NB SEMIPLATE SN 100

Pure tin plating process

INTRODUCTION

NB SEMIPLATE SN 100 is a high-purity electroplating process which produces fine-grained, matte, pure tin deposits.
It is especially formulated for use in the fabrication of circuit patterns and bumps on semiconductor wafers. The process contains no fluoborates or formaldehyde and is operated with soluble anodes.

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

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT.

MATERIALS REQUIRED

The following materials are normally recommended for a typical start up and operation:

Product Name	Comment
NB SEMIPLATE SN 100	• ready-for-use solution
SN 100 MAKE UP	• is a high purity, make up solution containing 20 g/L tin and 94 g/l free acid
SN 100 CONC	• is a high purity concentrate containing 300 g/l tin. It provides the tin ion concentration for the operating solution. It is necessary in case of using insoluble anodes.
SN 100 ACID	• is a high purity solution containing 942 g/l free acid. It provides acid for the operating solution and is necessary for solution stability and conductivity.
SN 100 REPLENISHER	• is a high purity solution containing the materials necessary to produce fine grained, matte deposits.

Materials are purified and packaged for semiconductor applications in clean room compatible packages

EQUIPMENT REQUIRED

The following section is a guide for usual operation conditions. The specific conditions and requirements may depend on tool vendor specifications and application.
Acidic solutions are highly corrosive. Therefore, exposed metal materials in the fab area should be protected from the effects of these solutions. Several coats of a vinyl coating can provide adequate protection.

Tanks	PVC, PVDC, polypropylene or Teflon tanks can be used.
Leaching	Tanks, filter cartridges, anode bags, and peripheral equipment must be leached prior to installation. Depending on tool status, this may include degreasing, base solution treatment, DI water rinse, acidic treatment and final DI-water rinse.
Agitation	Solution agitation is necessary to achieve the best results. Solution agitation, without air, is recommended. Increased solution flow rate can be important for uniform plate distribution and plating rate.
Heating and Cooling	Cooling coils may be considered for temperature adjustment. Cooling and heating coils made of titanium or Teflon-coated copper may be used. Teflon tube bundles, immersion type heat exchangers or external heat exchangers are preferred.

Filtration	Continuous filtration is necessary for maintaining low particle counts of the solution. Use woven Dynel or polypropylene filter cartridges (with a polypropylene core) with a 5 micron or less retention. Cotton filters must not be used. Filter cartridges must be leached before installation in the tool (refer to next section).
Ventilation	Ensure sufficient exhaust (acidic mists) and check with local regulations.
Rectifiers	Direct current or pulse rectifiers (direct or reverse mode) may be used. Make sure to use power supply without current ramping and ripple less than 2%. Consult NB Technologies GmbH for specific application recommendations.
Anodes	Titanium baskets with new anode bags made of PP are recommended. New anode bags have to be leached out. Do not introduce anode bags used before. Anode material: Sn-Domes or Sn-Wire. Use materials with high purity only. Metallic impurities have negative impact on the plating process.

MAKE UP PROCEDURE

1. Proper leaching and cleaning of the tank is mandatory. Depending on the tool status (used or first time of use), the tank must be leached with a solution containing 45 g/l trisodium phosphate and 7.5 g/l NaOH heated to 60 °C for 4 to 8 hours. Scrub tank lining with solution to remove any dirt, oils or surface soils. Be careful to flush thoroughly with several rinses to remove all residues of sodium (filled and drained).
2. Then leach with 10% by volume SN 100 ACID heated to 50°C for 4 to 8 hours. Again flush tank with water.
3. Empty the tank.
4. Soluble anodes need to be degreased with NaOH (e.g. 10% by volume), thoroughly cleaned with DI-water and shortly soaked in 10% by volume SN 100 ACID. If applicable, the anodes can be treated at same time in step 1 to 3.
5. Do NOT soak string wound polypropylene filter cartridges in NaOH, unless full removal of NaOH from the filter cartridge can be guaranteed. Leach string wound polypropylene filter cartridges by immersing in boiling DI-water for 30 minutes, followed by thorough rinsing with deionized water. This process must be repeated until there is no evidence of foam or turbidity of the boiling water. The cartridges must then be immersed in a solution of 10% by volume SN 100 ACID to which 20 ml/l of SN 100 REPLENISHER has been added. The cartridges must be allowed to soak for 1 hour. For sub-micron filters follow the manufacturer recommendation for preparation prior to installation.
6. Install leached filter cartridges.
7. Carefully pour or pump NB SEMIPLATE SN 100 solution OR NB SEMIPLATE SN 100 MAKE-UP added by 30ml/l Sn 100 REPLENISHER into the tank and start filtering the solution. The solution is now ready for production operation.
8. Take a sample of the solution to check for final additive concentrations, optionally send to NB Technologies GmbH for analysis.

