



List of products

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Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications											
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery		
Weakly Acid, Nickel-free Colour Gold Electrolytes (Decorative)																							
AURUNA® 215 Non-allergenic coatings since free from nickel and cobalt. Colour-constant over a wide operating range, for rack and barrel.	98.5	Fe/In	220	Approx. 1-2 N	3	2.5 (2.0-3.0)	4.0 (3.8-4.5)	1.5 (0.5-2.0)	0.14	35 (30-35)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■					■			
AURUNA® 215 Pale Non-allergenic coatings since free from nickel and cobalt. Colour-constant over a wide operating range, for rack and barrel.	96	Fe/In	220	Pale yellow	3	1.5 (1.3-1.7)	4.0 (3.8-4.5)	2.5 (2.0-3.0)	0.11	45 (40-50)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■					■			

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery			
Weakly Acid Colour Gold Electrolytes (Decorative)																								
AURUNA® 220 Coatings with good corrosion and abrasion resistance as well as high hardness. For rack and barrel. Often used for bathroom fittings.	96.5	Ni/In	270	14 ct Hamilton (pale yellow)	5	4 (3.5-4.5)	3.5 (3.4-3.7)	0.6	0.06	30 (28-32)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■		
AURUNA® 221 Coatings with good corrosion and abrasion resistance as well as high hardness. For rack and barrel.	98	Ni/In	240	ca. 1 N	5	5	3.5 (3.0-4.0)	0.6	0.07	30 (28-32)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■		
AURUNA® 222 Coatings with good corrosion and abrasion resistance as well as high hardness. For rack and barrel.	98.5	Ni/In	200	Approx. 2 N (light yellow)	5	5 (4.5-5.5)	3.5 (3.4-3.7)	1.0	0.12	30 (28-32)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■		
AURUNA® 230 Coatings with good corrosion and abrasion resistance as well as high hardness. High plating speed; for rack and barrel.	96	Ni/In	270	Pale yellow	5	4 (3.5-4.5)	3.5 (3.4-3.7)	2.5	0.3	45 (43-47)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■		

Gold Electrolytes

	Metal content in the deposit wt.%	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery			
Weakly Acid Colour Gold Electrolytes (Decorative)																								
AURUNA® 231 Coatings with good corrosion and abrasion resistance as well as high hardness. High plating speed; for rack and barrel.	97.2	Ni/In	250	light yellow	5	2.5	3.8 (3.7-3.9)	0.9	0.13	35	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■			
AURUNA® 232 Coatings with good corrosion and abrasion resistance as well as high hardness. High plating speed; for rack and barrel.	97.5	Ni/In	250	Approx. 2 N (light yellow)	5	4 (3.5-4.5)	4.2 (4.0-4.4)	2.0	0.25	45 (43-47)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■			
AURUNA® 241 Coatings with good corrosion and abrasion resistance as well as high hardness. For rack and barrel. Hot-water treatment required for stable and uniform colour.	92.5	Ni	290	Yellow-grey	1	2.5 (2.0-3.0)	4.0 (3.8-4.2)	1.0	0.12	45 (43-47)	Pt/Ti, Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■			
AURUNA® 246 Coatings with good corrosion and abrasion resistance. For rack and barrel. Post-treatment (cathodic degreasing or hot-water rinse) required for correct and constant colour. Special electrolyte for the bathroom fittings industry (technical term "Noble Brass").	93.5	Co	220	Grey-brown	1	2.5 (2.0-3.0)	4.2 (4.0-4.4)	1.0	0.11	45 (43-47)	Pt/Ti, Ru MMO PLATI-NODE® 167					■								

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications																					
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery												
Weakly Acid Colour Gold Electrolytes (Decorative)																																	
AURUNA® 247	92.5	Ni/Co	290	Yellow-Grey	1	2.5 (2.0-3.0)	4.0 (3.8-4.2)	1.0	0.12	50	Pt/Ti, Ru-MMO PLATI-NODE® 167										■	■	■										
Coatings with good corrosion and abrasion resistance. For rack and barrel. The coatings are glossy and color-stable up to layer thicknesses of 1 μm .																																	

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications									
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery
Weakly Acid Gold Electrolytes (Decorative and Technical)																						
AURUNA® 523 High-performance electrolyte with very wide operating range for rack, barrel and vibratory equipment. Hard, abrasion-resistant coatings with low, stable contact resistance.	99.7	Ni	140-180	Yellow	10	I-II C	4 (4-12)	4.4 (4.2-4.6)	Rack 1.0 (0.5-4.0) Barrel 0.5 (0.3-2.0)	0.1-0.8	35 (30-45)	Pt/Ti	■	■								
AURUNA® 526 Only for barrel plating and Vibromat application. Excellent throwing power and optimum thickness distribution (hollow bodies). Stable long-term behaviour of the electrolyte and simple bath maintenance.	99.8	Co	160	Deep yellow	5	I C	4 (2-5)	4.4 (4.0-4.6)	0.3 (0.3-1.0)	0,08	RT up to 30	Pt/Ti	■		■					■		
AURUNA® 527 Only for barrel plating and Vibromat application. Excellent throwing power and optimum thickness distribution (hollow bodies). Very stable long-term behaviour of the electrolyte, even under heavy loading.	99.8	Ni	150	Light yellow	10	I C	4 (2-5)	4.4 (4.0-4.6)	0.3 (0.1-0.5)	0,05 (0.02-0.1)	RT up to 28	Pt/Ti	■		■					■		

