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NI-STAR SP

ELECTROLESS NICKEL PLATING PROCESS

INTRODUCTION

Ni-Star SP is an advanced electroless nickel -plating process, designed to deposit a uniform very bright, nickel phosphorus deposit.

Ni-Star SP can be used to convert a bath of Ni-Star HP, which has completed 3-4 MTO's and would normally be discarded. The Ni-Star HP would then be run as Ni-Star SP for a further 3-5 MTO's thus saving on effluent disposal.

Ni-Star SP is supplied as a 3 part process:-

Ni-Star SP Part 1	Make up and Replenishment additive
Ni-Star SP Part 2	Make up additive
Ni-Star SP Part 3	Replenishment additive

BENEFITS

Consistent performance throughout bath life

High deposition rates throughout bath life, 17-25 microns per hour.

Excellent solution stability

Excellent ductility and adhesion

Can be used to convert Ni-Star HP to provide extended bath life

Can be used for rack and barrel plating

SOLUTION MAKE-UP

Ni-Star SP Part 1	8% v/v
Ni-Star SP Part 2	20% v/v

OPERATING DATA

Nickel	5.0 - 6.0g/L Optimum 5.6g/L
Temperature	85 - 90°C.
pH	4.6 - 4.9
Agitation	Mild clean air agitation recommended
Loading	0.5 - 1.7 dm^2/L
Plating Rate	17 - 25 microns/hr

Note: The plating rate is dependent on pH, temperature and bath age.

It is important not to leave the working bath idle at operating temperature for long periods of time. This activity will not only cause solution imbalance but also waste heat and expensive chemicals.

Conversion Procedure - Ni-Star HP → Ni-Star SP

To carry out a conversion of your Ni-Star HP bath to Ni-Star SP simply stop using Ni-Star HP Part 1 and Part 3 for replenishment and start using Ni-Star SP Part 1 and Part 3. The bath will slowly increase in plating speed and brightness. The bath should now be operated as Ni-Star SP.

EQUIPMENT

Tanks	High density polypropylene or 316 Stainless Steel.
Heaters	PTFE or 316 Stainless Steel are recommended. Steam coils can be used, again made from PTFE on 316 Stainless Steel.
Filtration	10 bath turnovers per hour through 5 microns or smaller filter bags or cartridge. All filter units must be of non metallic parts.

It is recommended that the solution tank and filter bodies are cleaned out at the end of every working day. If there is any sign of nickel metal the tank should be cleaned out with 50% Nitric Acid.

INSTALLATION

It is essential that the tanks to be used for Ni-Star SP are thoroughly cleaned and leached before any product is introduced. See Equipment

Maintenance for procedure.

1. Fill tank to half working volume with DI Water.
2. Add Ni-Star SP Part 1 (8% of final bath volume) mix well.
3. Add Ni-Star SP Part 2 (20% of final bath volume) mix well.
4. Add DI Water to final volume and mix well.
5. Check solution pH (optimum 4.7 - 4.8). Adjust to within range if required. To increase pH use 50% ammonia solution and to lower pH use dilute sulphuric acid.

PROCESS SEQUENCE

See notes on pre-treatment.

MAINTENANCE AND CONTROL

The solution should be analysed regularly and maintained at optimum concentrations detailed under operating data.

Nickel analysis is used as a basis of maintaining the additions of Ni-Star SP Part 1 and Ni-Star SP Part 3.

Ni-Star SP Part 1 and Ni-Star SP Part 3 are added on an equal basis.

Analysis		**Additions**	
Nickel	**Activity**	**Mls / litre Ni-Star SP Part 1**	**Mls / litre Ni-Star SP Part 3**
5.6	100%	0	0
5.5	98%	1.4	1.4
5.4	96%	2.9	2.9
5.3	95%	4.0	4.0
5.2	93%	5.7	5.7
5.1	91%	7.0	7.0
5.0	89%	8.5	8.5
4.9	88%	9.3	9.3
4.8	86%	10.0	10.0
4.7	84%	12.9	12.9
4.6	82%	14.3	14.3
4.5	80%	15.7	15.7
4.4	79%	17.1	17.1
4.3	77%	18.5	18.5
4.2	75%	20.0	20.0

Notes

1. To provide optimum plating conditions it would be preferable to make frequent
additions.

2. A complete solution replenishment is achieved when 80ml/s per litre additions of Ni-Star SP Part 1 and Ni-Star SP Part 3 have been made.

3. It is unwise to operate solution below 90% strength. Should this occur then
make several additions to restore optimum operating conditions. Failure to keep the bath at optimum can lead to instability and shorten life of the bath. Large additions may lead to over stability of the bath.

