

NB SEMIPLATE AG 100

Ag electroplating process

INTRODUCTION

NB SEMIPLATE AG 100 is an alkaline, non-cyanide electroplating formulation, which produces satin bright silver deposits. Deposits from the NB SEMIPLATE AG 100 have excellent physical characteristics such as solderability and good electrical conductivity.

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

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT.

PHYSICAL PROPERTIES OF THE DEPOSIT

| | |
|----------|------------------------------|
| Purity | 99.0 - 99.9% |
| Hardness | 70 to 90 HV _{0,020} |
| Density | 10.4 g/cm ³ |

MATERIALS REQUIRED

| Product Name | Comment |
|-----------------------|---|
| NB SEMIPLATE AG 100 | <ul style="list-style-type: none"> • ready-for-use solution |
| AG 100 SILVER COMPLEX | <ul style="list-style-type: none"> • For make up and maintenance; contains 60g/l silver metal |
| AG 100 CA | <ul style="list-style-type: none"> • For make up and maintenance; complexing agent; contains NO silver metal |
| AG 100 ADDITIVE D | <ul style="list-style-type: none"> • Brightening Agent |
| AG 100 ACID ADJUST | <ul style="list-style-type: none"> • To lower pH |
| Potassium hydroxide | <ul style="list-style-type: none"> • To increase pH |

EQUIPMENT REQUIRED

| | |
|-------------------|---|
| Tanks, pumps, etc | Polypropylene, CPVC, unfilled PVC, PTFE, HDPE and plexiglass are recommended. Viton is a recommended gasket material. If any questions arise as to material compatibility, consult NB Technologies. |
| Leaching | Leach all tanks and peripheral equipment thoroughly prior to installation of this process, e.g. 5 to 10% potassium hydroxide solution. |
| Heating | Titanium, stainless steel (type 316), Teflon, porcelain |
| Filtration | Continuous filtration is required. Use properly leached Dynel, or polypropylene filter cartridges. Make sure to rinse well after leaching. |

| | |
|-------------|---|
| Rectifiers | Sufficient to develop more than the greatest direct current required with less than 5% ripple at the amperage used. Use of Ampere-Minute-Meter is strongly recommended. |
| Anodes | Pure silver anodes or silver granulates in titanium baskets are recommended. For certain applications bagged high purist silver anodes or platinized titanium anodes may be used. |
| Agitation | Moderate to vigorous solution movement; venture jetting system can be used; no air agitation; |
| Ventilation | exhaust according to local regulations |

BATH PARAMETERS

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

| | NBT analysis | Units | Max. upper limit | Upper action limit | Optimum | Lower action limit | Lowest limit |
|-------------------|--------------|-------------------|------------------|--------------------|---------|--------------------|--------------|
| Ag | X | g/l | 40 | 35 | 30 | 25 | 20 |
| complexing agent | X | g/l | 150 | 140 | 130 | 125 | 120 |
| AG 100 ADDITIVE D | X | ml/l | 2.5 | 2.0 | 1.2 | 1.0 | 0.8 |
| Density | - | g/cm ³ | | | 1.17 | | |
| pH (50°C) | (X) | pH | 10.0 | 9.75 | 9.5 | 9.25 | 9.0 |
| pH (25°C) | (X) | pH | | | 10 | | |

GENERAL PLATING CONDITIONS

| Parameter | | Optimum | Range |
|--|----------------------|---------|-----------|
| Cathode current density | [A/dm ²] | 3.0 | 0.5 – 4.0 |
| Flow depending on tool | [l/h] | - | 1200 – |
| Anode to cathode spacing (depends on tool and wafer size) | [cm] | | 5 - 15 |
| Anode/cathode area ratio | - | 2:1 | >2:1 |
| Temperature | [°C] | 50 | 45 to 55 |

Time for 1 micron at 0.5/A/dm²: 3 min
 Efficiency: 65 mg/Amin
 Silver consumption: 4.0 g/Ah

MAKE-UP PROCEDURE

To make up 1 liters of working solution the following are required:

| | | |
|-----------------------|-----|------|
| AG 100 CA | 220 | ml/l |
| AG 100 SILVER COMPLEX | 500 | ml/l |
| AG 100 ADDITIVE D | 1.2 | ml/l |

Make up:

1. Thoroughly clean and leach the plating tank
2. Add 200ml/l AG 100 CA
3. Add slowly, under good agitation, 500ml/l AG 100 SILVER COMPLEX
4. While stirring, add 1.2ml/l AG 100 ADDITIVE D
5. Adjust to the final volume with deionised water and heat to the correct operating temperature.
6. Check and adjust pH to 9.5 if needed.

The solution is then ready for use.

