

riag SnNi 870

Rack and barrel electrolyte for use in decorative and technical applications

riag SnNi 870 is a weakly alkaline electrolyte for depositing a tin-nickel alloy of dark anthracite colour in rack and barrel plating equipment. The field of application of the coatings comprises the decorative field e.g. in the jewellery industry and related branches, as well as the technical sector, e.g. the coating of HF contacts and connectors.

The average alloy composition is 60 % Sn and 40 % Ni.

The electrolyte is suitable for depositing coatings of up to 0.5 µm in thickness, depending on the substrate. **riag SnNi 870** is usually deposited on bright nickel or bright copper.

Properties

- high electrolyte stability
- good covering power
- good metal distribution
- good corrosion protection
- insensitive to handling, tarnish-resistant
- free from fluoride and cyanide
- coating colour: anthracite

Make up

	Range	Optimum
Potassium pyrophosphate	110 – 150 g/L	130 g/L
Tin pyrophosphate chem. pure	2.4 – 3.5 g/L	2.8 g/L
Nickel chloride x 6 H ₂ O	20 – 41 g/L	25 g/L
riag SnNi 870 Make up	100 mL/L	100 mL/L
riag SnNi 870 Brightener 2	15 mL/L	15 mL/L

Operating Values

	Range	Optimum
Tin (Sn)	1.4 – 2.0 g/L	1.6 g/L
Nickel (Ni)	5.0 – 10.0 g/L	6.0 g/L
Potassium pyrophosphate	110 – 150 g/L	130 g/L

Make up

In a separate tank half of the planned volume is filled with deionized water.

At a temperature of at least 40 °C the potassium pyrophosphate and the tin pyrophosphate are added and completely dissolved. Then add **riag SnNi 870 Make up** and the nickel chloride dissolved in deionized water. Finally **riag SnNi 870 Brightener 2** is added and the mixture is filled with water to the final volume. If necessary, the pH is adjusted with diluted phosphoric acid. The electrolyte is then filtered through a filter of pore size $\leq 10 \mu\text{m}$ until it is clear. After heating to operating temperature the electrolyte is ready for use.

Operating Parameters

Temperature	50 °C (45 – 55 °C)
pH-value	7.7 (7.0 – 8.5)
Anodic current density	max. 1 A/dm ²
Current density rack operation	1.0 A/dm ² (0.5 – 1.5 A/dm ²)
Current density barrel operation	0.25 A/dm ² (0.1 – 0.4 A/dm ²)
Recommended layer thickness	0.1 – 0.3 μm
Maximum layer thickness	0.5 μm , depending on substrate
Current efficiency	approx. 70 %
Deposition rate	approx. 0.2 $\mu\text{m}/\text{min}$. at 1.0 A/dm ² approx. 0.06 $\mu\text{m}/\text{min}$. at 0.25 A/dm ²
Deposition quantity	approx. 1.12 g/Ah at 1.0 A/dm ²
Density of the coating	approx. 7.9 g/cm ³
Current load per litre	max. 0.3 A per litre of electrolyte under continuous load
Material of anodes	Graphite (as sheets or round anodes)
Agitation	Parts agitation / barrel rotation
Tanks	Plastic or lined steel
Filtration	Continuous through filter (pore size $\leq 10 \mu\text{m}$), recirculated volume per hour at least two to three times the volume of the electrolyte
Heating	Immersion heaters, but thermostatic control is essential PTFE or quartz (no stainless steel)
Cooling	not necessary
Fume extraction	required

Maintenance Analyse and adjust tin, nickel and potassium pyrophosphate regularly.

Additions Nickel chloride x 6 H₂O (4.1 g = 1 g Ni)
Tin pyrophosphate (1.7 g = 1 g Sn)
Potassium pyrophosphate
riag SnNi 870 Brightener 1
riag SnNi 870 Brightener 2

If continuous metal replenishment is practiced, please note that working conditions such as current density, temperature, agitation, filter efficiency, drag-out losses, etc. vary from user to user, so that the data given below may have to be amended correspondingly.

The following values are a guide to the consumption of **riag SnNi 870** components per 100 Ah (112 g of alloy):

Tin pyrophosphate	130 g
Nickel chloride x 6 H ₂ O	200 g
Potassium pyrophosphate	only by drag-out
riag SnNi 870 Brightener 1	500 mL
riag SnNi 870 Brightener 2	30 mL (and as required)

We recommend installing an ampere-hour meter so that replenishment intervals can be maintained accurately.
Replenish at the latest after 0.5 Ah/litre of electrolyte volume.

Contaminants Especially in cases where copper-plated articles are plated in **riag SnNi 870** a very thorough intermediate treatment is required to avoid the drag-in of components out of copper electrolytes, mainly copper ions. Copper as well as organic compounds from other electrolytes lead to considerable problems in **riag SnNi 870** electrolytes and may cause the destruction of the electrolyte.

pH-value adjustment Raise a too low pH-value with potassium hydroxide solution, lower a too high pH-value with dilute phosphoric acid.

