Ni-STAR MP (CAF)120

ELECTROLESS NICKEL PLATING PROCESS

INTRODUCTION

Ni-star MP (CAF)120 is a state of the art cadmium and ammonia free electroless nickel-plating process, designed to deposit a uniform, bright nickel – phosphorus deposit. Ni-Star MP (CAF)120 has been designed to plate on ferrous and non-ferrous substrates. Ni-Star MP (CAF)120 is particularly suitable for plating on aluminium alloys.

Ni-Star MP (CAF)120 is supplied as a 4-part process:-

Ni-Star MP (CAF) Part 120	Make up and Replenishment additive
Ni-Star MP (CAF) Part 2	Make up additive
Ni-Star MP (CAF) Part 3	Replenishment additive
Ni-Star pH Adjuster	pH adjuster

BENEFITS

- Bright deposits throughout solution life
- Consistent performance throughout bath life
- Excellent ductility and adhesion throughout bath life
- High deposition rates throughout bath life, 17 - 25 microns per hour
- Good solution stability
- Can be used for rack and barrel plating

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SOLUTION MAKE -UP

It is essential that the tanks to be used for PMD Ni-Star MP (CAF) are thoroughly cleaned and leached before any chemistry is introduced. See Equipment Maintenance for procedure.

Ni-Star MP (CAF) Part 120 5% v/v
Ni Star MP (CAF) Part 2 15% v/v

1. Half fill the clean empty tank with DI Water.
2. Add the required volume of Ni-Star MP (CAF) Part 1 and mix well.
3. Add the required volume of Ni-Star MP (CAF) Part 2 and mix well.
4. Make up to final volume with DI Water and mix well.
5. Analyse solution and adjust as necessary.
6. Heat solution to operating temperature.

OPERATING DATA

Nickel	5.5 – 6.5g/L Optimum 6.0g/L
Sodium hypophosphite	27 – 33g/L Optimum 30g/L
Temperature	85 - 90°C
pH	4.6 – 4.9
Agitation	Air or solution movement
Filtration	Continuous 5µm or less
Loading	0.5 – 1.7dm²/L
Plating rate	17 - 25µm/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.

EQUIPMENT

Tanks	High density polypropylene is recommended or 316 Stainless Steel.
Heaters	PTFE or 316 Stainless Steel are recommended. Steam coils can be used, again made from PTFE or Stainless Steel.
Filtration	10 bath turnovers per hour through 5 micron or smaller filter bags or cartridges. 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 with 50% Nitric Acid.
Extraction	Essential

PROCESS SEQUENCE

See notes on pre-treatment.

MAINTENANCE AND CONTROL

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

Nickel analysis is used as a basis of maintaining the additions of Ni-Star MP (CAF) Part 120 and Ni-Star MP (CAF) Part 3.

Ni-Star MP (CAF) Part 120 and Ni-Star MP (CAF) Part 3 are added in a 1: 2.4 ratio.

Analysis			Additions	
Titre	Nickel	Activity	Mls/litre Ni-Star MP (CAF) Part 120	Mls/litre Ni-Star MP (CAF) Part 3
5.1	6.0	100%	0	0
5.0	5.9	98%	0.8	2.6
4.9	5.8	96%	1.7	5.0
4.8	5.6	94%	3.3	7.2
4.7	5.5	92%	4.2	9.6
4.6	5.4	90%	5.0	12.0
4.5	5.3	88%	5.8	14.4
4.4	5.2	86%	6.7	16.6
4.3	5.0	84%	8.3	19.0
4.2	4.9	82%	9.2	21.4
4.1	4.8	80%	10.0	23.6
4.0	4.7	78%	10.8	26.0
3.9	4.6	76%	11.7	28.4

pH - The replenishment chemistry should maintain the pH within the specified range. If it is necessary to adjust use Ni-Star pH Adjuster to increase the pH or a 10% v/v solution of sulphuric acid to reduce it.

Notes

1. To provide optimum plating conditions it is be preferable to make frequent additions.
2. A complete solution replenishment is achieved when 50mls per litre additions of Ni-Star MP (CAF) Part 120 and 120mls per litre Part 3 have been made.
3. It is unwise to operate 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

1. 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 approximately 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.

2. Sodium Hypophosphite

Reagents

0.1N iodine (standard volumetric solution)

Concentrated hydrochloric acid

0.1 N sodium thiosulphate (standard volumetric solution)

Iodine indicator solution

Method

1. Pipette 5.0mls of bath(previously cooled) into an iodine flask.
2. Add approximately 50mls DI Water.
3. Add 50mls concentrated hydrochloric acid.
4. Pipette 50.0mls 0.1N iodine into flask. Stopper flask and shake.
5. Leave in a dark cupboard for 30 minutes.
6. Titrate with 0.1 N sodium thiosulphate to a pale straw colour.
7. Add a few drops of iodine indicator and continue titration to a clear end point.

Calculation

(50-t) x 1.06 = g/L sodium hypophosphite.

Replenishment

For every 1 g/L required add 2.3 ml/L Ni-Star MP Part 3. Do not add more than 7ml/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 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 MP (CAF).

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 MP (CAF) 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 MP (CAF) 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 MP (CAF).

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

DISPOSAL

Dispose of in accordance with Local Authority requirements.

PRODUCT FAMILIES

The following products are referred to in this data sheet.

PRODUCT NAME	PRODUCT NUMBER
Econoclense D	206004
Econoclense S	206005
Econovate Dray Acid Salt	223001
Ni-Star MP (CAF) Part 120 (25L)	IN557052
Ni-Star MP (CAF) Part 2 (25L)	551002
Ni-Star MP (CAF) Part 2 (200L)	551005
Ni-Star MP (CAF) Part 2 (1000L IBC)	551006
Ni-Star MP (CAF) Part 3 (25L)	555013
Ni-Star MP (CAF) Part 3 (200L)	555016
Ni-Star MP (CAF) Part 3 (1000L IBC)	555022
Ni-Sart pH adjuster	555012
Ni-Star MP (CAF) Part 3 (1000L IBC)	555022
Ni-Sart pH adjuster	555012