riag Oberflächentechnik AG · Postfach 169 · CH-9545 Wängi TG

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riag PN 102

Electroless plating nickel electrolyte for Aluminium

riag PN 102 is an alkaline process for the electroless plating of nickel for aluminum and its alloys prior to electroless or electrolytic nickel plating or copper plating.

riag PN 102 deposits very thin, uniform nickel coatings even on heavily profiled workpieces. These active nickel coatings can be further plated with excellent adhesion.

Make up

Operating temperature	Room temperature	35 – 43 °C
deionised water (electrical conductivity < 5 µS/cm)	500 mL/L	500 mL/L
riag PN 102 Make up	150 mL/L	150 mL/L
riag PN 102 Replenisher 2	88 mL/L	88 mL/L
riag PN 102 Stabiliser	0.8 mL/L	2.0 mL/L
pH value	9.6 – 11.5	9.6 – 11.5
Immersion time in minutes	5 – 10	3 – 6

After the make up at room temperature the pH is adjusted to approx. 11.0 with conc. ammonia solution chem. pure.

For the new preparation of the electrolyte **riag PN 102 Make up**, **riag PN 102 Replenisher 2** and **riag PN 102 Stabiliser** are used. **riag PN 102 Replenisher 1** and **riag PN 102 Replenisher 2** are used for the further operation of the electrolyte. **riag PN 102 Stabiliser** is only used for the make up and later added after each intermediate cleaning of the working tank.

Tank and equipment

riag PN 102 can be used in existing plants designed for electroless nickel plating. Tanks lined with PVC, polyethylene or polypropylene are used as tank material.

Heating should be done with PTFE or stainless steel steam coils or electrical immersion heaters (casing: stainless steel with anodic protection, glass or PTFE).

An exhaust ventilation system must be provided for the extraction of spray-mist and steam. A cover should be placed over the electrolyte during breaks in production to stop evaporation loss at working or near working temperatures. It also prevents the entry of dirt or other impurities from the surrounding air.

Filtration und tank agitation

Continuous filtration of the **riag PN 102** electrolyte during the operation helps to ensure optimum deposition. The materials used to make the parts of the filtering system that come into contact with the **riag PN 102** electrolyte should be resistant to both heat and chemicals. The filtering system should consist of an immersed centrifugal pump with downstream filter housings, the pump being used to provide tank agitation. A tank circulation rate of at least 2 - 3 tank volumes per hour is recommended to ensure that continuous operation is accompanied by optimum mixing of the electrolyte and inflowing replenishers. The system should be fitted with 3 µm polypropylene filters (cartridge- or bag type) for continuous operation, or 1 µm for non-continuous operation.

Make up

Before making up a new **riag PN 102** electrolyte or preparing it for the first time, all system parts that come into contact with the **riag PN 102** electrolyte solution must be treated with concentrated nitric acid. After thoroughly rinsing all these units with tap water and then distilled water, check the quality of the water flowing through the filter. It should not exceed an electrical conductivity of 10 µS/cm.

The volume of distilled water (electrical conductivity < 5 µS/cm) required for the preparation is added. Activate the filter circuit and add the **riag PN 102** make up chemicals. Wait for the system to warm up to operating temperature and then take another pH-reading.

Base materials

riag PN 102 can be used on all ferrous alloys (steel, stainless steel, etc.), nickel-iron alloys, copper alloys, copper-nickel alloys, aluminium alloys and their derivatives.

riag Oberflächentechnik will be pleased to supply pre-treatment instructions designed for specific applications.

Operating conditions

Replenishment:	**riag PN 102 Replenisher 1**	60 g/L nickel
	riag PN 102 Replenisher 2	308 g/L sodium hypophosphite
	Ammonia 15 %	600 mL/L ammonia 25 %
Dosing ratio:	**Replenisher 1** : **Replenisher 2**	1 : 1
	riag PN 102 Stabiliser and ammonia 15 % if required	
Operating temperature:	20 – 43 °C (see first page)	
	The normal working temperature is between 20 and 43 °C. Lower temperatures reduce the deposition rate.	
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pH value:	9.6 – 11.5 (measured at 20 °C, electrometric)	
Nickel content:	5.5 ± 1.0 g/L	
Reducing agent:	27 ± 5 g/L	
Agitation:	Part agitation is useful but not essential	

Electrolyte maintenance

To achieve an optimal deposition rate, it is necessary to comply with the parameters provided under "operating conditions". Ensure that the solution does not deviate more than 20 % from the target metal content (see "operating conditions"). Additions should be made more frequently and slowly in small quantities or, in the case of larger volumes, by means of an automatic pH value or a nickel-content control system.

