAR

Boric Acid Free Nickel for Barrier & Enhanced Via Fill Semiconductor Metallization

Product Code: 263862

DESCRIPTION

MICROFAB EVF NiBAR is a sulfamate nickel electroplating process that produces a pure, ductile, fine-grained, low stress nickel deposit required to meet the needs of the semiconductor industry for quality assured chemistry. **MICROFAB EVF NiBAR** is manufactured to meet the exacting performance and manufacturing requirements associated with wafer plating and contains no boric acid in compliance with specific regulatory needs.

The **MICROFAB EVF NiBAR** process contains an anode activating agent in controlled amounts to enhance anode corrosion and prevent anode passivation. Deposit properties are easy to control and maintain.

The **MICROFAB EVF NiBAR** process is capable of via filling with the optional **NiBAR-S** component. It can be also used as a diffusion barrier between copper and solder; moreover, it may be used for Under Bump Metallization (UBM) applications. Please consult with a Commercial Representative to discuss the material needed for this application.

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT

PROCESS COMPONENTS REQUIRED

1. **MICROFAB EVF NiBAR -VMS** is a virgin make up solution used in addition to the additives for make-up of new solutions and to replenish solution drag-out. It is supplied ready to use and has been carbon treated and tested. Available in 20 and 200 liter containers.
2. **MICROFAB EVF NiBAR-A** is the accelerator additive and used for replenishment.
   Available in 1 and 4 liter containers
3. **MICROFAB EVF NiBAR-S** is the suppressor additive and used for replenishment. *This component may be optional, depending on the application requirements*.
   Available in 1 and 4 liter containers
4. **MICROFAB EVF NiBAR NAA** is the anode activator used to accelerate dissolution of the nickel anode.
5. **MICROFAB EVF NiBAR Acid** is a Sulfamic Acid solution (NH_2SO_3H) to lower the pH of the operating solution when necessary.
6. **MICROFAB NI REPLENISHER** contains 150 g/L (20 oz/gal) of nickel in a purified solution; it is used to replenish metal losses due to heavy drag-out.

MAKE UP PROCEDURE

After all parts of the system that will come in contact with the solution have been cleaned and leached as recommended, the **MICROFAB EVF NiBAR** solution may be poured or pumped into the tank. **MICROFAB EVF NiBAR VMS,** along with **MICROFAB EVF NiBAR-A and MICROFAB EVF NiBAR-S** may be used to make up the plating solution, depending on the application requirements. The process may be used once it reaches operating temperature.

EQUIPMENT

Follow instruction from the tool manufacturer.

MICROFAB EVF NiBAR has a wide operating window. The optimum plating recipe will vary significantly depending on the tool platform (agitation, Anode/Cathode configuration, flow rate), exposed area on the wafer, and the plated pattern within each die.

Please consult with Field Service Sales & Engineers for assistance in developing specific plating recipes for a given tool and wafer platform.

OPERATING PARAMETERS

Parameter	Range	Recommended
Nickel	45 to 55 g/L	50 g/L
Temperature*	40 to 60 °C	Consult M.A.
pH	3.5 to 4.5	4.0
MICROFAB EVF NiBAR-A*	0 to 20 mL/L	Consult M.A.
MICROFAB EVF NiBAR-S*	0 to 20 mL/L	
MICROFAB EVF NiBAR NAA	50 to 60 mL/L	55 mL/L
Current Density	2 to 6 ASD	3 ASD
Anode	Soluble Anode is recommended Insoluble Anode- please contact Technical Service	

* The **MICROFAB EVF NiBAR** make up concentrations and operating conditions are dependent on the application (UBM/barrier vs via fill) and performance requirements.

Rate of Deposition for MICROFAB EVF NiBAR

(Time in Minutes) Thickness in Microns

ASD	Rate µm/min
1.1	0.21
2.2	0.42
3.2	0.63
4.3	0.83
5.4	1.04
10.8	2.08

Control of Impurities

Control of contaminants that may adversely affect the performance of the MICROFAB EVF NiBAR process solution is best achieved through prevention methods, such as good rinsing and avoiding solution contact with acid soluble metals.

