TECHNICAL DATA SHEET

SPECTEK 890 BRIGHT NICKEL PROCESS

(Ultra performance Bright Nickel Process)

Spectek 890 process is a high performance addition agent system for bright nickel plating. The process has been formulated to give superior leveling, brightness, coverage, better chrome receptivity and extremely good brightness at medium and low current density areas.

Spectek 890 process is designed to produce excellent deposit of nickel on different base metals, with maximum rate of brightness and leveling and gives an outstanding performance with air agitated solutions. The brightener system employed is versatile and gives excellent result in watts nickel formulation.

Spectek 890 process employs addition agents namely Spectek 890 and a Nickel Additive 722/1022. Both to be used for initial make – up and to replenish the brightener components in an operating bath. Occasional separate additions of Antipit 10 may be required.

The process gives excellent performance over a wide range of operating bath concentrations, temperature and current densities. Spectek 890 process can be used for either rack or barrel plating applications and bath with air or mechanical agitations.

The performance can be improved on unpolished steel by the addition of **separate** leveling additive i.e. Nickel Leveller 1044 enabling the user considerable flexibility in controlling the process.

FEATURES :

- Spectek 890 process built brightness faster with high leveling.
- Spectek 890 process has a wide bath chemistry.
- Spectek 890 process is very receptive to chromium deposits.
- Spectek 890 provides high brightness with less deposit thickness.

SOLUTION COMPOSITOIN :

	OPTIMUM	RANGE
Bright Nickel Salt	350 g/l	250-400 g/l
Nickel Additive 722/1022	15 ml/l	10-20 ml/l
Spectek 890	0.6 ml/l	0.5-1 ml/l
Antipit 10 (optional)	1 ml/l	0.8-1.6 ml/l

OPERATING CONDITONS :

	OPTIMUM	RANGE
Cathode current density	4.0 A/dm^2	2.0-6.0 A/dm^2
Anode current density	2.0 A/dm^2	1.0-3.0 A/dm^2
Temperature	55°C	55-65°C
pH	4.4	4.0-4.8
Density	24° Be.	20-28°Be
Agitation	Cathode Rod /low pressure air	Air
Filtration	Continuous	

Optimum bath composition depends upon the particular requirements unique to the processing equipment and the parts to be plated. This include cathode current density type and finish of basis metal pated ; deposit thickness; part geometry etc.similarly addition agents consumption also varies depending upon the above mentioned factors.

FUNCTIONS OF SOLUTION CONSTITUENTS :

NICKEL SULPHATE:

Nickel Sulphate is the main source of nickel ions to the operating solution.A low Nickel Sulphate yields low concentration of Nickel ion which reduces the overall cathode efficiency A high nickel sulphate level allows higher operating current densities.

NICKEL CHLORIDE:

Nickel chloride improves the bath conductivity and anode dissolution. Lower concentration can reduce the conductivity of the bath whereas higher concentration of

nickel chloride can lead to increased attack on processing equipment and decrease deposit ductility.

BORIC ACID:

Boric acid acts as an overall pH buffer for the solution and prevents burning, pitting giving ductile deposits.

However higher concentration can lead to shelf roughness, if it is present in a concentration above its solubility limit.

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REPLENISHMENT ADDITIONS :

Both the addition agents namely Spectek 890 and Nickel Additive 722 are required to be added regularly to maintain the brightener components at the optimum concentration level.

Replenishment additions should be normally based on the ampere hours of plating done. The required amount of addition depends upon degree of leveling and brightness required drag out, base out base metal finish, and operating temperature etc.

Based on our experience, the replenishment additions are expected to be in the following range.

Spectek 890	150-250 cc/1000 ampere –hours
Nickel Additive 722/1022	150-250 cc/1000 ampere hours

For extra performance in poor initial surface condition 50-100 ml/ 1000 amp hours of Nickel Leveller 1044 to be added.

OPERATING CONDITIONS :

TEMPERATURE:

The optimum temperature to be maintained is in the range of 45 to 60°C. Too low an operating temperature can cause high current density burning at normal amperages. Higher values of temperature doesn't help base it gives rise to unnecessary energy loss.

pH CONTROL:

The recommended pH range for rack plating solutions is 4.0-4.6 and for barrel plating solution is 4.0-4.4.A lower pH is suggested for barrel plating to minimize laminated deposits, and to ensure maximum deposit ductility.

Due to difference in efficiencies of cathode and anode, it is generally tendency of the solution that pH is increased during regular operation. The necessary change in pH should be made, with technical grade sulphuric acid to reduce the pH and Nickel carbonate to increase the pH. Use of sodium hydroxide is not recommended.

CURRENT DENSITY:

The Anode current density is calculated by following equation.

Anode current density = total current /total anode surface area

Similarly,

Cathode current density=total current/ total cathode surface area

Too high an operation cathode current density can produce burning while too low a cathode density results ion decreased plating speed. Similarly too high anode current density (i.e. too low anode area) can cause anode polarization and generation of chlorine gas at the anode. While too low and anode current density can lead to increase in Nickel content in the bath during bath operation.

PURIFICATION:

Most common metallic impurities found in nickel solutions are copper, zinc chromium, lead, and iron. Copper, Zinc, and lead can be removed by using corrugated dummy cathode at current density of 3 amps per sq.ft. Higher agitation

Low pH and high temperature is recommended.

