392 Electroless Nickel

Mid-Phosphorus Semi-Bright Plating, Available in Self- and Non-Self-Regulating pH Packages

Product Code: 3631 (392-M), 3636 (392-N), 3632 (392-R)

1. PERFORMANCE

OVERVIEW

Acculabs 392 is a mid-phosphorus electroless nickel plating system, specifically formulated to produce a semi-bright nickel-phosphorus deposit (7–9% P) at a consistent high rate of deposition. The 392 System is recommended for applications requiring a semi-bright functional finish and moderate corrosion resistance, and is supplied in both non-self-regulating (392-R) and self-regulating (392-RH) pH packages so the operator can match the bath chemistry to the substrate and pH-adjustment strategy. Replenishment is straightforward, with one-to-one volumetric additions of nickel and reducer guided by routine EDTA titration.

FEATURES & BENEFITS

EXCEPTIONAL BATH STABILITY	High intrinsic stability supports predictable bath performance with reduced operator intervention, minimizing downtime from solution decomposition or stabilizer drift.
CONSISTENT, HIGH RATE OF DEPOSITION	Typical plating rate of 1.0 mils/hour with all parameters at optimum (new bath), with 7–9% phosphorus deposits maintained across bath life — supporting demanding production schedules and tight thickness control.
FLEXIBLE PH-CONTROL CHEMISTRY	Available in non-self-regulating (392-R) and self-regulating (392-RH) packages, with ammonium hydroxide for steel substrates or liquid potassium carbonate for aluminum, letting the operator match bath chemistry to substrate and shop preference.
SEMI-BRIGHT FUNCTIONAL FINISH	Delivers a semi-bright nickel-phosphorus deposit suitable for functional applications with moderate corrosion resistance — passes the hydrochloric acid test and provides up to 100 hours neutral salt spray to first corrosion.

HIGH TOLERANCE TO CONTAMINANTS	High contaminant tolerance reduces the impact of carry-over and routine bath excursions on deposit quality, extending usable bath life on both steel (6–10 MTO) and aluminum (5–10 MTO depending on pH-adjustment strategy).
LOW OPERATING COST	Simple two-component make-up (392-M + 392-N) and one-to-one volumetric additions of 392-N with 392-R or 392-RH keep replenishment chemistry costs and operator labor predictable across the life of the bath.

TYPICAL DEPOSIT PROPERTIES

Property	Typical Value
Phosphorus Content	7–9% (typical weight percentage)
Melting Range	1620–1760° F
Density	8.1 g/cc
Hardness	550 HK_{100} as plated
Magnetic Properties	Slightly Magnetic
Nitric Acid Test	Fails
Hydrochloric Acid Test	Passes
Neutral Salt Spray	Up to 100 hours to first corrosion

OPERATING PARAMETERS

Parameter	Optimum	Range
Nickel Metal	6.0 g/l	5.10–6.30 g/l
Hypophosphite	30.0 g/l	27.0–33.0 g/l
pH	4.90	4.70–5.10*

Parameter	Optimum	Range
Temperature	190° F	180–200° F
Bath Loading	0.50 sqft/gal	0.10–1.00 sqft/gal
Plating Rate	1.0 mils/hour	1.0 mils/hour at optimum (new bath)

NOTE: pH can be adjusted upward with a 50% solution of ammonium hydroxide (typically for steel) or liquid potassium carbonate (typically for aluminum). If pH needs to be adjusted downward, a 10% sulfuric acid solution can be used. *For applications requiring additional corrosion protection, the pH can be lowered to and maintained at 4.50. Solution life (metal turnovers): 6–10 on steel; on aluminum, 5–7 with ammonium hydroxide pH adjustment, 7–9 with potassium carbonate pH adjustment, or 6–10 with an alkaline strike prior to plate. Individual applications and practices will affect bath life; contact your Accu-Labs representative for options to increase bath life.