BATH PARAMETERS

The following table shows the bath parameters, which should be maintained and checked with regular sample analysis.

	NB analysis	Units	Max. upper limit	Upper action limit	Optimum	Lower action limit	Lowest limit
Tin (2+) Concentration	X	g/l	40	30	20	18	17
SN 100 ACID	X	ml/l	120	11	100	90	80
SN 100 REPLENISHER	X	ml/l	80	40	30	25	20

PLATING CONDITIONS

Parameter		Optimum	Range
Cathode current density	[mA/cm²]	20	10 - 30
Flow (depending on tool)	[l/h]	-	500 - 1000
Anode to cathode area ratio		3:1	or higher
Temperature	[°C]	24	21 - 27

OPERATION

The concentrations of tin (2+), free acid ions, and SN 100 REPLENISHER are determined by solution analysis and maintained through additions of SN 100 CONC, SN 100 ACID, and SN 100 REPLENISHER respectively.

SN 100 Replenisher

The consumption rate of SN 100 REPLENISHER will be a function of the type of plating equipment used. However, the replenishment rate will normally be 0.1 to 0.3 mL per ampere-hour. If deposits appear dark, SN 100 REPLENISHER may be added in 2ml/l to 10ml/l increments. A slight overdose is not critical.

SN 100 ACID

The acid concentration should not fall below 70ml/l. For replenishment add the correspondent volume of SN 100 ACID.
Low levels of acid concentrations effect higher anode potential, poorer uniformity and higher rate of Tin(IV) generation. Higher levels of acid concentration reduce the maximum plating current density, but do not impact the plating quality in general.

Temperature

Control the temperature of the solution between 20 and 27 °C. The optimum operating temperature is 24 °C. Lower temperature effects better thickness uniformity, but limits the maximum current density to be used and effects bigger grain size. Higher temperature enables higher plating currents and finer grains, but effects poorer uniformity.

Filtration

Continuous filtration for the removal of particulate matter is strongly recommended. Clean and leach cartridges or filter bags prior to use according to the solution make-up section of this document. Do not operate continuously with carbon filter cartridges, or addition agent will be removed from the solution.
Capacity of the pump and filter must be sufficient to turn over the complete volume of solution at least once per hour, preferably two or more times per hour. Pumps, fittings, pipes, valves, connections and filter must be of inert acid resistant materials. Plastic and hard rubber are recommended for pumps. PVC, PVDC, polypropylene and approved grades of rubber are suitable materials of construction for filter chambers and baffles.

Anodes

Maintain the anode area at least three times of the cathode plating area (wafer) for NB SEMIPLATE SN 100 process. Anodes facing tank walls have only 85% of their full surface area anodically effective. Establish a maintenance program to replace anodes as consumed to keep the anode to cathode ratio within the operating limits.

Current Density

The normal current density range of 20 mA/cm² (1.0 to 3.0 ASD) is recommended for most applications.

CONTAMINATION PRECAUTIONS

Make sure to prevent sulfuric acid to enter the bath. The bath will be destabilized at small concentrations, such as 0.4g/l H_2SO_4 or 4ml per liter H_2SO_4 (10%).

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 of 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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