Nickel Whitener

Unique Features

- very good brightness and levelling even at lower layer thickness
- coatings are very active and easy to chromium plate
- very good throwing power and metal distribution
- deposits “white” nickel
- insensitive against impurities
- process is easy to handle and to control (additives can be premixed)
- stable brightener system, very much reduced in building up of break down products

Bath Preparation

Make-up concentration

nickel sulfate x 6 aq	220 g/L
nickel chloride x 6 aq	50 g/L
boric acid	40 g/L
nickel additive	7mL/L (6-9 mL/L)
nickel brightener	0.7mL/L (0.6-0.9mL/L)
Nickel Whitener	0.3mL/L (0.2-0.4mL/L)

Analytical values:

nickel (Ni^{2+})	60 g/L (55-65 g/L)
chloride (Cl^-)	12 g/L (10-15 g/L)
boric acid	40 g/L (35-45 g/L)

Make-up: In a separate tank, dissolve nickel salts and boric acid in very hot (at least 60 ºC) deionised water of about 1/3 of the final volume, stirring well. Add 5 g/L active carbon and stir again for about 2 hours. Then allow to settle, filter into the active tank, and fill up to the final volume with deionised water. Do dummy plating for about 4 hours at 0.4 A/dm^2, then plate a test panel. If this is ductile enough, the additives can be added, if not, dummy plating has to be continued further.

Temperature: 55 ºC (55-65 ºC)

pH value: 4.5 (4.0-4.8)
adjust with sulfuric acid or increase by plating

Cath. current density:	3 A/dm^2	(1-6 A/dm^2)
Anod. current density:	1.5 A/dm^2	(0.5-2.5 A/dm^2)
Current efficiency:	98%	
Deposition rate:	0.66 µm/min at 3 A/dm^2	

Anodes: pure nickel anodes according DIN 1702, anode to cathode ratio 2:1, anode bag of precleaned Polypropylene

Agitation: mechanical: 3-6 m/min
or air agitation (oil free!)

Tank material: steel tanks coated with plastic or PVC reinforced material

Filtration: continuously at 4-5 x bath volume per hour;
pore size: 5-10 µm

Heating: out of porcelain, hard glass, Teflon or titanium

Exhauster: required for worker's protection

Maintenance: compensate evaporation losses by deionised or distilled water. The analytical values must be restrained: A loss of nickel or boric acid leads to burnings, an excess of boric acid leads to pitting. A loss of chloride causes a low anodic dissolution. A low pH-value decreases the levelling power, a high pH-value leads to burnings.

Consumption: depends on drag-out, but the following values can give a range (per 1000 Ah):

Nickel Additive	125mL – 175mL
Nickel Brightener	125mL – 175mL
Nickel Whitener	25mL – 50 mL

Effect of the Additives

Nickel Additive

It is the basis of the additive system. Excess will have nearly no effect (neither positive nor negative); a lack will lead to milky haze and brittle nickel layers.

Nickel Brightener

It gives brightness and levelling to the deposit. A lack results in weak brightness and bad levelling. Never add more than 0.2mL/L at a time. Excess will lead to bad adhesion of the layer and even to double nickel layers.

Nickel Whitener

It gives extreme low current area coverage and brightness. If mixed in excess, it gives overall dullness. Hence never add more than 0.1 mL/L at a time.

Quality Control

Sample Preparation

Take the sample at a homogeneously mixed position and let it cool down to room temperature. If dull, allow to settle and decant or filter.