We recommend regular analyses of the nickel and hypophosphite content.

	Addition in mL/L	
Nickel content (g/L)	**riag PN 102 Replenisher 1**	**riag PN 102 Replenisher 2**
5.5	0	0
5.3	3.3	3.3
5.1	6.7	6.7
4.9	10.0	10.0

pH value correction

To lower the pH, use sulphuric acid approx. 10 % (60 mL/L concentrated sulphuric acid p.a.), to raise the pH, use ammonia approx. 15 % (600 mL/L concentrated ammonia).

All additions must be made slowly and with thorough stirring. Observe the applicable accident-prevention regulations for alkaline and acid substances when handling ammonia and sulphuric acid.

Waste water treatment

riag PN 102 and its rinsing water must be decontaminated and neutralised before disposal in the drain outlet to the sewer system. riag can supply details of these waste water treatment methods on request.

Possible hazards and safety precautions

These details can be found in the material safety data sheets for **riag PN 102 Make up**, **riag PN 102 Replenisher 1** & **2** and **riag PN 102 Stabiliser**. The relevant material safety data sheets for the handling of ammonia and sulphuric acid should be requested from their respective suppliers.

The **riag PN 102 Make up**, **riag PN 102 Replenisher 1** & **2** and **riag PN 102 Stabiliser**, along with the ammonia, should all be stored between 10 and 25 °C.

If excessive cooling should cause partial crystallisation of the solution, warm it up to > 20 °C (stirring is recommended).

Prevent skin or eye contact with **riag PN 102 Make up**, **riag PN 102 Replenisher 1** & **2**, **riag PN 102 Stabiliser** and ammonia. In case of skin contact, rinse the affected area with plenty of cold running water. Seek medical attention immediately if eye injuries are involved.

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.

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Analysis – Analytic methods

Nickel

Target value:	5.5 g Ni/L
Required reagents:	Na_2EDTA 0.1 mol/L NH_4OH solution, concentrated (approx. 25 %) Murexide powder (1 g murexide and 99 g NaCl) Deionised water
Apparatus required:	Erlenmeyer flask, 300 mL Pipette, 5 mL microburette (Bang), 10 mL
Method:	Pipette to add 5 mL of electrolyte (20 °C) to a 300 mL Erlenmeyer flask. After adding 10 mL of NH_4OH and a spatula-tip of murexide powder, top up to about 150 mL with distilled water. Titration now takes place with Na_2EDTA 0.1 mol/L until there is an abrupt colour-change from yellow to violet.
Calculation:	nickel (g/L) = 1.174 x consumed mL Na_2EDTA 0.1 mol/L

The described analysis should be done daily. It also serves to check the flow photometer. Furthermore, every newly prepared electrolyte should be checked in this way.

Reducing agent

Target value:	27 g/L sodium hypophosphite monohydrate
Required reagents:	Starch solution 1 % 6 mol/L HCl (600 mL/L 32 % HCl) 0.05 mol/L KJO_3/KJ (iodate-iodide) 0.1 mol/L $Na_2S_2O_3$ (sodium thiosulphate)
Apparatus required:	Pipette, 2 mL 2 burettes, 50 mL -1/20 division- with fitting-stopper glass taps or Teflon tap cocks automatic tipping device, 20 mL Erlenmeyer flask with tight-fitting glass stopper (iodine-count flask)
Method:	Pipette 2 mL electrolyte (20 °C) in an Erlenmeyer flask, add 25 mL 0.05 mol/L potassium iodide-iodate and acidify with 20 mL 6 mol/L HCl. Tightly seal Erlenmeyer flask with stopper and allow sample to react for half an hour in total darkness. Then titrate with 0.1 mol/L sodium thiosulphate solution until a pale yellowish coloration becomes apparent. Add two drops of 1 % starch solution to mark the transition point exactly. Now continue to titrate until there is a transition from bluish-violet to colourless.

Calculation: reducing agent (g/L) = (mL 0.05 mol/L KJO_3/KJ – mL 0.1 mol/L $Na_2S_2O_3$) x 2.65