Metallic contaminants such as iron, tin, and lead will alter both the efficiency of the solution and stress of the deposit if allowed to reach appreciable levels. Maintain the concentration of each of these metallic contaminants below 10 ppm. Frequent low current density "dummy" plating with a corrugated nickel (or nickel plated) cathode at 0.5 ASD will selectively remove these metals.

Organic contamination may be typically introduced to the solution in the form of lubricants, tape residues and plating resist breakdown products. Organic contaminants will affect the stress of the deposit by interfering with the brightening system of this process if allowed to reach appreciable levels. These materials can only be removed by the carbon treatment procedure available.

SOLUTION MAINTENANCE

Follow instructions from the tool manufacturer.

MICROFAB NIBAR has a wide operating window. The nominal plating recipe will vary significantly depending on the tool platform (agitation, Anode/Cathode configuration, and flow rate), exposed area on the wafer, and the plated pattern within each die.

Please consult with Field Service Sales & Engineers for assistance in developing specific plating recipes for a given tool and wafer platform.

Analytical Control

Procedures for determining nickel, **MICROFAB EVF NiBAR-A**, **MICROFAB EVF NiBAR-S**, and **MICROFAB EVF NiBAR NAA** may be obtained from us upon request.

Maintaining Additives

MICROFAB EVF NiBAR-A, **MICROFAB EVF NiBAR-S**, and **MICROFAB EVF NiBAR NAA** are replenished based on a specific customer requirement or as provided by specific tool supplier's feed algorithm. Additionally, the additive concentrations can be analyzed by HPLC.

Nickel

Replenish nickel with **MICROFAB NI REPLENISHER** containing 150 g/L (20 oz/gal) of nickel.

pH control

Maintain the pH of the solution between 3.5 and 4.5 to improve the solution conductivity and permit the use of higher current densities. High pH values result in less ductile deposits and lower pH values cause lowered plating efficiencies. The best results are obtained at pH 4.0. Use **MICROFAB EVF NiBAR ACID** to lower the pH.

Temperature

Maintain the temperature of the plating solution between 50 and 60 °C, unless otherwise specified. For uniform results, keep the solution temperature near 55 °C. If the temperature falls below 50 °C, the current efficiency will decrease. If the temperature is above 60 °C, nickel sulfamate decomposes more quickly.

ANALYTICAL PROCEDURES

The following analytical procedures are recommended for use by personnel who have been trained to use laboratory practices which are considered safe and prudent by chemical industry standards. Such practices include suitable personal protective equipment, the use of proper equipment, the use of proper methods of handling all chemicals and proper laboratory procedures. Use only analytical reagent grade chemicals and deionized or distilled water in the following analytical procedures.

CAUTION: The following procedures involve the use of potentially hazardous chemicals. Consult manufacturer's material safety data sheets and follow the appropriate safety precautions.

I. Analysis for Nickel

A. Equipment Needed

- 2 mL Class A volumetric pipets
- 10 mL graduated cylinder
- 25 mL Class A volumetric pipets
- 25 mL buret
- 250 mL Erlenmeyer flask

B. Reagents Needed

0.1 M Ethylene-diamine-tetra-acetic Acid, Disodium Salt, Dihydrate ($EDTA \cdot Na_2 \cdot 2H_2O$) - Dissolve 37.224 grams of EDTA in 500 mL of water. Cool and dilute to one liter in a volumetric flask. Standardize against a zinc solution of known concentration.

Ammonium Hydroxide (NH_4OH) Solution - Concentrated reagent grade (commercially available)

Murexide Indicator - Mix 0.2 gram of murexide (acid ammonium purpurate) with 100 grams of sodium chloride. Grind together with a mortar and pestle.

C. Procedure

1. Pipet a 2 mL sample of the solution into a 250 mL Erlenmeyer flask. Add 50 mL of deionized or distilled water.
2. Add ammonium hydroxide to a deep blue color.
3. Add 1 murexide indicator tablet or a few grains of murexide and sodium chloride mixture (1 part murexide to 500 parts sodium chloride) to get a straw color.
4. Titrate with a standard 0.1M EDTA solution to end point, indicated by a sharp color change from green to deep blue/purple.