2. PROCESS SETUP & OPERATIONS

MAKE-UP COMPONENTS

Material	Quantity	Notes
392-M	15% by volume	Makeup component (make-up only)
392-N	7% by volume	Nickel component
Deionized Water	Balance to working volume	Used to fill operating volume
50% Ammonium Hydroxide	As required	For pH control (raises pH); typical for steel substrates
Liquid Potassium Carbonate	As required	For pH control (raises pH); typical for aluminum substrates

MAKE-UP PROCEDURE

SOLUTION MAKE-UP

1. Add DI water to a properly cleaned and passivated tank, filling to half volume.
2. Add the required amount of 392-M (15% by volume).
3. Add the required amount of 392-N (7% by volume).
4. Fill tank to working volume with DI water.
5. Mix thoroughly with solution and slight air agitation.
6. Heat to 190° F.
7. Analyze nickel content and adjust to 6.0 g/l.
8. Check pH and adjust to 4.70–5.10.

NOTE: For self-regulating processes, 392-RH will usually maintain sufficient pH. However, since conditions vary within each plating operation, there may be a need to add a small amount of ammonium hydroxide or liquid potassium carbonate to the self-regulating bath to maintain the desired pH. Contact your Accu-Labs representative for more information.

REPLENISHMENT & MAINTENANCE

To ensure proper operation of the 392 system, the solution chemistry should be maintained using the operating parameters above. This is accomplished by measuring and monitoring the nickel metal concentration. Upon determination of the nickel metal concentration, additions of 392-N and either 392-R (non-self-regulating) or 392-RH (self-regulating) are made based on the replenishment schedule below for a 100-gallon bath. Within each row, the 392-N and reducer additions are equal in volume.

REPLENISHMENT SCHEDULE

Nickel %	Nickel Conc.	392-N Addition	392-R Addition	392-RH Addition
100%	6.0 g/l	None	None	None
95%	5.7 g/l	1300 mL	1300 mL	1300 mL
90%	5.4 g/l	2600 mL	2600 mL	2600 mL
85%	5.1 g/l	3.9 liters	3.9 liters	3.9 liters

Nickel %	Nickel Conc.	392-N Addition	392-R Addition	392-RH Addition
80%	4.8 g/l	5.2 liters	5.2 liters	5.2 liters
75%	4.5 g/l	6.5 liters	6.5 liters	6.5 liters

NOTE: Use 392-R for non-self-regulating baths and 392-RH for self-regulating baths. Add the reducer at the same volume as 392-N for each replenishment row above. If the bath drifts below 75% nickel activity, contact your Accu-Labs representative before making large additions.

ANALYTICAL METHODS

ANALYSIS OF NICKEL (392-N)

Reagents: 0.0575M EDTA standardized solution; 50% Ammonium Hydroxide; Murexide Indicator.

1. Add 10 ml bath sample to 100 ml DI water.
2. Add 10 ml ammonium hydroxide solution.
3. Add 0.2 grams murexide indicator.
4. Titrate with EDTA from pale yellow to purple (violet) end point.
5. Record number of mls of EDTA titrated.
6. Calculate: mLs of 0.0575M EDTA × 0.339 = grams/liter nickel; or mLs of 0.0575M EDTA × 5.65 = % nickel in bath.

ANALYSIS OF REDUCER

Replenishment additions of 392-R or 392-RH made in step with the nickel-metal analysis above will normally keep the hypophosphite concentration within the recommended operating range of 27–33 g/L. If routine verification of the reducer level is required, contact your Accu-Labs representative for the recommended sodium hypophosphite analysis procedure.

3. HANDLING & COMPLIANCE

SAFETY & HANDLING

When handling Acculabs 392 components, proper precautions should be observed. Do not take internally and avoid contact with skin and eyes. Wear clean chemical-resistant gear, goggles, gloves,

apron, footwear, and face shield. Read the Safety Data Sheet (SDS) prior to use, and ensure all applicable health, environmental, and safety regulations and standards (OSHA, NIOSH, ACGIH, NFPA) are met.

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