BERKEM®
performance in plating

PROCESS TECHNICAL DATA SHEET

NICKELOR 100 *series*

NICKEL FOR PLATING SOLUTION

Colour : **Gray nickel** Use : **Bath** Colour coordinates : **L : 83.6** **a: 0.7** **b: 6.2**

Product description

NICKELOR 100 series are a nickel plating bath purposely designed for flash or thickness plating. The processes NICKELOR 100 are characterised by the considerable compactness and resistance of the galvanic layer which makes it particularly suitable as a barrier against the diffusion of copper, silver and its alloys. These characteristics of compactness and resistance also make NICKELOR 100 particularly suitable for use as an intermediate layer very hard and bright considerably reducing the possibility of scratches and abrasion of the plated articles.

Application field

NICKELOR 100 can be deposited directly on Silver, Tin, Lead, Zinc, Cadmium, Aluminium, copper, nickel and Iron.

Operating conditions and deposit data

Parameter	UM	Operative range	optimum
Nickel concentration	g/l	50 - 80	65
Solution density	Bé°	20 - 32	23
Treatment time	Min	10 - 40	20
Temperature	°C	50 - 60	55
Voltage	V	4.0 - 10.	5.0
Current	A/dm^2	1.0 - 6.0	3.0
Cathodic efficiency	mg/Amin	15 - 17	16
pH	Un	4.0 - 4.6	4.3
Nickel deposited at 1000 A/min	g	15 - 17	16
Speed deposition	u/min	0.5 - 0.7	0.6
Deposition time for 0.6 micron at 3 A/dm^2	s	50 - 70	60
Density of deposit	g/cm^3		9.0
Anodes			Nckel
Anodes/Cathode rates		1:1 - 4:1	2:1
Agitation			Moderate
Filtration			Necessary over 5 litres

Berkem srl, Via G.Galilei 1/a , 35030 Caselle di Selvazzano D. (Padova). Email: info@berkem.it www.berkem.it

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Packaging
The product is contained in a high-density polyethylene bottle or cans

Equipment

Tanks : Mild steel with hard rubber lining, PVC or PVC-Polyester reinforced material or Pyrex glass in case of small volumes.

Anodes : Rolled pure nickel anodes, electrolytic nickel anodes, or S-nickel rounds (INCO) in titanium anode baskets. Anode bags required.

Anode bags : Required; use of twin bags is recommended. Made of Dynel or Polypropylene leached in a 10 % sulfuric acid solution and then flushed with hot running water prior to use.

Heaters : porcelain, hard glass, PTFE. Heat exchanger: titanium.

Required a Mechanical and / or air-agitation.

stroke length double stroke/min Horizontal 100 mm 20 – 25 (4 – 5 m/min) Vertical 60 mm 25 – 30 (3 – 4 m/min) The required amount of air is: 12 – 20 m3/h per meter of cathode rod. Blowers are to be used in order to avoid contamination of the electrolyte by oil or dirt in compressed air. Additionally, use of cathode rod agitation is advantageous in order to reach all parts of the rack by the air stream.

Filtration
Continuous filtration is recommended. The entire bath volume should be filtered at least 4 – 6 times per hour with 5 µm filters. As a guide, it is suggested that the filter be packed with 0.5 g of activated carbon per liter of solution per 40 production hours. It is further suggested that one-fifth of this amount of carbon be added along with some filter aid per eight production hours. When adding carbon to the filter, it should be mixed with an equal volume of filter aid in order to maintain a maximum rate of solution flow.

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Make Up

Make-Up of 100 l	**Liter / Kg**
Nickel Sulphate ($NiSO_4 \cdot 6\ H_2O$)	25 Kg
Nickel Chloride ($NiCl_2 \cdot 6\ H_2O$)	6.0 Kg
Boric Acid	4.5 Kg
NICKELOR 113	0.1 L
NICKELOR 100SL	2.0 L
NICKELOR 130 (if required)	0.02 L
NICKELOR 100P	1.0 L
NICKELOR 100TM	1.2 L

The solution should be made up in a storage tank which has been thoroughly cleaned. The plating tank and all associated plumbing, including pumps, spargers, heaters, filters, racks, etc., should be cleaned. All dirt, grease etc. should be wiped off and the tank sides and bottom scrubbed with a wetting agent and hot water and thoroughly rinsed. The lining of the tank, filters, etc. should be leached with a 0.2 to 0.5 % (v/v) of sulphuric acid heated to 60 °C, containing 1 l of **NICKELOR 100TM** per 1000 liter of acid. Leaching should continue overnight.

