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TECHNICAL DATA BULLETIN

Regal Bright Nickel Z-101

Ultra-Leveling System

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Introduction

◆ **REGAL Bright Nickel Z-101** is our finest **Zinc tolerant product** formulated to provide a brilliant ductile deposit primarily for rack applications but certainly is more than suitable for barrel. It has outstanding leveling characteristics that will uniformly plate bright and semi-bright steel and mixed metal such as brass and copper but typically not recommended for zinc die-cast where the parts fall into the tank or there are blind areas that dissolve rather than plate. **REGAL'S** unique nickel chemistry offers the plating shop with peerless bright nickel deposits with excellent chromium acceptance while remaining dependable, and economical. It may be used as the top layer of a duplex nickel system to provide the ultimate corrosion protection of the substrate.

<u>Features and benefits</u>	
Outstanding Bright finish	High leveling characteristics
Wide operating parameters	Excellent chromium receptivity

Plating with the *REGAL* Bright Nickel Z-101 solution

Material	SOLUTION MAKE-UP:	
	Range	Optimum
Nickel as Metal	9.0-15 oz/gal	
Nickel Sulfate (NiSO ₄ .6H ₂ O)	15-50 oz/gal (110-375 g/L)	24 oz/gal (180 g/L)*
Nickel Chloride (NiCl ₂ .6H ₂ O)	5-20 oz/gal (38-150 g/L)	12 oz/gal (90 g/L)*
Boric Acid (H ₃ BO ₃)	5-6.5 oz/gal (38-50 g/L)	6 oz/gal (45 g/L)
BRIGHT NICKEL MAKE-UP	0.5-1.5 %/vol (5-15 mL/L)	1 %/vol (10 mL/L)
Regal Carrier Z-101	3.5-4.5% /vol (35-45 mL/L)	4 %/vol (40 mL/L)

Regal Brightener 2*w/air agitation***3-5 qts/1000 gal(0.75-1.25 mL/L)****4 qts/1000 gal(1.0 mL/L)***w/mech. agitation***4-8 qts/1000 gal(1.0-2.0 mL/L)****6 qts/1000 gal(1.5 mL/L)****Maximum Allowable Impurities.**

Values are approximate and the effects of such will vary depending on the concentration and overall condition of the plating bath.

Impurity	Concentration (ppm)
Aluminum	60
Copper	40
Chromium	10
Iron	50
Lead	2
Zinc	50

Calcium-pH dependent; precipitation will occur. High ph tends to remove metallic contaminants. Also electrolytic dummmying is very effective.

The Regal Nickel Z-101 system also has a maintenance brightener, Regal Maint that can be used instead of the Regal Brightener 2. This contains both the Carrier Z-101 and Brightener 2. The Regal Maint used on a regular basis should maintain both components of the bath near optimum condition. Routine analysis will verify the results of the Maint. An occasional adjustment may be necessary to bring the components back into balance.

Regal Maint. (In place of Brightener 2 for solution make-up)

W/air agitation	1.5-2.5 gal/1000 gal (1.5-2.5 mL/L)	2 gal/1000 gal(2.0 mL/L)
w/mech. Agitation	2-4 gal/1000 gal(2.0-4.0 mL/L)	3 gal/1000 gal(3.0 mL/L)

ANTI-PITTING AGENT

Anti Pitt Air w/air agitation	0.1-0.4 %/vol (1-4 mL/L)	0.25 %/vol (2.5 mL/L)
Anti Pitt Mech w/mech. Agitation	0.2-0.4 %/vol (2-4 mL/L)	0.25 %/vol (2.5 mL/L)

New bath make-up (100 gallons)	Barrel	Rack	Optimum
Nickel sulfate hexahydrate	200 pounds	220 pounds	112 pounds
<i>Liquid nickel sulfate (5 lb./gal)</i>	<i>40 gallons</i>	<i>44 gallons</i>	<i>22.5 gallons</i>
Nickel chloride hexahydrate	62 pounds	94 pounds	94 pounds
<i>Liquid nickel chloride (6 lb./gal)</i>	<i>10.5 gallons</i>	<i>16 gallons</i>	<i>16 gallons</i>
Boric acid	38 pounds	38 pounds	40 pounds
pH ~4.0	Reduce with sulfuric acid or raise with nickel carbonate		

REGAL Bright Nickel components Refer to guidelines on page 2 for specific applications

OPERATING PARAMETERS and GENERAL SYNOPSIS:

Frequent additions produce superior results eliminating the up and down (see saw effect) effect of high and low salts and brightener values.

Nickel sulfate

The nickel sulfate is important for the nickel metal concentration. This is what provides the latitude for the operating current density range. For more complex the parts, a higher nickel sulfate concentration will aid in higher current densities. Less complicated designs will generally require lower nickel sulfate as low as 15 oz/gal (115 g/L). Nickel sulfate should be maintained on the basis of regular analysis.

Nickel chloride

The nickel chloride concentration primarily contributes the chloride ion for proper anode corrosion, good bath conductivity and for improving the limiting current density. Concentrations higher than those recommended may be used but may pose equipment corrosion problems and/or reduced ductility. Nickel chloride should be maintained on the basis of regular analysis.

