

# NB SEMIPLATE NI 100

Nickelsulfamate process

## INTRODUCTION

**NB SEMIPLATE NI 100** is a nickelsulfamate electroplating process that produces a pure, ductile, fine-grained, semi-bright low stress nickel deposit required to meet the needs of the semiconductor industry for quality assured chemistry. NB SEMIPLATE NI 100 is manufactured to meet the requirements associated with the electroforming of micropatterned wafers (Micro System Technology).

The NB SEMIPLATE NI 100 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.

“**NB SEMIPLATE NI 100**” is shipped **ready-for-use**, while the “**NI 100 xxx**” are compounds and used for mixture and maintenance.

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT.

## FEATURES/BENEFITS

- Pure nickel depositions
- High ductile plating
- Fine grained, satin dull deposition
- Controllable inner stress of the deposition up to 7000 µm
- No anode passivation
- High hardness, controllable
- Good throwing power

## NB SEMIPLATE NI 100 DELIVERY PROGRAMME

Product Name	Comment
NB SEMIPLATE NI 100	• ready-for-use solution
NI 100 ANODE ACTIVATOR	• anode activating agent for proper anode solubility
NI 100 ADD. AGENT	• grain refiner and smoothing agent for shiny surface
NICKELSULFAMATE SOLN 185 G/L NI	• nickelsulfamate concentrate for mixture and nickel replenishment
BORIC ACID	• boric acid for pH-buffering and conductivity
SULPHAMIC ACID	• used to lower the pH

## READY FOR USE SOLUTION

The NB SEMIPLATE NI 100 is shipped as ready-for-use solution. Due to the high boric acid content, the boric acid falls out at room temperature.

## **NOTE**

When filling the solution into the plating tank, make sure to drag out all precipitated boric acid. The boric acid will re-dissolved when heated to operating temperature.

**EQUIPMENT**

**TANKS**

Tanks made of temperature resistant polymers such as PP, PE, PTFE or glass are recommended materials. First they have to be leached, the best overnight or over the weekend with ca. 5-10% caustic soda solution at approx. 50°C, rinse with deionised water and neutra lised with ca. 5% sulphamic acid.

**HEATING**

Automatical temperature control recommended. Use porcelain-, quarz-, or glass heaters, do not use steel or stainless steel.

**Remark:** agitation at heating zones recommended to avoid local overheating.

**ANODES**

Titanium baskets with new anode bags made of PP are recommended.  
Anode material: S-Ni-Pellets (Ø6-13 mm) or S-Ni-Rounds (Ø21 mm).  
New anode bags have to be leached out. Do not introduce anode bags used before.  
New anodes have to be degreased and run in. For degreasing use 10 to 20% NaOH at 20°C to 50°C. Make sure to clean thoroughly with DI-water. Then do a slight etch witch sulphamic acid 10 to 20% for at least 1 hour at 20°C to 50°C, at best for a couple of hours until the solution shows slight green colour. For running in do dummy plating with varying current densities from 10 to 30mA/cm<sup>2</sup>, e.g. for 1 hour each.

**FILTRATION**

Continuously, e.g. with filter cartridges (1-5 µm pores); filtration capacity at least 1 volume per hour. Tube connections should be made of fibre strengthened polymer.

**AGITATION**

Use vigorous, uniform agitation.

**RECTIFIER**

Sufficient to provide the necessary direct current with less than 5% ripple.

**OPERATING CONDITIONS**

	<b>Optimum</b>	<b>Range</b>
Nickel metal	90 g/l	80 – 110 g/l
Boric acid	45 g/l	35 – 45 g/l
NI 100 ANODE ACTIVATOR	160 ml/l	130 – 170 ml/l
NI 100 ADD. AGENT	21 ml/l	Depend on application
pH	3.25	2.5 – 4.0
Temperature	52°C	40 – 56°C
Cathodic current density	1 A/dm <sup>2</sup>	0.1 to 8.0 A/dm <sup>2</sup>
Anode to cathode surface		minimum 2 : 1
Agitation of the electrolyte	Vigorous	

**COMPONENTS TO MAKE-UP A VOLUME OF 10 LITER**

NICKELSULFAMATE SOLN 185 G/L NI	4,9 l
BORIC ACID	450 g
<b>NI 100 ANODE ACTIVATOR</b>	1,6 l
<b>NI 100 ADD. AGENT</b>	210 ml

## PREPARATION OF THE SOLUTION

1. All parts of the equipment, which are in direct contact with the electrolyte should be leached with 60 g/l tri-sodium phosphate solution for 8 hours at a temperature of 50°C. It should then be rinsed with clean water and leached with a 5% v.v. sulphamic acid solution for 8 hours at a temperature of 60°C. Again, it should be thoroughly rinsed with clean water.
2. Fill the tank to 35% (35 liters) of the required volume with deionised water.
3. Add, with agitation, the nickel sulphamate solution (185 g/l Ni metal) and stir well.
4. Add, with agitation, the boric acid while heating the solution to 60-70°C. Make sure, that it is completely dissolved before you go to the next step
5. Add, with agitation, NI 100 ANODE ACTIVATOR.
6. Add, with agitation, NI 100 ADD. AGENT
7. Adjust to final volume with deionised water.
8. Check and correct pH to 3.5 with sulphamic acid.
9. Analyse for the additive concentration and adjust if necessary.
10. Carry out internal stress measurement
11. The bath is then ready for use.