SPECIFIC REQUIREMENTS

- Fixtures and anode should be operated in symmetric conditions to the wafer centre (distance of wafer edge to fixture edge, distance of fixture to tank wall, electrical contacting)
- Proper anode material (see above).
- Fixture and others features of PP, PFTE, POM or compatible-proven materials (degreased, leached)

MAINTENANCE

The product should be stored dry, **free from freezing and UV radiation.**

Silver anodes should be removed from the plating bath at longer idle periods.

Routinely analyze the plating solution for metal concentration to determine the need for replenishment or to verify the accuracy of a replenishment schedule based upon Ampere-minutes of use. NB Technologies offers bath analysis service and sample kits for shipping.

SILVER concentration / AG 100 SILVER COMPLEX**With silver anodes:**

The consumption rate of AG 100 CA complexing agent depends on the drag out and process parameters. During ramp up, the concentration should be analysed frequently. Based on the results, the Ag 100 CA should be added regularly to avoid over- or underdosing according to the Ampere hours. If the anodes dissolve correctly, the silver content should be maintained automatically. Note that the silver anodes should be removed from the plating bath during longer idle periods.

With insoluble anodes:

If insoluble anodes are used, the silver content must be maintained by addition of AG 100 SILVER COMPLEX. For every g/l silver metal consumed, add 17ml/l AG 100 SILVER COMPLEX. The consumption rate of AG 100 CA complexing agent depends on the drag out and process parameters. During ramp up, the concentration should be analysed frequently. Based on the results, the AG 100 CA should be added regularly to avoid over- or underdosing according to the Ampere hours. In some cases, particularly if the anode area is insufficient for the applied current density, a frequent carbon treatment may be required.

Range: 20 – 40g/l (30g/l)

Influence: Less than 30g/l decrease the maximum applicable current density. Low concentration affects the thickness distribution and limits the cathodic current density.

Adjustment: To increase the silver metal content by 1 g/l add 16.6ml/l AG 100 SILVER COMPLEX

pH control and adjustment

- Range: 9.0 – 10.5 (@50°C)
- Influence: Lower than 9.0 might cause instability of the silver complex and will give a white precipitation (will disappear by increasing pH). Higher than 11.0 will passivate the anodes and create process instability.
- Adjustment: Use potassium hydroxide to increase the pH and AG 100 ACID ADJUST to decrease the pH. When lowering the pH using AG 100 ACID ADJUST a slight turbidity might occur. The turbidity will disappear in a short time by good agitation.
- Note: pH should be measured at 50°C (operating temperature).

AG 100 CA (complexing agent)

- Too low: Affects the thickness distribution and stability of the bath.
- Adjustments: Should be done preferably when the solution is not in use and at sufficient agitation.

Both, the AG 100 SILVER COMPLEX and the AG 100 CA contain complexing agent.

| | Complexing agent | Metal concentration |
|----------------------------|------------------|---------------------|
| Optimum bath concentration | 130 g/l | 30 g/l |
| AG 100 SILVER COMPLEX | 150 g/l | 60 g/l |
| AG 100 CA | 250 g/l | 0 g/l |

Adding AG 100 CA:

- 1 g/l complexing agent is added by 4ml/l AG 100 CA

Adding AG 100 SILVER COMPLEX:

- 1g/l silver is added by 16.6ml/l AG 100 SILVER COMPLEX
- 16.6 ml/l AG 100 SILVER COMPLEX adds 2.5g/l complexing agent
- **Adding 1g/l silver metal adds 2.5g/l complexing agent at same time**

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 required, if sufficient anode area is provided. Contact NB Technologies for technical assistance.

Impurities

Introduction of metallic impurities into the solution should be prevented by proper rinsing of the parts to be plated. The NB SEMIPLATE AG 100 process is relative tolerant to low levels of heavy metal contaminants, as it will co-deposit these metals without serious effect upon either the appearance or physical properties of the deposit. Organic impurities may be dragged into the plating solution from a variety of sources and will usually result in a significant decrease in plating efficiency which will eventually lead to bath decomposition.

The use of adequate pre-treatment or proper bath entry procedures (in case of copper alloy as plating base) are always preferable.

SPECIFIC PROCEDURES

- Oxygen plasma before plating
- Pre-treatment of copper seed layers
- Cleaning of all items with DI before insertion in electrolyte
- Wetting of wafer surface with DI water before insertion into bath (check for wetting)
- No dwelling in bath before current application (especially if seed layer can be dissolved in the bath)

CUSTOMER SUPPORT

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

BATH ANALYSIS SERVICE

Periodic analysis of the NB SEMIPLATE AG 100 is strongly recommended. 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.

ADDRESS

NB Technologies GmbH
Fahrenheitstr. 1
28359 Bremen
Tel. +49 421 2445810
Fax. +49 421 22379787
info@nb-technologies.de