Nickel

Reagents:	0.1 N EDTA, concentrated ammonia solution, indicator: Murexid
Process:	pipette 1 mL bath solution into a 250 mL Erlenmeyer beaker, add approx. 100 mL deionised water, 12 mL ammonia, and a spatula tip of indicator. Titrate with 0.1 N EDTA from yellow to violet.
Calculation:	consumption in mL x 5.87 = g/L nickel
Correction:	to increase 1g/L = addition of: 4.8 g/L nickel sulfate x 6 aq or: 4.1 g/L nickel chloride x 6 aq

Chloride

Reagents:	0.1 N silver nitrate solution, indicator: 5% potassium chromate solution or 5 g $K_2Cr_2O_7$ + 95 g $NaHCO_3$
Process:	pipette 1 mL bath solution into a 250 mL Erlenmeyer beaker, add approx. 100mL deionised water, and some indicator. Titrate with 0.1 N silver nitrate from yellow to brown.
Calculation:	consumption in mL x 3.54 = g/L chloride
Correction:	to increase 1 g/L = addition of: 3.0mL/L HCl (30%) or: 3.4 g/L nickel chloride x 6 aq

Boric Acid

Reagents:	0.1 N NaOH, EDTA sodium salt, mannitol, 15% NaOH solution
Process:	pipette 10 mL bath solution into a 250 mL Erlenmeyer beaker, add approx. 50mL deionised water, and 2-4 g EDTA salt. Adjust the pH to 7.9 with 15% NaOH solution and add 2 g mannitol to the **clear** solution. Titrate with 0.1 N NaOH to a pH of 7.9 again.
Calculation:	consumption in mL. x 0.618 = g/L boric acid

Technical Specification

(at 20 ºC)	Colour	Density	pH value
Nickel Additive	colourless	1.08 g/mL	3-5
Nickel Brightener	yellowish	1.03 g/mL	2-5
Bright Nickel Whitener	Light green	1.01 g/mL	3-5

Trouble Shooting

Problem	**Possible cause**	**Necessary action**
Burning	a) too high current density	lower current density
	b) insufficient agitation	improve the agitation
	c) too little carrier	rise the carrier
	d) low metal content	addition of nickel sulfate
	e) too little boric acid	addition of boric acid
Cloudy or hazy deposit	a) insufficient pretreatment	check the pretreatment, improve the rinsing process
	b) too high bath temperature	lower temperature
	c) too high metal content	reduce the anode surface, work out excessive nickel
	d) too much carrier	work out
	e) too low current density	rise current density
	f) too little brightener	addition of brightener
	g) improper agitation	adjust speed and/or type of agitation
Insufficient throwing power	a) too high metal content	reduce the anode surface, work out excessive nickel
	b) too much additives	work out at pH 3.8
	c) organic impurities	active carbon treatment
Turbid bath solution	a) too high bath temperature	lower temperature
	b) insufficient filtration	improve filtration
	c) too much boric acid	filtrate the bath solution at 25 ºC
	d) iron impurity	peroxide treatment at high pH
	e) calcium impurity	precipitate Ca by addition of KF
Pitting	a) insufficient agitation	improve agitation
	b) too low metal content	addition of nickel sulfate
	c) too high current density	lower current density
	d) too little wetting agent	addition of wetting agent
	e) calcium impurity	precipitate Ca by addition of KF
Insufficient layer thickness	a) too low metal content	addition of nickel sulfate
`	b) too low current density	rise current density
	c) defective contacts	check contacts and clean them
	d) too small anode surface	increase anode surface
	e) too much brightener	work out at pH 3.8
	f) too short plating time	longer plating time
Double nickel	a) too much brightener	work out at pH 3.8

	b) too high pH value	adjust with sulfuric acid
	c) bad contacts	check contacts and clean them
Yellowish Ni layer	a) iron impurity	peroxide treatment at high pH
	b) iron in spare rinse	refill spare rinse freshly
hazy in LCD	too little brightener	addition of brightener
hazy in HCD	a) too little carrier b) organic impurity	addition of carrier active carbon treatment
Rough deposit	a) contamination with anode sludge	check anode bags, filtrate the bath solution
	b) iron impurity	peroxide treatment at high pH
	c) bad pretreatment	improve pretreatment
Brittle Ni layer	a) too much brightener	work out at pH 3.8
	b) organic impurities	active carbon treatment

Warranty: The above information has been given in good faith and based on our knowldege, information and experience. RRR has no control over the goods once it leaves our premises. All chemicals, including those which are not classified as hazardous, must be treated with proper care and all necessary precautions for handling and disposing of chemicals must be followed. No liability arises out of handling or use.

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