Boric acid

The boric acid concentration contributes the cathode film buffering necessary for the bath to produce deposits with good ductility, brightness, leveling and limiting current density. Concentrations of Boric Acid greater than those recommended may produce clogged air pipes, deposit roughness, etc, due to the lower solubility of boric acid.

Anti-Pitters

Use of a small amount of anti-pitter in the solution will aid in preventing gas pitting of the deposit under most conditions.

CAUTION! DO NOT ADD MECHANICAL ANIT PITT TO AIR-AGITATED solutions or serious foaming will result. Concentrations of about 0.15%/vol (1.5 mL/L) will be satisfactory in most circumstances.

Regal Carrier Z-101

Regal Z-101 is the primary brightener or carrier and works synergistically with Regal Brightener 2 to deposit a bright, ductile and uniform finish while providing excellent leveling characteristics. Regal Z-101 should be maintained within the limits provided within this TDS for best results. Consumption of the Regal Z-101 should be based on Ampere hours and analysis. Too low of concentration will cause the following problems; poor ductility, low current density darkness, sensitive to organic and inorganic contaminants, reduce chrome receptivity and leveling. High Regal Z-101 is not especially harmful but will add to your operating cost considering drag out, and may also cause some crystallization especially at lower temperatures.

Regal Brightener 2

Regal 2 is the brightener that works synergistically with Regal 1 to produce bright deposits. Too high of Regal 2 will reduce ductility and chromium acceptance. The control is simply by observation and experience. The best tool of course is the Hull Cell either on brass panel with integral scratch's or steel

panels depending on circumstances and basis metal being plated on line.

Regal Maint

Regal Maint can be used in place of Regal Z-101 and 2. Regal Maint contains both constituents in the proper proportions found in most plating situations. Optimum conditions are generally observed using the Regal Maint product and can be adjusted occasionally if required by analysis.

Anti-Pitters

Anti Pitt Air or Anti Pitt Mech will help prevent gas pitting of the deposit under most conditions.

CAUTION! NEVER USE ANTI PITT MECH IN AN AIR PLATING BATH! Serious foaming will result. Use only 0.15% /vol (1.5 ml/L) will be satisfactory in most situations.

pH

The Regal process will function over a wide pH range, but best results will be obtained within the range 3.5-4.5. Many metallic impurities will precipitate within this range and will be removed by the filter on a continuous basis (e.g. Fe^{+3} , Al, Si, Cr^{+3}).

The pH will rise during normal operation of the bath. Dilute sulfuric acid (at least 1 part H_2SO_4 to 2 parts water) of an acceptable grade should be used to adjust the pH lower toward optimum level of 4.2.

Temperature

The Regal process can be operated over a wide temperature range, however, it is recommended that a relatively narrow range be selected and adhered to. Wide fluctuations in temperature will affect the current being drawn at a given voltage setting and can result in either poor performance or uneconomical operation.

Agitation

Air agitation from a low-pressure blower is preferred. Parameters for construction of a suitable air agitation supply system are available.

Mechanical agitation of the oscillatory type, at a rate of 3-8 feet/minute, should also prove satisfactory.

Current Density

Cathode Current Density

The Regal process operates over a wide range of cathode current densities; however, an average current density of 30-40 ASF (3-4 asd) should prove adequate for most cases.

Anode Current Density

Sufficient anode area should be provided to produce a maximum anode current density of about 30 ASF (3 asd) for air agitated solutions and 18 ASF (1.8 asd) for mechanically agitated solutions. Insufficient anode area may lead to anode polarization, which, in turn, will produce poor deposits due to low thickness, high addition agent consumption, etc.

Anodes

Electrolytic squares, R-Rounds*, or S-Rounds* used in titanium baskets are preferred for use. See "Anode Current Density" above. Baskets should be filled on a regular basis to assure maximum anode area.

* Trademark of the International Nickel Company

Anode Bags

Double cotton, cotton flannel or napped polypropylene anode bags are preferred. Cotton bags should be leached, before use, in 5% sulfuric acid solution containing 0.1% of the anti-pitter used. Polypropylene bags should be laundered and rinsed thoroughly using conventional laundry procedures and detergent.

Equipment

Tanks should be lined with a suitable synthetic material, such as PVC, which will withstand the temperatures expected.

Filtration

Filtration is strongly recommended. The filter should have at least one square foot of surface area for each 100 gallons of solution. The pump should be capable of turning the solution over at least every hour for air agitated solutions.

Conversion of existing baths

REGAL Bright Nickel Z-101 components are fully compatible with most existing systems, so that a simple "slide-in" conversion is acceptable. It is common to allow existing brightener to deplete as much as possible while still producing acceptable work. It is best to submit a representative sample of the solution to Howard Supply Company's laboratory for analysis and Hull cell testing. We will then advise the best conversion method.

WARRANTY AND DISCLAIMER:

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Products are warranted to be from defects in material and workmanship at the time of delivery. Under no circumstances shall manufacture or seller be liable for any loss, damage or other expense, direct or consequential, arising out of use or inability to use the product. Materials shall not be returned to seller or manufacture without express written permission. No information or suggestions given by us shall be deemed to be a recommendation to any product in conflict with existing patent rights.