- Fill the off-line tank about two thirds full with distilled or deionized water, heat to 40 – 50 °C.
- Dissolve the boric acid, nickel sulfate and nickel chloride in the hot water while stirring well.
- Raise the pH to approx. 5.2 (measured electrometrically) by adding nickel carbonate or 4 % (42 g/l) sodium hydroxide solution, with vigorous stirring.
- Add 4 g/l of **Berkem** activated powdered carbon and stir for 30 – 60 minutes. Turn off agitation and allow carbon to settle to bottom of the tank for 3 – 4 hours or preferably overnight.
- Pump the solution above the carbon through a filter into the clean plating tank. (Take care that the temperature of the solution during filtration stays above 50 °C to prevent precipitation of boric acid).
- Clean and repack the filter with filter aid material then add a mixture of filter aid and activated carbon (0.15 g per liter of solution).
- Fill the tank to nearly the final volume with DI-water. Check and, if necessary, adjust the operating temperature.
- Adjust the pH to 4.0 with a 10 % (v/v) solution of sulphuric acid.
- Electrolyze the solution with dummy cathodes at 0.54 Ah/l for about 12 hours or until recesses in the corrugated cathodes are light in colour. Use of agitation and filtration during this period is beneficial.
- Readjust the pH, if necessary.
- Add the required amounts of **NICKELOR 113 ,NICKELOR 100P,NICKELOR 100TM,NICKELOR 100SL** and circulate for 20 minutes to assure thorough mixing.
- The electrolyte is now ready for use.

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General Data of Plating Solution

Nominal values	On make up	During operation
Nickel	70 g/l	55 – 80 g/l
Chloride ions	18 g/l	10 – 25 g/l
Boric acid	40 g/l	35 – 50 g/l

Additions of 10 g/l each of the following salts will change the inorganic bath values as follows:

Salt	Nickel	Chloride ions	Boric Acid
10 g/l Nickel Sulfate ($NiSO_4 \cdot 6\ H_2O$)	2.2 g/l	---	---
10 g/l Nickel Chloride ($NiCl_2 \cdot 6\ H_2O$)	2.5 g/l	3.0 g/l	---
10 g/l Boric acid (H3BO3)	---	---	10.0 g/l

The pH can be adjusted with sulphuric acid (diluted to 10 % (v/v)) or – if there is a lack of chloride ions – with hydrochloric acid (diluted at a ratio of 1 : 1). Evaporation losses must be replenished by adding distilled or deionised water

Data of Additives of Plating Solution

Nominal values	On make up	During operation
NICKELOR 113	0.5-1.0 ml/l	0.5-1.0 ml/l
NICKELOR 100SL	20 ml/l	15 – 25 ml/l
NICKELOR 100P	10 ml/l	10 – 15 ml/l
NICKELOR 100TM	12 ml/l	8.0 – 12 ml/l

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Function and dosage of the Additives

Consumption for 10,000 Ampere hours	Liter
NICKELOR 113	4.0 (3.0 – 5.0)
NICKELOR 100SL	0.5 (0 – 1.5)
NICKELOR 100P	2.0 – 6.0
NICKELOR 100TM	0.6 (0 – 0.8)

NICKELOR 113

With the **NICKELOR 113** bright and leveled nickel layers can be deposited over a wide current density range.
Lack of **NICKELOR 113** results in reduced brightness and leveling. Excess of **NICKELOR 113** could cause skip plating in LCD areas and the nickel deposit could become brittle. In most installations, **NICKELOR 113** is sufficient to maintain the required brightness, leveling and metal throw. However, in some installations, depending on current density, drag-out losses etc., small supplemental additions of the other additives e.g. **NICKELOR 130** may be required to balance the bath or optimum performance. For the maintenance of **NICKELOR 113** an automatic dosing based on Amperehours is recommended.