## MAINTENANCE OF THE SOLUTION

### Boric acid

Serves as a buffer to prevent variations in solution pH during the plating cycle. It also reduces the tendency toward burning at higher current densities and should be maintained at optimum for best results. At lower temperatures, boric acid tends to fall out if concentration is at 45g/l. Then lower concentrations may be operated such as 35 to 40g/l.

### Temperature

Maintain the temperature of the plating solution between 32 and 54°C. For uniform results, keep the solution temperature near 50°C. Agitation must be vigorous!! See "Equipment Required".

### pH control

Maintain the pH of the solution between 2.75 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 3.25. Use only reagent grade sulphamic acid to lower the pH and high purity nickel carbonate to raise the pH. Do not add nickel carbonate directly to the solution. Either make a slurry with a portion of the solution and add to sump or weir or fill an anode bag and hang it in the solution where solution movement is good.

## NICKEL CONCENTRATION

Nickel sulphamate solution contains 185 g/l nickel metal. This solution is used for make-up and compensation for drag-out losses.

### NI 100 ANODE ACTIVATOR

Is used to improve solution conductivity, throwing power and anode corrosion. For best results the anode activator should be maintained at the optimum range and added on the basis of analysis.

### NI 100 ADDITION AGENT

Contains a wetting agent along with a stress reducer. This material serves the functions of keeping the deposit at a low internal stress (slightly compressive) as well as semi-bright and ductile, it increases also the hardness of the deposit up to 580 HV.

The semi-brightness is a side effect of the stress reducer in the addition agent, which should be maintained by use of an ampere hour meter, the rate of addition being 0.5 ml per ampere hour.

**ANALYSIS**

The electrolyte should be analysed routinely to control concentrations of its additives. NB Technologies GmbH offers analysis of the contents from 100 ml samples.

**RATE OF DEPOSITION FROM NB SEMIPLATE NI 100 NICKEL SULPHAMATE SOLUTIONS**

ASD \ μm	2.5	7.5	12.5	17.5	25	50
1.1	12	36	60	84	120	240
2.2	6	18	30	42	60	120
3.2	4	12	20	28	40	80
4.3	3	9	15	21	30	60
5.4	2.4	7.2	12	16.8	24	48
10.8	1.2	3.6	6	8.4	12	24

**CONTROL OF IMPURITIES**

Control of contaminants, that may adversely affect the performance of the NB SEMIPLATE NI 100 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 A/dm<sup>2</sup> 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 interaction with the brightening system of this process if allowed to reach appreciable levels. These materials can only be removed by the carbon treatment procedure.

**CARBON FILTERING**

In order to remove organic contaminations as per analysis or by suspect, organic cleaning and carbon filtering may be applied. After the procedure, analysis and replenishment of the additioners is required. Regular carbon filtering is not recommended. Contact NB Technologies for technical assistance.

**SPECIFIC PROCEDURES**

- Oxygen plasma before plating
- chemical pre-treatment not recommended/normally not needed
- Cleaning of all items with DI before insertion in electrolyte
- Wetting of wafer surface with DI water before insertion into bath (check for wetting)

**CUSTOMER SUPPORT**

Further customer support on the process with this product is available by contacting NB Technologies GmbH.

**BATH ANALYSIS SERVICE**

NB Technologies supports the bath analysis and provides special shipping kits including shipping box, sample bottles and labels.

**DATA LOGGING**

Keep a record of ampere-hours of use to determine replenishment volumes. Examples of process log sheets are available by contacting NB Technologies GmbH.

## HANDLING AND SAFETY INSTRUCTIONS

For detailed information consult the material safety data sheets for this product.  
Please read material safety data sheets carefully before using this product.

## DISCLAIMER

All recommendations and suggestions in this bulletin concerning the use of our products are based upon tests and data believed to be reliable. Since the actual use by others is beyond our control, no guarantee expressed or implied, is made by NB Technologies GmbH, its subsidiaries or distributors, as to the effects of such use or results to be obtained, nor is any information to be construed as a recommendation to infringe any patent.

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