SOLUTION PREPARATION:

A fresh nickel plating bath is prepared as follows:

- Leach a rubber lined tank and filled with 5 % sulphuric acid (by volume) and 1 cc/lit Antipit 10 at 50-70° C and agitate the bath for some time. Leave it overnight and clean it with soft water next day.

- Fill the plating tank with 2/3rd of warm water and add required amount of Nickel Salt by stirring to dissolve completely.
- Make the level and adjust the pH to 2.5-3.5 with pure sulphuric acid (25% volume)
- Dummy the solution at 3 amps per sq.ft. for minimum of 12 hours. Remove the anodes and plate at low c.d.
- Pump the hot solution to the storage tank and add sufficient nickel carbonate and stir to raise the pH to 5-5.5 and add 2cc/l (100 of volume)

  Hydrogen peroxide stir vigorously at 50-70^{0}C for 2 hours.
- Add 2 grams per liter activated carbon and air agitable for some time and leave it over night.
- Filter the solution back into the clean plating tank without disturbing the layer of sludge on the bottom of tank.
- After addition of brightener and pH adjustments the bath is ready for plating.

EQUIPMENT:

AGITATION :

Low pressure, oil free air agitation equipment is recommended to give a vigorous agitation to the solution. The air agitation coil should have been made of either Ebtonite or polypropylene.

Compressed air coming from an oil compressor, should not be used since oil will get into the solution resulting in faulty deposit such as pitting etc.

FILTRATION:

Continuous filtrating through a mixture of filter aid and activated carbon is suggested for optimum performance. Approximately 0.2gm of activated carbon should be added for each liter of operating solution per week.

The filter capacity should be selected to turn the solution over at least 3 to 5 turn overs / hour.

MAINTENANCE :

Nickel salt :

Where the anode dissolution is proper the nickel salt is generally lost only by drag out and by general wastage. it is strongly recommended that small daily addition of Nickel Salt are made and analytical control used to adjust the amounts of the dally addition; adjust the bath contents as given below :

Nickel metal	60-80 g/l
Nickel sulphate	250-350 g/l
Chloride as nickel chloride	35-70 g/l
Boric acid	35-45 g/l

When it is required to make large addition of nickel salt , this additions should be followed by low current density electrolysis to remove metallic impurities.

OXIDATION CARBON TREATMENT :

When the contamination is not severe, the solution can be continuously filtered through a small amount of carbon packed with the filter. Should the solution become seriously contaminated, with organic impurities oxidation, carbon treatment is required to remove the same and should be carried out as follows :

Heat the solution to 70^{o}C and pump it into a storage tank. Add 1-2 grams per liter of potassium permanganate dissolved in water or 2-3 ml of hydrogen peroxide (100 volumes.) Stir well for 30 min. Add 3 gms/lit Activated carbon and equal quantity of filter aid. Air agitate vigorously for at least 2 hours. Allow the solution to stand out without string overnight so as to allow the carbon and the other impurities to settle. Filter the solution back into the plating tank, taking care not to disturb the layer of the sludge at the bottom of the tank.

This treatment will remove the Nickel Additive 722 and Spectek 890 and it is therefore recommended to add Nickel Additive 722/1022 at the rate of 2-4 ml /l of and Spectek 890 at the rate of 0.1-0.2 ml/l. Exact addition of Spectek 890 and Nickel Additive 722 should be decided by Hull Cell test.

ANALYTICAL PROCEDURE:

ESTIMATION OF NICKEL

Pipette 1 ml of the plating solution into a 500 ml conical flask and dilute it with a small quantity of distilled water. Add about 5 ml of ammonium hydroxide solution

And a few grains of Murex idée indicator. Shake the flask well and titrate against 0.1M.E.D.T.A. To purple color end point. Note the reading let it be “a” ml of E.D.T.A.

CALCULATION:

“a” ml of E.D.T.A. x 5.869=gm/lit Nickel metal in bath.

ESTIMATION OF NICKEL CHLORIDE

Pipette 5ml of the solution into 500ml conical flask and dilute with distilled water. Add few drops of potassium chromate indicator and titrate against 0.1n silver nitrate until the white precipitate of silver chloride takes on a very faint reddish brown tint. It requires practice to detect the exact end point easily. Note the reading.

CALCULATION:

Ml of 0.1 Silver nitrate used x 2.378=gms/lit Nickel chloride ($Nicl_2$-$6H_2O$) n the bath.

ESTIMTION OF NICKEL SULPHATE:

From the total Nickel Metal and Nickel Chloride concentration nickel sulphate can be calculated as follows:

[(gm/lit of Nickel metal)-(gm/lit of Nickel chloride x 0.247)] x 4.79 =gms/lit Nickel sulphate ($NiSO_4 7H_2O$)

ESTIMATION OF BORIC ACID:

Pipette 1 ml. of the plating solution into 500ml. conical flask, add one spatula of Mannitol powder, Swirl it to make slurry, add 2-3 drops of Bromocresol purple and titrate it against 0.1N sodium hydroxide to violet colour end point.

CALCULATION :

ml of sodium hydroxide x 6.184=gm/lit of Boric acid.

DISCLAIMER: