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22.09.2014

DURNI-COAT® DNC 100

Electroless plating NiP-process as a pre-nickel plating process of aluminium- and steel parts

The **DNC 100** is being used as a pre-nickel plating-process of aluminium- and steel parts. This procedure shall prevent an impurification of the main electroless plating electrolyte through drag in of pretreatment chemicals and/or zinc. Therefore the quality of the main electroless plating electrolyte remains on a high level. When plating aluminium parts the lifetime of the electrolyte will increase.

The **DNC 100** is used on a base of downgrade. Thereby the resources nickel and sodium hypophosphite of old electrolytes are being utilized to a rest nickel content of 2 g/L, instead of losing them. As an old electrolyte you may use any **DNC** electrolyte which contains ammonia and that cannot be used anymore due to the end of lifetime. Electrolytes that are turbid or contains impurities must not be used. Also not suitable are electrolytes that cause irregularity in plating or in the layer. Old leadfree **DNC** electrolytes up to 4 MTO may also be used for a make up. There are several possibilities for the make up, seen on page 2.

Tank and equipment

A PP tank with a filter circulation rate of about 2 – 3 tank volumes per hour is recommended, but a stainless steel tank with anodic protection is preferred. When required, a filter system is necessary. When a leadfree **DNC** electrolyte is used a filter system is necessary. It should be fitted with 1 µm polypropylene cartridge filters for continuous operation. When making up a new electrolyte a cooling system is advisable due to the generated heat of the neutralisation reaction. Should the room temperature rise above 35 °C a cooling system is also necessary.

Make up

Following the make up procedure:

1. Clean the tank and rinse with DI water (last rinsing water: < 20 µS/cm)

	Examples for the use of different old DNC electrolytes and alternatives for the make up of DNC 100			
	DNC 520 new make up*	**DNC 520/ 9,11,12 DNC 700-3 - 3 MTO**	**DNC 571 – 4 MTO or DNC 471**	**New make up no old electrolyte used***
2. Add Make up chemicals or old electrolyte	42 mL/L Repl 1 (520); 180 mL/L make up 100 mL/L Stabi 10	800 mL/L old el.	800 mL/L old el.	42 mL/L Repl 1 (520, 571, 471); 40 g/L sodium hypophosphite
3. **DNC 100 GC**	100 mL/L	100 mL/L	100 mL/L	100 mL/L
4. Add stabiliser to	13 mg/L	13 mg/L	13 mg/L	13 mg/L
5. Add ammonia 25%	150 mL/L	n.a.	n.a.	150 mL/L
6. Add NaOH	to pH 8.5	to pH 8.5	to pH 10.5	to pH 8.5
7. Filtration	no	no	mix during 4 days at RT; no than 24 h sedimentation; afterwards filtration 1 µm (+ filter aid)	

***Important:** the make up with example one and four (without the use of an old electrolyte) is not practicable if a cyanide zincate for the pretreatment of aluminium is in use!

To 2.: Make up chemicals or old electrolyte are filled to 80% of the tank volume.

These electrolytes must not be used:

- Turbid electrolytes, caused by electrolyte losses (precipitation of chemical ingredients)
- Turbid electrolytes, caused by drag in of pretreatment chemicals (clearly visible precipitations)
- Turbid electrolytes, caused by drag in of impurities (larger quantities of e.g. rubbed-off parts of barrel plating, cover material, metallic abrasion parts, SiC-particle, PTFE-Dispersion,…)
- Electrolytes, which have been plating irregular (visible at the layer) or with passivity or discoloured layers (white to grey layers)

The turbidity of a solution may be tested with the following procedure:
Fill a sample in a clean, transparent beaker and let a beam of light (with a torch e.g. LED) pass the solution to be tested. There shouldn't be any diffused light.

To 3.: Add 100 mL/L **DNC 100 GC**, calculated on the final volume.

To 4.: Adjust the content of stabilizer to 13 (+/- 3) mg/L (=5.7 – 8.7 mg/L lead), calculated on the final volume

To 6.: Add approx. 100 mL/L caustic soda (NaOH 50 %), calculated on the final volume; the temperature must not exceed 50 °C.

To 7.: Let the solution cool down to less than 35 °C and filter, if necessary, with a filter aid (Becofloc). After this procedure the electrolyte is adjusted to a pH value or 8.5 and is ready-to-operate.

Operating conditions

Nickel content:	2 – 5 g/L
Sodium hypophosphite:	20 – 50 g/L
Stabiliser (Lead acetate):	13 +/- 3 ppm
pH value:	8.5 +/- 0.5
Operating temp.:	25 – 35 °C

We recommend daily analysis of the amounts of nickel and sodium hypophosphite present.
The analysis methods for nickel and sodium hypophosphite may be taken from any TDS for a DNC process. The content of stabiliser and the pH value should be kept within the given range.
The electrolyte is intended to be used on a decrease base, until a nickel content of 2.0 – 2.5 g/L has been reached. Than the electrolyte has to be discharged. Of course there is the possibility to replenish the electrolyte and operate further on.
The plating speed is about 1 µm/h. When used as a pre-nickel plating-process a plating time of 15 minutes is enough. Do not plate more than an hour, as high thicknesses (> 1 µm) cause brittle layers.

Electrolyte maintenance

Adjust the content of stabiliser according to the analysis. The pH value should be kept within the given range, preferably with ammonia. It is not necessary to correct the content of nickel and sodium hypophosphite, but may be done with **DNC 471 Repl 1** or **DNC 520-9 Repl 1** and **DNC 450-9 Repl 2** or **DNC 700-1 Repl 2**. In this case an automatic pH-value, a (particularly) nickel-content control system and a dosage system are recommended.

Disposal criteria

If a nickel content of 2.0 – 2.5 g/L has been reached, the electrolyte may be discarded. A fixed coated/treated surface may serve as a disposal criteria, on a calculation base up to 100 dm^2/L. It depends on the base material and layout. The zinc content of the pre-nickel plating-process does not need to be supervised. At thicknesses of < 1 µm, it does not disturb the adhesion or the further plating process if the zinc content increases. Until now no zinc content higher than 30 mg/L has been reached, due to the integration in the layer.

Waste water treatment

When this waste water is treated in the waste water plant, please note that, this electrolyte contains in contrast to DNC electrolytes small quantities of amines. Therefore it is advisable to work with sulphide or a cation exchanger at the end to reach the discharge limit. An alternative would be to heat the electrolyte to 90 °C and add 0.1 g/L iron powder. Within one hour the entire content of nickel will plate out through reduction. The remaining nickel content should be lower than 0.5 mg/L, the pH value between 7 – 8. Take care to discharge in accordance with local effluent control regulations.

The first rinse after DNC 100 is discharged with the other waste water rinse, when the content of nickel is less than 200 mg/L. The drag out of the most production lines do not affect the waste water treatment negatively.

Alloys which have been successfully treated

Al Mg Si 1;
Al Mg Si 0,5;
Al Cu Mg Pb;
Al Cu Mg 1;
G Al Si Cu Ni;
Al Zn Mg Cu 1,5;
GD Al Si 12;
Al Mg 4,5 Mn;
Al 99,5
Alternative identification of alloys, that may be plated: 1050; 5083; 6063; 7075

Environmental considerations and product safety

Information can be gleaned from the material safety data sheets. Chemicals shall not be stored below 10 °C.

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