How the additives work

Potassium pyrophosphate regulates the pyrophosphate content in the electrolyte. A lack is usually indicated by a smaller process window and possibly by precipitates in the electrolyte.

Tin pyrophosphate regulates the tin content in the electrolyte. A lack is indicated by matt and hazy deposits in medium to high current density areas.

Nickel chloride x 6 H₂O regulates the nickel content in the electrolyte. A lack is indicated by a reduced operating range. A too high nickel content will result in matt-grey deposits.

We recommend pre-dissolving the salts in electrolyte and adding the required amount by filter pump. Never add directly to the electrolyte when articles are being plated (spotted deposits, roughness).

riag SnNi 870 Brightener 1 produces homogeneous deposits. A lack is indicated by inhomogeneous deposits and / or whitish precipitates in the electrolyte.

riag SnNi 870 Brightener 2 produces uniform anthracite layers at all current densities and prevents „edge weakness“. A lack is indicated by lighter deposits and / or non-uniform coatings. An excess dose of **riag SnNi 870 Brightener 2** is indicated by a decrease in deposition speed.

Environmental considerations and product safety

All concentrates, rinse waters and waste solution must be treated and discharged in accordance with local effluent control regulations. Information can be gleaned from the material safety data sheets. Chemicals shall not be stored below 10 °C.

Liability

This instruction manual was compiled with reference to the state of the art and all current standards, and is based on the long-term knowledge and experience of riag. However, riag cannot monitor compliance with this instruction manual and the methods described herein at the customer/end-user's premises. Work carried out with riag products must be adapted accordingly to meet local conditions. In particular, riag cannot accept liability for damage, loss or cost incurred due to a failure to adhere to this instruction manual, improper application of the methods, unauthorised technical modifications, insufficient maintenance or the absence of maintenance in respect of the requisite technical hardware or equipment, or in the event of use by unqualified personnel. riag is not liable for damage or loss caused by riag or its employees except where intention or gross negligence can be proved. riag furthermore reserves the right to make changes in relation to products, methods and the instruction manual without prior notice.

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This transaction is governed by material Swiss law (Law of Obligations), excluding private international law (conflict of laws) and intergovernmental treaties, specifically the CISG.

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Analysis (Analytical Methods)

Sample preparation:

The sample must be taken from a well-mixed point.

Tin

Reagents:	Sodium bicarbonate Iodine 0.05 mol/L Starch solution 1 % Hydrochlorid acid 1:1
Procedure:	50 mL deion. water and 20 mL hydrochlorid acid are transferred in 250 mL beaker, add approx. 2 g sodium bicarbonate (frothing), add 5.0 mL electrolyte and 1 mL starch solution and titrate with iodine 0.05 mol/L from colourless to dark blue. The dark blue colour has to stay for 30 s
Calculation:	Consumption of mL iodine 0.05 mol/L x 1.19 = g/L Tin

Nickel

Reagents:	Hydrogen peroxide 35 % Buffer solution pH 10 Na ₂ EDTA 0.1 mol/L Murexide (Sodium chloride 1: 100)
Procedure:	5.0 mL electrolyte and 20 mL deion. water are transferred into 250 mL beaker, add 5 mL hydrogen peroxide and boil the solution for 1 – 2 min., then let it cool down to room temperature. Add 30 mL buffer solution pH 10 and 100 mL deion. Water 1 spatula tip of Murexide are added The sample colour should then be deep yellow Titrate immediately with Na ₂ EDTA 0.1 mol/L to a blue- end- point
Calculation:	Consumption of mL Na ₂ EDTA 0.1 mol/L x 1.173 = g/L Nickel

Potassium pyrophosphate

Reagents: Bromocresol green indicator 0.1 % in H₂O
Hydrochlorid acid 0.1 mol/L
Sodium hydroxide 0.1 mol/L
Zinc sulfate 20 %: as ZnSO₄ x 7 H₂O

pH-value of electrolyte has to be 3.8, lower or increase pH-value with HCl / NaOH

Procedure: 1.0 mL electrolyte and
50 mL deion. water are transferred into in 150 mL beaker, add
approx. 1 mL bromocresol green indicator
Adjust the pH-value with hydrochloric acid to 3.8 using a pH-meter (the colour of the solution changes from blue to yellowish-green), add
25 mL zinc sulfate, stir for 4-5 min. (colour change from yellowish-green to yellow)
Titrate with NaOH until the pH reaches 3.8
Endpoint: yellow to yellowish-green

Calculation: Consumption of mL NaOH 0.1 mol/L x 16.5 = g/L potassium pyrophosphate