D. Calculation

mL of 0.1M EDTA solution titrated x 2.93 = g/L nickel

mL of 0.1M EDTA solution titrated x 0.393 = oz/gal nickel

E. Replenishment

Replenish operating solution with **MICROFAB NI REPLENISHER** (contains 150 g/L of nickel metal, 20 oz/gal) to obtain the desired nickel metal concentration.

II. Analysis for MICROFAB Ni EVF NiBAR NAA

A. Equipment Needed

- 5 mL volumetric pipet
- 10 mL graduated cylinder
- 25 mL Class A volumetric pipets
- 25 mL buret
- 250 mL Erlenmeyer flask

B. Reagents Needed

2% Sodium Chromate (Na_2CrO_4) Indicator Solution - Dissolve 2 grams of sodium chromate salt in 100 mL of water.

0.1N Silver Nitrate ($AgNO_3$) Indicator Solution - Weigh our exactly 17 grams of AR grade silver nitrate on an analytical balance. Dissolve in 500 mL of either distilled or deionized water and dilute to one liter. Standardization is required. Store in brown bottle in a cool place out of direct light.

Calcium Carbonate ($CaCO_3$) - Commercially available

C. Procedure

1. Pipet 5.0 mL of the plating solution to be analyzed into a 250 mL Erlenmeyer flask.
2. Add 50 mL of deionized water and 1 mL of 2% Sodium chromate (Na_2CrO_4) indicator solution.
3. Check pH of sample solution. If the pH of the sample solution is below 4.5, add 50 mL of deionized water; then add 5 grams of calcium carbonate ($CaCO_3$).
4. Titrate the above solution with standard 0.1N silver nitrate ($AgNO_3$) indicator solution to a reddish-brown precipitate endpoint.

D. Calculation

mL of 0.1N $AgNO_3$ solution titrated x 9.62 = mL/L MICROFAB EVF NiBAR NAA

mL of 0.1N $AgNO_3$ solution titrated x 1.23 = fl oz/gal MICROFAB EVF NiBAR NAA

E. Replenishment

Replenish operating solution to obtain the desired **MICROFAB EVF NiBAR NAA** concentration.

III. Analysis for Other Additives

Please contact a representative for the analytical procedures.

SAFETY & WARNING

It is recommended that the company/operator read and review the Safety Data Sheets for the appropriate health and safety warnings before use.

Safety Data Sheets are available.

WASTE TREATMENT

Prior to using any recommendations or suggestions for waste treatment, the user is required to know the appropriate local/state/federal regulations for on-site or off-site treatment which may require permits. If there is any conflict regarding our recommendations, local/state/federal regulations take precedent.

ORDER INFORMATION

Product	Code
MICROFAB EVF NiBAR-VMS	263862
MICROFAB EVF NiBAR-A	264157
MICROFAB EVF NiBAR-S	264290
MICROFAB EVF NiBAR NAA	267297
MICROFAB EVF NiBAR ACID	267266
MICROFAB NI REPLENISHER	248780

CONTACT INFORMATION

To confirm this document is the most recent version, please contact techinfo@MacDermidAlpha.com

www.macdermidalpha.com

North America	Europe	Asia
3950 Johns Creek Ct, Suite 300 Suwanee, GA 30024 USA 908.791.2300	Unit 2, Genesis Business Park Albert Drive Woking, Surrey, GU21 5RW, UK 44.01483.758400	14 Joo Koon Crescent, Singapore 629014 65.6430.0700

Also read carefully warning and safety information on the Safety Data Sheet. This data sheet contains technical information required for safe and economical operation of this product. READ IT THOROUGHLY PRIOR TO PRODUCT USE. Emergency safety directory assistance: US 1 202 464 2554, Europe + 44 1235 239 670, Asia + 65 3158 1074, Brazil 0800 707 7022 and 0800 172 020, Mexico 01800 002 1400 and (55) 5559 1588