ANALYSIS METHODS

Nickel Concentration

Reagents

0.1M EDTA (standard volumetric solution)
50% ammonia solution
Murexide indicator

Method

1. Pipette 5.0mls of bath (previously cooled) into a conical flask.
2. Add 50mls of DI Water.
3. Add 10mls 50% ammonia solution.
4. Add a small spatula tip of Murexide.
5. Titrate against 0.1 M EDTA solution to a purple end point.
6. Record titre = t mls.

Calculation

t x 1.174 = g/L Nickel

Replenishment

Refer to table in Maintenance and Control for appropriate additions.

Sodium Hypophosphite Concentration

Reagents

0.1 N iodine (standard volumetric solution)
Concentrated hydrochloric acid
0.1 N sodium thiosulphate solution (standard volumetric solution)
Iodine indicator solution

Method

1. Pipette 5.0mls of bath (previously cooled) into an iodine flask.
2. Add 50mls concentrated hydrochloric acid.
3. Pipette 50.0mls 0.1 N iodine into flask. Stopper flask and shake.
4. Leave in a dark cupboard for 30 minutes.
5. Titrate with 0.1 N sodium thiosulphate to a pale straw colour.

6. Add a few drops of iodine indicator and continue titration to a clear end point.
7. Record titre = t mls.

Calculation

(50-t) x 1.08 = g/L sodium hypophosphite.

Replenishment

For every 1g/L required add 2.5ml/L Ni-Star SP Part 3. Do not add more than 7.5ml/L in a single addition.

EQUIPMENT MAINTENANCE

Good housekeeping in electroless nickel plating is essential. All electroless nickel processes are sensitive to contamination such as metals, sulphur compounds and particulate matter such as dust. Great care should be taken to avoid contamination.

It is good practice to pump the solution out through the filter each day and wash the tank out. Once a week(or more often if required) carry out the full stripping procedure as described below.

When not in use the solution should be covered to reduce evaporation losses and contamination.

STRIPPING PROCEDURE

When preparing brand new equipment fill the tank with fresh 50% v/v nitric acid (SG 1.37) and pump round the system for a minimum of 8 hours. This passivates stainless steel and leaches out soluble organics from plastic equipment. This should be followed by a thorough washing as indicated below.

Used tanks should be stripped regularly as follows:

1. Transfer the solution to spare tank.
2. Remove and clean filter bags.
3. Rinse and pump water round the equipment.
4. Fill the tank with 50% nitric acid.
5. Circulate the acid to ensure that all surfaces are contacted.
6. Leave overnight to strip nickel deposits which may have built up.

7. Pump acid to storage or effluent.
8. Wash out the tank and circulate water round system thoroughly.
9. Drain tank.
10. Fill tank with deionised water and circulate.
11. Drain tank.
12. Fit new filter.
13. Return nickel solution to tank, make up to volume with deionised water and analyse.

NOTES

Pre-Treatments

Correct cleaning is absolutely vital in electroless nickel plating. Good rinsing is also important in order not to drag into the solution ions which could cause contamination of the Ni-Star SP.

It is preferable that the articles enter the solution with an alkaline rather than acid film in order to give the best possible start to the process and increase adhesion.

All materials must be free of oils, grease, organic contaminants, oxides and scales. It is very important that the base metal itself is carefully examined for physical damage such as scratches, pits, inclusions, cracks, roll or extrusion marks, all of which may adversely affect the appearance and performance of the electroless nickel deposit.

The general pre-treatment sequence for steel is as follows.

1. Econoclense S, hot soak clean.
2. Rinse.
3. Econoclense D, periodic reverse clean.
4. Rinse.
5. Econovate acid activate or pickle (vary concentration and temperature depending on requirement).
6. Rinse.
7. Econoclense D, anodic clean.
8. Rinse.
9. Ni-Star SP Electroless Nickel.

Ferrous metals, including low carbon steel, high carbon low alloy steels, cast iron, cobalt and nickel together with precious metals will all plate spontaneously on immersion in the Ni-Star SP solution.

Copper and its alloys, zinc, lead, tin, chromium and cadmium all need initiation before they will plate. This may be carried out using a separate electrolytic nickel strike.

Stainless steels should be treated in a Woods nickel strike solution before immersing in the Ni-Star SP.

Non metals such as alumina, graphite, plastics and silicon can also be coated after using appropriate pre-treatment systems.

DISPOSAL

Dispose of in accordance with local authority requirements.

PRODUCT FAMILIES

The following product or product families are referred to in this data sheet.

Product Name	Product Number
Econoclense D	206004
Econoclense S	206005
Econovate Dry Acid Salt	223001
Ni-Star SP Part 1	557024
Ni-Star SP Part 2	557025
Ni-Star SP Part 3	555017

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