

# Ni-STAR MP (CAF)

## ELECTROLESS NICKEL PLATING PROCESS

### INTRODUCTION

Ni-star MP (CAF) 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) has been designed to plate on ferrous and non-ferrous substrates. Ni-Star MP (CAF) is particularly suitable for plating on aluminium alloys.

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

|                         |                                    |
|-------------------------|------------------------------------|
| Ni-Star MP (CAF) Part 1 | 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**

|                         |         |
|-------------------------|---------|
| Ni-Star MP (CAF) Part 1 | 8% v/v  |
| Ni-Star MP (CAF) Part 2 | 15% v/v |

**OPERATING DATA**

|                      |                              |
|----------------------|------------------------------|
| Nickel Concentration | 5.5 - 6.5 g/L optimum 6g/L   |
| Sodium hypophosphite | 27 – 33g/L optimum 30g/L     |
| Temperature          | 85 – 90°C                    |
| pH                   | 4.6 - 4.9                    |
| Agitation            | air movement                 |
| Filtration           | continuous 5 micron or less  |
| Plating Rate         | 17 - 25 microns / hour       |
| Loading              | 0.5 - 1.7 dm <sup>2</sup> /l |

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 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 with 50% nitric acid.

Extraction - Essential.

## **INSTALLATION**

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.

1. Half fill 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.

## **PROCESS SEQUENCE**

See notes on pre-treatment.

## **MAINTENANCE 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 1 and Ni-Star MP (CAF) Part 3.

Ni-Star MP (CAF) Part 1 and Ni-star MP (CAF) Part 3 are added in a 1: 1.5 ratio.

| <b>Analysis</b> |               |                 | <b>Additions</b>                         |  |
|-----------------|---------------|-----------------|--|--|
| <b>Titre</b>    | <b>Nickel</b> | <b>Activity</b> | <b>Mls/litre Ni-Star MP (CAF) Part 1</b> | <b>Mls/litre Ni-Star MP (CAF) Part 3</b> |
| 5.1             | 6.0           | 100%            | 0  | 0  |
| 5.0             | 5.9           | 98%             | 1.7                                      | 2.6                                      |
| 4.9             | 5.8           | 96%             | 3.3                                      | 4.9                                      |
| 4.8             | 5.6           | 94%             | 4.9                                      | 7.3                                      |
| 4.7             | 5.5           | 92%             | 6.4                                      | 9.6                                      |
| 4.6             | 5.4           | 90%             | 8.0                                      | 12.0                                     |
| 4.5             | 5.3           | 88%             | 9.5                                      | 14.3                                     |
| 4.4             | 5.2           | 86%             | 11.1                                     | 16.6                                     |
| 4.3             | 5.0           | 84%             | 12.7                                     | 19.0                                     |
| 4.2             | 4.9           | 82%             | 14.2                                     | 21.3                                     |
| 4.1             | 4.8           | 80%             | 15.8                                     | 23.7                                     |
| 4.0             | 4.7           | 78%             | 17.3                                     | 26.0                                     |
| 3.9             | 4.6           | 76%             | 18.9                                     | 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.

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Notes

1. To provide optimum plating conditions it would be preferable to make frequent additions.
2. A complete solution replenishment is achieved when 80mls per litre additions of Ni-Star MP (CAF) Part 1 and 120 mls per litre Ni-Star MP (CAF) 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

0.1 M 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.
4. Add a small spatula tip of murexide indicator.
5. Titrate against 0.1 M EDTA solution to a purple end point.
6. Record titre = t mls.

Calculation

$t \times 1.174 = \text{g/L nickel.}$

Replenishment

Refer to table in Maintenance and Control for appropriate additions.

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Sodium Hypophosphite

Reagents

0.1 N 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.
8. Record titre = t mls.

Calculation

$(50 - t) \times 1.08 = \text{g/l sodium hypophosphite.}$

Replenishment

For every 1 g/l required add 4.6 ml/l Ni-Star MP (CAF) Part 3. Do not add more than 13.8 ml/l in one 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 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.

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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.

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**DISPOSAL**

Dispose of in accordance with local authority requirements.

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**PRODUCT FAMILIES**

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

| <u>Product Name</u>             | <u>Product Number</u> |
|---------------------------------|-----------------------|
| Econoclense D                   | 206004                |
| Econoclense S                   | 206005                |
| Econovate Dry Acid Salt         | 223001                |
| Ni-Star MP (CAF) Part 1 (25L)   | 557018                |
| Ni-Star MP (CAF) Part 1 (200L)  | 557023                |
| Ni-Star MP (CAF) Part 1 (1000L) | 557038                |
| Ni-Star MP (CAF) Part 2 (25L)   | 551002                |
| Ni-Star MP (CAF) Part 2 (200L)  | 551005                |
| Ni-Star MP (CAF) Part 2 (1000L) | 551006                |
| Ni-Star MP (CAF) Part 3 (25L)   | 555013                |
| Ni-Star MP (CAF) Part 3 (200L)  | 555016                |
| Ni-Star MP (CAF) Part 3 (1000L) | 555022                |
| Ni-Star pH adjuster             | 555012                |

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