NICKELOR 130

NICKELOR 130 can be added on make-up of a new bath or on conversion of any existing bath. **NICKELOR 130** can be used in addition to **NICKELOR 113** in order to increase the leveling of the bath when electroplating badly polished or unpolished work and in situations where the maximum rate of leveling is required. **NICKELOR 130** must be used in conjunction with **NICKELOR 113**– it is NOT a replacement for **NICKELOR 113** . A typical addition of **NICKELOR 130** is 0.25 – 0.50 ml/l depending on leveling required. Generally **NICKELOR 130** is added as and when required although it can be added on a continuous basis to tailor make the process to meet specific needs. Excess of **NICKELOR 130** could cause skip plating in LCD areas.

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NICKELOR 100SL

It is important for the ductility and reduces the inner stress of the nickel layer. Is needed for maximum brightness and ductility and it is depleted very slowly by electrolysis and is removed only slightly by continuous filtration through a carbon pack.

NICKELOR 100P

It is added to provide maximum rates of brightness and levelling. It also diminishes the tendency of liberated hydrogen to form gas pits. A too low concentration may result in reduced luster and levelling of plated parts. It is lost mainly by electrolysis. Average amounts of activated carbon (2.4 – 6.0 g/l) will not substantially reduce the concentration of **NICKELOR 100P**

WETTING AGENTS

NICKELOR 100TM is a wetting agent for air agitated solutions. It should be maintained at a level to give a surface tension of 40 – 45 dynes/cm.

NICKELOR 100TM2 should only be used when the solution is operated with mechanical agitation.
Both wetting agents are removed by batch treatments with activated carbon and to some extent when operating with a carbon packed filter.

Cleaning of the Plating Solution

In order to reduce the content of metallic impurities, a continuous or periodic electro cleaning with 0.05 **–** 0.3 A/dm2 (the area of the cathode should be as large as possible) is recommended. Agitation improves the cleaning effect. In order to reduce the content of organic impurities (break down products and drag in) batch treatment with activated carbon is recommended at certain intervals. To increase the intervals between batch carbon treatments, continuous treatment with granulated activated carbon (approx. 4 g per 100 l of electrolyte) as media on a filter or in activated carbon cartridges is recommended. The consumption of wetting agent is slightly increate

Safety Information
NICKELOR 100 is composed by many solutions so , check carefully the related safety data sheet. (MSDS)

Note
Technical information and data regarding the composition, properties or use of the products described herein is believed to be reliable. However, no representation or warranty is made with respect thereto except as made by Berkem in writing at the time of sale. Berkem can not assume responsibility for any patent liability which may arise from the use of any product in a process, manner or formula not designed by Berkem srl

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Recommendations for Wastewater Treatment

Rinse water
Nickel can be precipitated by adjusting the rinse water pH to between 9.5 - 10. The filtered solution can subsequently be sent to final neutralization.

Concentrates
The following options are possible when concentrated Nickel solutions must be treated.
When nickel is to be recycled, it is generally necessary to treat these nickel solutions separately from other solutions.
The following recycling methods are typical, although others can be recommended:

- Electrowinning of nickel using an appropriated electrolytic cell.
- Treatment of nickel concentrate, or of a precipitated nickel sludge, by a specialized recycling company.

If these methods cannot be used, the nickel concentrate together with the complexing agent free wastewaters can be treated by adjusting the pH to between 9.5 - 10. For better precipitation the concentrates must be diluted in a ratio of 1 : 10 before sending to the wastewater treatment plant. For better flocculation we recommend to add a flocculant (e.g. a polyacrylamide/anionic with a mol mass of 4 – 6 million). The solution is then stirred and the precipitation is allowed to settle for better filtration.

Related products

Cod.Articles	Description	Colour	Packaging
NI013601	NICKELOR 101 Nichel plating solution ready to use	Gray	1 litre
NI013610	NICKELOR 101 Nichel plating solution ready to use	Gray	10 litres
NI010325	NICKELOR 110 Primary brightener additive		1-25 litres
NI010525	NICKELOR 120 Brightener additive		1-25 litres
NI010625	NICKELOR 130 Levelling additive		1-25 litres
NI010410	NICKELOR 113 Complete brightener additive		1-25 litres
NI010725	NICKELOR 100F Co-brightener additive		1-25 litres
NI010805	NICKELOR 100P Co-brightener additive		1-25 litres
NI011105	NICKELOR 100SL Secondary brightener additive		1-25 litres
NI012610	NICKELOR 100TM Wetting agent additive		1-25 litres