Gold Electrolytes

	Metal content in the deposit wt.%	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications									
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery
Weakly Acid Gold Electrolytes (Decorative and Technical)																						
AURUNA® 528 Hard-gold electrolyte with a high current efficiency, thus low evolution of hydrogen. Particularly gentle treatment of printed circuit boards with sensitive resists (no lifting). Also for decorative applications.	99.85	Ni	150	Yellow	10	I C	8 (4-12)	4.7 (4.6-4.8)	1.0 (0.8-2.0)	0.3-0.9	35 (33-37)	Pt/Ti	■	■	■	■	■	■	■	■	■	
AURUNA® 529 Hard-gold electrolyte with a high current efficiency, thus low evolution of hydrogen. Particularly gentle treatment of printed circuit boards with sensitive resists (no lifting). Also for decorative applications.	99.75	Co	150-200 HV 0.01	Yellow	10	I-II C-D	4 (3-8)	4.7 (4.6-4.8)	1.0 (0.8-2.0)	0.3-0.8	35 (33-37)	Pt/Ti, Ir MMO PLATI-NODE® 177	■	■		■	■	■	■	■	■	
AURUNA® 530 Hard-gold electrolyte with a high current efficiency. For printed circuit boards with aqueous processable resists and electrical contacts.	99.7	Co	150-200 HV 0.01	Yellow	5	I-II C-D	4 (3-8)	4.0 (4.0-4.4)	0.8 (0.5-2.0)	0.1-0.5	35 (35-45)	Pt/Ti	■	■								

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications											
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery		
Weakly Acid Gold Electrolytes (Decorative and Technical)																								
AURUNA® 535 Hard gold electrolyte with simple bath maintenance for deposition of bright and hard gold coatings for decorative and technical applications. Stainless steel anodes permitted.	99.8	Ni	140-150	Deep yellow	10	I C	4.0	4.8-5.0	0.5-1	0.2	RT up to 25	Stainless steel Pt/Ti MMO Type 187 SO	■	■	■	■	■	■	■	■	■			
AURUNA® 539 Electrolyte with high plating speed for rack and barrel. Ultra-bright hard-gold coatings with good corrosion and abrasion resistance as well as low, stable contact resistance.	99.7	Co	150-220	Yellow	10	II D	8 (4-12)	4.2 (4.0-4.6)	2.5 (1-5)	0.2-1.0	45 (43-47)	Pt/Ti	■	■	■	■	■	■	■	■	■			
AURUNA® 535 LC Electrolyte with low gold content and simple bath maintenance. Stainless steel anodes permitted. Mostly used as a gold strike electrolyte or for barrel plating, otherwise similar to AURUNA® 535.	99.5	Ni	140-150	Deep yellow	1	II C	1.0 (0.6-1.0)	4.8 (4.8-5.0)	0.2-0.7	0.06	RT up to 30	Stainless steel Pt/Ti	■	■	■	■								

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications									
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery
Weakly Acid Gold Electrolytes (Decorative and Technical)																						
AURUNA® 539 LC Electrolyte with low gold content and simple bath maintenance. Mostly used as a gold strike electrolyte or for barrel plating, otherwise similar to AURUNA® 539.	99.5	Co	200	Deep yellow	2	II D	2 (1.0-4.0)	4.0 (3.8-4.2)	1-2	0.15-0.26	50 (48-52)	Pt/Ti	■	■	■	■	■	■	■	■	■	■
AURUNA® 5300 Electrolyte free from nickel and cobalt for rack and barrel with high plating speed. Good corrosion and abrasion resistance as well as low, stable contact resistance.	99.7	Fe	150-170	Yellow	20	I-II C	8 (2-12)	4.0 (3.8-4.2)	2-3 (0.5-4)	0.1-1.0	45 (43-47)	Pt/Ti	■	■	■	■	■	■	■	■	■	■
AURUNA® 5400 Electrolyte with very wide operating current density range for rack and barrel. Bright hard gold coatings with high corrosion and abrasion resistance as well as low, stable contact resistance.	99.7	Fe	150-220	Yellow	10	I-II C-D	8 (0.5-12)	4.2 (3.8-4.6)	2.5 (1-5)	0.1-1.0	50 (48-52)	Pt/Ti, MMO PLATI-NODE® 167, 177	■	■	■	■	■	■	■	■	■	■

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.01 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications								
													Printed circuit boards	Connectors/contacts	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery	
High Speed Acid Gold Electrolytes																					
AURUNA® 7000* High-speed electrolyte for hard-gold deposition. Simple bath maintenance, no oxidation of the alloy partner, unproblematic precipitation of metallic contaminants. Very well suited to brush applications. Also for use as a gold strike electrolyte.	99.9-99.7	Fe	170-200	Yellow	10	I-II C-D	12 (2-18)	4.2-4.6	2-40*	0.3-8*	55 (45-60)	Pt/Ti	■	■							
AURUNA® 7100* High-speed electrolyte for hard-gold deposition. Suitable for all electronic components where cobalt is specifically demanded. Also for use as a gold strike electrolyte.	99.9-99.6	Co	140-200	Yellow	10	I-II C-D	12 (2-18)	4.2-4.6	2-40*	0.3-8*	55 (45-60)	Pt/Ti	■	■							
AURUNA® 8100* High-speed electrolyte for hard gold deposition with extended operating range and extremely high deposition speed. Also for use as a gold strike electrolyte.	99.9-99.6	Co	120-200	Yellow	10	I-II C-D	12 (2-30)	4.2-4.6	2-80*	0.3-11*	55 (45-65)	Pt/Ti	■	■							

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.01 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications						
													Printed circuit boards	Connectors/contacts	Jewellery	Watches	Spectacle frames	Writing implements	Household articles
High Speed Acid Gold Electrolytes																			
AURUNA® 8400* High-speed electrolyte for hard gold deposition with extended operating range and extremely high deposition speed. Also for use as a gold strike electrolyte.	99.9-99.6	Ni	130-190	Yellow	10	I-II C-D	12 (2-18)	4.3 (4.2-4.4)	2-80*	0.3-12*	60 (45-60)	Pt/Ti	■ ■						

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications									
													Printed circuit boards	Connectors/contacts	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery		
Strongly Acid Gold Electrolytes																						
AURUNA® 311 Particularly suitable for the adhesive direct gold-plating of stainless steel and substrates difficult to plate. Very good activation effect – without halogenides. The coatings are ductile, have few pores and protect against corrosion. Suitable as a gold strike electrolyte as well as for thick coatings. Special gold complex required. Also available as a special <u>cobalt-free</u> version.	99.7	Co	165	Deep yellow	10	-	2 (1.0-2.5) or 4 (3.5-4.5)	0.6 (0.1-0.8)	2-6	0.04-0.15	Room temperature up to 40	Pt/Ti, Ir MMO PLATINODE® 177	■	■	■	■	■	■				
AURUNA® 312 Particularly suitable for the adhesive direct gold-plating of stainless steel and substrates difficult to plate. Very good activation effect – without halogenides. The coatings are ductile, have few pores and protect against corrosion. Suitable as a gold strike electrolyte as well as for thick coatings. Special gold complex required.	99.7	Co	160	Deep yellow	10	-	2 (1-10)	0.3 (0.1-0.8)	2-6	0.08 at 2 g/l Au, 2 A/dm^2 , 25 $^{\circ}\text{C}$ 0.25 at 4 g/l Au, 4 A/dm^2 , 40 $^{\circ}\text{C}$	25 (20-40)	Pt/Ti, Ir MMO PLATINODE® 177	■	■	■	■	■	■				

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery
Fine Gold Electrolytes																									
AURUNA® 550 Neutral electrolyte for fine gold coatings with a high current efficiency. Operating conditions gentle to resists, for sensitive printed circuit boards. Excellent bonding and soldering properties, low hardness, low contact resistance.	99.9	-	85	Matt yellow	10	III A	8 (7-12)	6 (5.8-6.2)	0.4 (0.1-0.8)	0.22	50 (45-55)	Pt/Ti	■	■											
AURUNA® 551 Gold strike electrolyte for depositing thin coatings. Good activation of the substrate. Protects the main gold electrolyte from contaminants. Electrolyte works at room temperature (RT). Suitable for high-speed equipment.	99.9	-	-	Yellow	0.1	-	1 (0.6-1.2)	4 (3.8-4.2)	0.2-0.8	Flash 0.065	RT (20-30)	Stainless steel, Pt/Ti, Ir MMO PLATINODE® 177	■	■	■	■	■	■	■	■	■	■	■	■	■
AURUNA® 552 Fine gold electrolyte for printed circuit board and electronics applications. Very good soldering and bonding properties, good resist compatibility. Silk-matt coatings with good ductility, hardly any internal stress. Simple bath maintenance.	99.99	-	80 HV 0.01	Yellow	10	III A	8 (6.5-12)	6 (5.8-6.2)	0.15-0.5	0.3	70 (66-72)	Pt/Ti	■	■											
AURUNA® 553 Neutral electrolyte for silk-matt coatings with excellent ductility. The coatings are yellow and smooth even at higher layer thicknesses. Very good soldering and bonding properties.	99.9	-	90 HV 0.01	Yellow	>200	III A	10 (6-10)	6 (5.8-6.2)	0.5 (0.2-0.6)	0.3	70 (60-70)	Pt/Ti	■	■											

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery
Fine Gold Electrolytes																									
AURUNA® 554 Neutral electrolyte for thin, decorative gold-copper or gold-silver coatings. The coating colour can be individually adjusted from green/yellow to reddish. Layers colour-constant from approx. 0.05 µm, very good throwing power. For rack and barrel.	>90	Ag or Cu	-	Variable	0.25	-	1.0 (0.5-2.0)	7 (6.5-7.5)	Rack 1.0 (0.5-2.0) barrel 0.5 (0.1-0.5)	0.12	50 (25-50)	Stainless steel, Pt/Ti				■	■	■	■		■	■	■	■	
AURUNA® 555 Neutral electrolyte for thin coatings. Economic due to low gold content. Due to the particularly good covering and throwing power the full colour effect can be achieved with very thin layers, colour-constant from approx. 0.05 µm. Long lifetime, insensitive to contaminants, without complexing agents. For rack and barrel.	99.9	-	-	Deep yellow	0.25	-	1.0 (0.8-2)	7 (6.0-8.2)	Rack 1.0 (0.5-1.0) barrel 0.5	0.12-0.16	50 (45-55)	Stainless steel, Pt/Ti				■		■	■	■		■	■	■	■
AURUNA® 556 Bright fine gold coatings with high hardness. High current efficiency. Preferably for sensitive printed circuit boards, operating conditions gentle to resists, no lifting of the resists.	99.9	-	250	Yellow	>200	III D	8 (7-9)	6 (5.8-6.2)	Up to 0.8 (0.2-0.8)	0.5	50 (45-55)	Pt/Ti	■	■		■		■	■	■		■	■	■	■

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications														
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery		
Fine Gold Electrolytes																											
AURUNA® 558 Weakly alkaline fine gold electrolyte for silk-matt coatings of high purity, low hardness, very fine grain structure, and excellent bonding properties. Citrate-free, simple bath maintenance, environmentally friendly, contains no arsenic, thallium, lead, no carcinogenic substances such as hydrazine or formaldehyde. High current densities and thus high plating speeds possible. For rack and barrel.	99.9	-	70	Light yellow	>20	III A	12 (10-12)	8.2 (8.0-8.4)	2.5 (0.5-4.0)	0.27-2.4	72 (70-75)	Pt/Ti	■	■													
AURUNA® 559* Neutral fine gold electrolyte specially developed for application in high-speed equipment. High current densities and thus high plating speeds possible, depending on the flow conditions in the equipment. Excellent bonding properties.	99.9	-	100	Light yellow	>20	III B	16 (14-16)	7.5 (7.3-7.5)	10-25*	6-15*	70 (70-75)	Pt/Ti		■													
AURUNA® 580* Weakly acid gold strike electrolyte for use in combination with AURUNA® 558 and 559 for depositing thin, bright coatings. For rack, barrel, or high-speed equipment.	99.9	-	-	Deep yellow	0.3	-	2 (1-4)	3.9 (3.8-4.2)	0.5-8*	0.06-1.6*	20-40	Pt/Ti	■	■													

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery
Fine Gold Electrolytes																									
AURUNA® 5000 Neutral fine gold electrolyte with resist-friendly operating conditions, for flexible printed circuit boards in particular. High-purity gold coatings with excellent bonding and soldering properties.	99.95	-	≤85	Mat yellow	5	III A/B	7 (5-9)	6.0 (5.8-6.2)	0.3 (0.1-0.5)	0.17	65 (62-68)	Pt/Ti	■	■											
AURUNA® 5000 LC Neutral gold strike electrolyte for AURUNA® 5000, can also be used alone as fine gold electrolyte with resist-friendly operating conditions, for flexible printed circuit boards in particular. High-purity gold coatings with excellent bonding and soldering properties.	>99.9	-	70-90	Satin, yellow	0.15	III A/B	2 (1-3)	6.0 (5.8-6.2)	0.15 (0.1-0.3)	0.04-0.17	35 (30-65)	Pt/Ti	■	■											
AURUNA® 5100 Neutral fine gold electrolyte with operating conditions that are gentle to resists, excellent bondability and solderability. High current efficiency, low hardness, low contact resistance. For P-BGA.	99.99	-	85	Lemon yellow	10	III A/B	5 (4-8)	6.0 (5.8-6.2)	0.2 (0.1-0.5)	0.13	65 (60-70)	Pt/Ti	■	■											

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery			
Alkaline-cyanide Gold Alloy Electrolytes (Decorative)																								
AURUNA®-Color 100-160 Colour gold-plating electrolytes in approx. 20 different, exactly reproducible colour shades including the standard colours. Colour-constant deposition, coatings colour-stable and tarnish-resistant, good abrasion resistance due to hardener. Simple bath maintenance. Not suitable for barrel plating.	>85	Different	-	Various	0.2	1 (0.9-1.1)	Alk.	5-10	0.2	65 (62-68)	Stainless steel	■	■	■	■	■	■	■	■	■	■			
AURUNA® 500 Gold-saving, red, approx. 18 carat gold-copper coatings. Resistant to tarnishing and corrosion. High hardness, abrasion-resistant. The neutral electrolyte works without free cyanide. Also for technical applications. Can be operated with either 5 or 10 g/l gold.	75	Cu	380-400	Red	10	5 (4.5-5.5) or 10 (9-11)	5 g/l Au: 7.4 (7.2-7.6) 10 g/l Au: 7.2 (7.0-7.3)	5 g/l Au: 0.4 (0.2-0.8) 10 g/l Au: 0.75 (0.3-1.0)	5 g/l Au: 0.14 10 g/l Au: 0.22	5 g/l Au: 45 (40-50) 10 g/l Au: 57 (55-60)	MMO PLATINODE® 187 SO	■	■	■	■	■	■	■	■	■	■			
AURUNA® 500 LC Gold-saving, red, approx. 18 carat gold-copper coatings. Resistant to tarnishing and corrosion. High hardness, abrasion-resistant. The neutral electrolyte with low gold content works without free cyanide.	75	Cu	380-400	Red	1	2 (1.5-3)	7.0 (6.8-7.2)	0.3-1.0	0.12	57 (55-60)	MMO PLATINODE® 187 SO	■	■	■	■	■	■	■	■	■	■			

Gold Electrolytes

	Metal content in the deposit wt.%	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery			
Alkaline-cyanide Gold Alloy Electrolytes (Decorative)																								
AURUNA® 502 Gold-saving, red, approx. 18 carat gold-copper coatings. Resistant to tarnishing and corrosion. High hardness, abrasion-resistant. The neutral electrolyte works without free cyanide. Also for technical applications.	75	Cu	380-400	Red	10	4 (3.5-4.5)	7.5 (7.2-8.0)	0.5 (0.3-0.8)	0.15	57 (55-60)	Pt/Ti, MMO PLATI-NODE® 187 SO	■	■	■	■	■	■	■	■	■	■			
AURUNA® 503 Gold-saving, red, approx. 18 carat gold-copper coatings. Resistant to tarnishing and corrosion. High hardness, abrasion-resistant. The neutral electrolyte works without free cyanide. Also for technical applications.	75	Cu	380-400	Red	5	6 (5-7)	7.5 (7.3-7.8)	0.8 (0.6-1.2)	0.25	65 (60-70)	Pt/Ti	■	■	■	■	■	■	■	■	■	■			
AURUNA® 504 Gold-saving, red, 18 carat gold-copper coatings. Resistant to tarnishing and corrosion, hard and abrasion-resistant. High electrolyte stability. For technical and decorative applications.	65-75	Cu	320	Red	10	4 (3-5)	11 (10.5-11.5)	Rack 0.7 (0.5-0.9) Barrel 0.25 (0.2-0.5)	0.34 at 0.7 A/dm ²	68 (66-70)	Pt/Ti	■	■	■	■	■	■	■	■	■	■			

Gold Electrolytes

	Metal content in the deposit wt.%	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
												Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Bathroom fittings	Lighting fixtures	Household articles	Accessories	Cutlery			
Alkaline-cyanide Gold Alloy Electrolytes (Decorative)																								
AURUNA® 570 Gold-saving 18 carat gold-silver coatings. Even thick layers are bright. Easy bath maintenance, electrolyte works at room temperature (RT), very stable. For rack and barrel. <u>LC variant</u> with lower gold content for thin layers.	75	Ag	115	Green-yellow	>10	8 (7.5-8.5) <u>LC: 4</u> (3.6-4.4)	>11	1.0 (0.2-1.8) <u>LC: 0.6</u> (0.2-1.0)	0.6 <u>LC: 0.3</u>	35 (30-40)	Stainless steel	■	■	■	■	■	■	■	■	■	■			
AURUNA® 575 Gold-saving, approx. 12 carat gold-silver coatings. Mainly used for gold-saving intermediate layers under final layers of higher caratage. Resistant to corrosion and tarnishing. Excellent ductility, no cracking when bent. For rack and barrel.	50	Ag	220 HV 0.015	Yellowish white	20	6 (5-6)	11.5 (11.2-11.8)	0.6-0.8	0.3-0.45	45 (40-47)	Pt/Ti	■	■	■	■					■	■			

Gold Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications					
													Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Spectacle frames	Writing implements
Electroless Gold Electrolytes																		
AURUNA® 510 Immersion gold electrolyte for electroless deposition by charge exchange, particularly on electrodeposited or electrolessly deposited nickel layers. Specially on printed circuit boards for Chip-on-Board technology (COB) or Surface-Mount technology (SMT). Very good solderability and bondability. Long lifetime, simple bath maintenance. Free from EDTA.	99.9	-	-	Light yellow	0.3	-	2	4.7 on electroless Ni 4.3 on electro-deposited Ni	-	0.008 on electroless Ni	85 on electroless Ni 60 on electro-deposited Ni	-	■	■				
AURUNA® 511 Immersion gold electrolyte for electroless deposition by charge exchange on copper or nickel basis. For thin coatings, decorative and technical applications. Good bonding and soldering properties on electroless nickel (NIRUNA® process).	99.9	-	-	Light yellow	0.2	-	4 (3-4)	4.5-5.1 on electro-deposited Ni 4.5-4.7 on electroless Ni 5.7-6.0 on Cu	-	0.005	90-98	-	■	■	■	■	■	■

Gold Electrolytes

	Metal content in the deposit wt.%	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Classification acc. to ASTM B 488-01	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications				
													Printed circuit boards	Connectors/contacts	Semiconductors Jewellery	Spectacle frames	Writing implements
Electroless Gold Electrolytes																	
AURUNA® 511-AF Immersion gold electrolyte for electroless deposition by charge exchange on copper or nickel basis. For thin coatings, decorative and technical applications. Good bonding and soldering properties, no ammonia smell.	99.9	-	-	Light yellow	0.3	-	2 (1,5-4)	4,5-5,1 on electro-deposited Ni 4,5-4,8 on electroless Ni 5,7-6,0 on Cu	-	0,05 on electroless Ni 0,02 auf Cu	85-98	-	■	■	■	■	■
AURUNA® 512 Electroless gold electrolyte (charge exchange, immersion gold) similar to AURUNA® 510, it contains EDTA, however. For thin coatings on nickel and nickel alloys.	99.9	-	-	Light yellow	0.2 on electro-deposited Ni	-	3 (1-3)	4.5 (4.2-4.8)	-	0.003-0.006	95 (80-100)	-	■	■	■	■	■
AURUNA® 514 Immersion gold electrolyte with long lifetime and simple bath maintenance. Very good soldering and bonding properties. Particularly suitable for gold-plating electroless or electrolytic nickel on printed circuit boards or ceramic substrates for Chip-on-Board technology (COB) or Surface-Mount technology (SMT) and Ball-Grid-Array applications.	99.9	-	-	Light yellow	0.2 on electroless Ni 0.3 on electrolytic Ni	-	2 (1-3)	4.9 on electroless Ni (4.7-5.1) 4.7 on electrolytic Ni (4.5-4.9)	-	0.008	80 on electroless Ni (75-85) 60 on electrolytic Ni (55-65)	-	■	■			

Platinum Electrolytes

	Metal content in the deposit wt. %	Alloy components wt. %	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Platinum Electrolytes and Platinum Alloy Electrolytes																							
PLATUNA® N1 Strongly acidic platinum electrolyte for white and ultra-bright platinum coatings up to approx. 1 μm . For technical and decorative applications, for rack and barrel. Wide operating range.	99.9	-	500	White	1	2 (0.5-4)	<1	1.5 (0.5-5.0)	0.08	30 (25-40)	Pt, Pt/Ti, Pt/Nb, Ir MMO PLATI-NODE® 177			■	■	■	■	■	■	■	■		
PLATUNA® PT Strongly acidic platinum electrolyte for white and ultra-bright platinum coatings up to approx. 0.5 μm . For technical and decorative applications, for rack and barrel. Wide operating range.	99.9	-	350	White	0.5	2 (1-6)	<1	5 (0.5-10)	0.13	60 (55-65)	Pt, Pt/Ti, Ir-MMO PLATI-NODE® 187 SO			■	■	■	■	■	■	■	■		
PLATUNA® B1 Strongly acidic platinum electrolyte for white and ultra-bright platinum coatings up to approx. 5 μm . For technical and decorative applications, for rack and barrel. Wide operating range. Ru can be alloyed for improved ASET performance.	99.9 or 99	- Ru 1	450 455	White	5	3 (2-4) Ru 250 mg /l	<1	1-3	0.13	55 (50-60)	MMO PLATI-NODE® 187 SO	■		■	■	■	■	■	■	■	■		

Platinum Electrolytes

	Metal content in the deposit wt. %	Alloy components wt. %	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Platinum Electrolytes and Platinum Alloy Electrolytes																							
PLATUNA®-Alloy 1 Acidic platinum-ruthenium alloy electrolyte for white, ultra-bright and extremely abrasion-resistant platinum-ruthenium coatings up to approx. 1 µm. For decorative applications, for rack use. Wide operating range.	Pt 75	Ru 25	500	White	1	Pt 1 (0.8-1.2) Ru 1 (0.8-1.2)	<1	2.0 (0.5-5.0)	0.08	35 (30-40)	MMO PLATI-NODE® 187 SO				■	■	■	■	■				
PLATUNA®-Alloy RH Strongly acidic platinum-rhodium alloy electrolyte for white, ultra-bright platinum-rhodium coatings up to approx. 0.5 µm. For decorative applications, for rack and barrel. Wide operating range	Pt 80	Rh 20	600	White	0.5	Pt 1.2 (0.8-1.6) Rh 0.3 (0.2-0.4)	<1	5.0 (0.5-10)	0.12	60 (55-65)	Pt, Pt/Ti, Ir-MMO PLATI-NODE® 187 SO				■	■	■	■	■				
PLATUNA®-Alloy RU Strongly acidic platinum-ruthenium alloy electrolyte for white, ultra-bright platinum-ruthenium coatings up to approx. 0.5 µm. For decorative applications, for rack and barrel. Wide operating range	Pt 80	Ru 20	500	White	0.5	Pt 1 (0.8-1.2) Ru 1 (0.8-1.2)	<1	3.0 (0.5-10)	0.06	60 (55-65)	Pt, Pt/Ti, Ir-MMO PLATI-NODE® 187 SO				■	■	■	■	■				

Rhodium Electrolytes

	Metal content in the deposit wt. %	Alloy components wt. %	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Rhodium Electrolytes and Rhodium Alloy Electrolytes																							
RHODUNA® Diamond Bright Brilliant white, ultra-bright coatings of previously unattained lightness and brilliance up to 5 μm layer thickness, for decorative applications. Excellent throwing power with high covering speed. For rack and barrel.	99.9	-	800-900	Brilliant white	5	2 (1.6-3)	<1	1-2 (0.5-10)	0,08 at 1 A/dm^2 0.10 at 2 A/dm^2	40 (20-65)	Pt/Ti, Ir-MMO PLATI-NODE® 177, 187			■	■	■	■			■	■		
RHODUNA® J1 Brilliant white, very light coatings up to 0.3 μm layer thickness for decorative applications, specially for jewellery, watches, and spectacle frames. For rack and barrel.	99.9	-	800-900	Brilliant white	0.3	2 (1.6-2.4)	<1	1 (0.5-2)	0.025	35 (20-40)	Pt/Ti, Ir MMO PLATI-NODE® 177			■	■	■	■			■	■		
RHODUNA® TD Brilliant white, ultra-bright coatings up to 0.2 μm layer thickness for decorative applications, specially for jewellery, watches, and spectacle frames. For rack and barrel.	99.9	-	800-900	Brilliant white	0.2	2 (1-3)	<1	1-2	0.1	40 (RT-65)	Pt/Ti, Ir MMO PLATI-NODE® 177 / 187			■	■	■	■			■	■		

Rhodium Electrolytes

	Metal content in the deposit wt. %	Alloy components wt. %	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Rhodium Electrolytes and Rhodium Alloy Electrolytes																							
RHODUNA® PT Acidic rhodium-platinum alloy electrolyte for smooth, brilliant and extremely abrasion-resistant rhodium-platinum coatings of a light colour up to a layer thickness of 0.3 μm . For rack and barrel. Wide operating range. RHODUNA® PT INDIVIDUAL By individual electrolyte mixtures, platinum-rhodium alloys deviating from the standard can be deposited as well.	Rh 50	Pt 50	600	White	0,3	Rh 1.5 (0.8-1.8) Pt 0.6 (0.4-0.8)	<1	Rack 3 (2.0-4.0) Barrel 1.5-2.0	0.1 at 3 A/dm^2	45 (40-50)	Ir-MMO PLATINODE® 187 SO	■	■	■	■	■	■	■	■	■			
RHODUNA® PT - 1 g Version RHODUNA® PT with precious metal content 1 g per litre.	Rh 20	Pt 80	600	White	0.3	Rh 0.3 Pt 0.7	<1	3 (2-5)	0.06 at 3 A/dm^2	45 (40-50)	Pt/Ti, Ir-MMO PLATINODE® 187 SO	■	■	■	■	■	■	■	■	■			
RHODUNA® PT ONE RHODUNA® PT with precious metal content 1 g per litre as easy- to-use batch type for rack applications.	Rh 20	Pt 80	600	White	0.3	Rh 0.3 Pt 0.7	<1	3 (2-5)	0.06 at 3 A/dm^2	45 (40-50)	Pt/Ti, Ir-MMO PLATINODE® 187 SO	■	■	■	■	■	■	■	■	■			

Rhodium Electrolytes

	Metal content in the deposit wt. %	Alloy components wt. %	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Rhodium Electrolytes and Rhodium Alloy Electrolytes																							
RHODUNA® T For technical applications, e.g. reed contacts. Crack-free coatings up to approx. 3 μm thickness.	99.9	-	800	Light grey	3	5 (4-6)	<1	1	0.14	40 (35-45)	Pt/Ti, Ir MMO PLATI-NODE® 177	■											
RHODUNA®-Alloy 1 Acidic rhodium-ruthenium alloy electrolyte for white, ultra-bright and extremely abrasion-resistant rhodium-ruthenium coatings up to approx. 1 μm . For decorative applications, for rack and barrel. Wide operating range.	Rh 75	Ru 25	600-900	White	1	Rh 1.6 (0.8-1.8) Ru 0.4 (0.2-0.5)	Acidic	4.0 (3.0-5.0)	0.2	45 (40-50)	MMO PLATI-NODE® 187 SO			■	■	■	■				■		
RHODUNA®-Alloy 1 RtR Acidic rhodium-ruthenium alloy electrolyte for white, ultra-bright and extremely abrasion-resistant rhodium-ruthenium coatings up to approx. 4 μm . Special version for reel-to-reel applications.	Rh 95	Ru 5	900	White	4	Rh 10 8-12) Ru 0.2 (0.1-0.75)	Acidic	2-50	0.84-1.29	45 (40-50)	MMO PLATI-NODE® 187 SO	■	■	■									

Rhodium Electrolytes

	Metal content in the deposit wt. %	Alloy components wt. %	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Rhodium Electrolytes and Rhodium Alloy Electrolytes																							
RHODUNA® 471 Black Acidic electrolyte for decorative, anthracite to black layers up to 0.7 μm . Good colour constancy, brightness-retaining, easy electrolyte maintenance. Can also be used for technical applications in reel-to-reel applications.	>95	-	-	Anthracite to black	0.7 0.5	2 (1.8-2,2)	Acidic	0.5 (0.25-2) 3 (2-5)	0.01-0.04 0.08-0.13	60 (55-65)	Pt/Ti (2.5 μm Pt)	■	■	■	■	■	■	■	■				
RHODUNA®-Alloy Black 1 Acidic rhodium-ruthenium alloy electrolyte for decorative, grey to black (anthracite) layers up to 0.5 μm . Good colour constancy, brightness-retaining, extremely abrasion-resistant, easy electrolyte maintenance.	Rh 50	Ru 50	-	Grey to black	0.5	Rh 1.0 Ru 1.0	Acidic	2 (0.5-5)	0.04	45 (40-50)	MMO PLATINODE® 187 SO			■	■	■	■		■				

Ruthenium Electrolytes

	Metal content in the deposit wt.%	Alloy components	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
											Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery			
Ruthenium Electrolytes and Ruthenium Alloy Electrolytes																							
RUTHUNA® 474 Black Acidic electrolyte for decorative black coatings up to 0.5 μm layer thickness. Good colour constancy, simple bath maintenance, easy-to-use batch type.	>95	-	Anthracite (black)	0.5	5	1.4 (1.0-1.5)	1.0 (0.5-2.0)	0.08	70 (65-75)	Pt/Ti (2.5 μm Pt), Ir MMO PLATINODE® 177				■	■	■	■		■				
RUTHUNA® 475 Black Acidic electrolyte for decorative black coatings up to 0.3 μm layer thickness. Good colour constancy, simple bath maintenance, easy-to-use batch type.	>95	-	Anthracite (black)	0.3	2	1.0 at 25°C 1.1 at 65°C	1.5 (0.5-3.0)	0.05	65 (60-70)	Pt/Ti (2.5 μm Pt), Ir MMO PLATINODE® 177				■	■	■	■		■				
RUTHUNA® 479 Black Acidic electrolyte for decorative, very dark to black coatings up to 0.3 μm layer thickness, degree of blackening adjustable. Good colour constancy, simple bath maintenance, long lifetime.	>95	-	Grey to anthracite (black)	0.3	5 (2-10)	1.2 (0.8-1.3)	1.0 (0.5-3.0)	0.12	65 (60-70)	Pt/Ti (2.5 μm Pt), Ir MMO PLATINODE® 177				■	■	■	■		■				
RUTHUNA® 490 Black Neutral electrolyte for decorative dark-grey to anthracite coatings up to 0.3 μm layer thickness. Good colour constancy, simple bath maintenance.	>95	-	Grey to anthracite (black)	0.3	2 (1.8-2.2)	7.0 (6.5-9.0)	1.0 (0.5-3.0)	0.02	65 (60-70)	Pt/Ti (2.5 μm Pt), MMO PLATINODE® 167, 177				■	■	■	■		■				

Ruthenium Electrolytes

	Metal content in the deposit wt.%	Alloy components	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
											Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery			
Ruthenium Electrolytes and Ruthenium Alloy Electrolytes																							
RUTHUNA® 491 Neutral electrolyte for decorative, grey ruthenium coatings as final or intermediate layers. High colour constancy, brightness-retaining, easy electrolyte maintenance. Suitable as replacement for palladium.	Pure Ru	-	Grey	0.5	2-10 (1.5-11) depending on application	7.0 (6.5-7.5)	2-10 (1.5-11) depending on application	0.03-0.05 depending on application	45 (40-50)	Pt/Ti (2.5 μm Pt), MMO PLATINODE® 167, 177			■	■	■	■			■				
RUTHUNA® 492 Neutral electrolyte for decorative, grey ruthenium-nickel coatings. High colour constancy, brightness-retaining, easy electrolyte maintenance. Suitable as replacement for palladium or palladium-nickel.	94	Ni 6	Grey	0.7	Ru 5 (4-6) Ni 1.5 (1-2)	7.3 (6.5-7.5)	2.0 (0.5-4.0)	0.04	45 (40-50)	Pt/Ti (2.5 μm Pt), MMO PLATINODE® 167, 177			■	■	■	■			■				
RUTHUNA® 493 Neutral electrolyte for decorative, grey ruthenium-cobalt coatings. High colour constancy, brightness-retaining, easy electrolyte maintenance. Suitable as replacement for palladium, palladium-cobalt or palladium-nickel.	80	Co 20	Grey	0.7	Ru 5 (4.5-5.5) Co 1 (0.8-1.2)	6.0 (5.5-6.5)	3 (1-5)	0.08	50 (45-55)	Pt/Ti (2.5 μm Pt), MMO PLATINODE® 167, 177			■	■	■	■			■				

Palladium Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications										
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery
Palladium Electrolytes and Palladium Alloy Electrolytes																						
PALLUNA® 451* For selective deposition in continuous lines, e.g. reel-to-reel, tabplater, and spot-plating equipment. Additionally also for rack plating. The semi-bright to bright coatings are crack-free, they have few pores and a good abrasion resistance. High plating speed, very good soldering and bonding properties, simple bath maintenance.	99.9	-	360	White	3	6-35	8.0 (7.6-8.6)	1-80*	0.6-18.0*	40 (35-50)	Pt/Ti	■	■	■								
PALLUNA® 452 Weakly ammoniacal electrolyte for depositing pure palladium coatings with excellent bondability and solderability. High plating speed and simple bath maintenance, for continuous lines and racks. For lead-frames.	99.9	-	-	White	0.3	3 (2.5-7)	8.0 (7.5-8.4)	1-2	0.25 at 1 A/dm ² 0.50 at 2 A/dm ²	55 (50-60)	Ru MMO PLATI-NODE® 167	■	■									
PALLUNA® 457 Weakly alkaline electrolyte for ultra-bright, white pure palladium coatings, crack-free bendable up to 3 μm . Suitable for decorative and technical applications, for rack and barrel.	99.9	-	300-350 HV 0.015	White	5	10 (8-12)	7.7 (7.2-8.2)	Rack 1 (0.5-3) Barrel 0.5 (0.2-0.8)	0.24 at 1 A/dm ² 0.12 at 0.5 A/dm ²	42 (40-45)	Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Palladium Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Palladium Electrolytes and Palladium Alloy Electrolytes																								
PALLUNA® 458 Neutral palladium electrolyte for white, bright and low-pore pure palladium coatings. The ductile, low-stress layers besides high hardness and good wear resistance exhibit good corrosion and tarnish resistance.	99.9	-	300-350	White	3	10 (9-11)	7.0 (6.8-7.2)	1.0 (0.5-1.5)	0.13-0.38	50 (45-55)	Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■		
PALLUNA® 459 Weakly alkaline palladium electrolyte. Deposits ultra-bright, decorative, light palladium coatings up to 0.5 μm . As palladium strike layer and diffusion barrier, as final layer up to 0.5 μm in the jewellery and spectacle frames industries.	99.9	-	230-250	White	0.5	1.5-2.0	7.0-7.2 or 8.5-9.0	0.5	Up to 0.07	25-30	Ru MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■	■	■	■		
PALLUNA® 462 Ammoniacal palladium-nickel electrolyte. Coatings bright and crack-free up to 10 μm . Ductile, with few pores, resisting corrosion and tarnishing, high hardness. For decorative and technical applications, for rack and barrel.	65-80	Ni	620 HV 0.01	White	10	7 (6-8) or 10 (9-11) or 15 (13-17)	8.2 (8.0-8.4) or 8.5 (8.4-8.7)	1.0 (1.0-2.0)	0.22-0.25	25-35	Ru MMO PLATI-NODE® 167, graphite	■	■	■	■	■	■	■	■	■	■	■		

Palladium Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Palladium Electrolytes and Palladium Alloy Electrolytes																								
PALLUNA® 463 Weakly alkaline palladium-nickel electrolyte. Bright, low-pore and low-stress, ductile coatings with high hardness, resisting corrosion and tarnishing. Stable electrolyte with simple bath maintenance for decorative and technical applications, for rack and barrel.	80	Ni	550	White	10	10 (9-11)	8.2 (7.7-8.7)	1.5 (0.5-2.5)	0.33	25 (20-35)	Ru MMO PLATI-NODE® 167, graphite	■	■	■	■	■	■	■	■	■	■			
PALLUNA® 468* High-speed electrolyte for use in continuous lines (jet plating, brush plating, selective dipping, tab plating). Improved plating speed, high current efficiency, constant alloy composition, long lifetime.	80	Ni	580-620	White	10	20 (28-22)	7.5 (7.4-8.0)	Up to 60*	Up to 16*	45 (43-47)	Pt/Ti	■	■	■										
PALLUNA® 4700* Chloride-free ammoniacal high-speed electrolyte for use in continuous lines and rack operations. High plating speed, reduced equipment corrosion, longer lifetime of anodes, constant alloy composition.	80	Ni	550	White		20	7.7	Up to 50*	Up to 12*	40	Pt/Ti	■	■	■										

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Palladium Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Palladium Electrolytes and Palladium Alloy Electrolytes																								
PALLUNA® ACF-100* High-speed electrolyte free of ammonia and chloride for depositing a bright palladium-nickel alloy in reel-to-reel equipment (selective dipping, jet and brush plating, tabplaters).	80	Ni	550	White	2-4	15 (14-16)	5.5 at 60 °C (5.2-5.8)	Up to 70*	Up to 15*	60 (58-62)	MMO PLATI-NODE® 187 SO	■	■	■										
PALLUNA® ACF-200 Palladium-nickel electrolyte free of ammonia and chloride for printed circuit board applications. Ductile, crack-free coatings of high hardness with good corrosion resistance.	80	Ni	530	White	2-4	6 (5-7)	5.2 at 60 °C (5.0-5.5)	Up to 4	Up to 0.9	60 (58-62)	MMO PLATI-NODE® 187 SO	■												
PALLUNA® ACF-800* Palladium electrolyte free of ammonia and chloride for racks and continuous lines. Ductile, ultra-bright and crack-free coatings with very good bonding and soldering properties.	99.9	-	280 HV 0.002	White	1	12 (5-30)	6.5 (6.0-7.0)	Up to 25*	Up to 5.5*	60 (55-65)	MMO PLATI-NODE® 187 SO	■	■	■										

*) For use in special high speed equipment; applicable current density and plating speed depend on the equipment.

Silver Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery		
Silver Electrolytes																								
ARGUNA® ET Semi-bright coatings for (electro)technical and decorative applications, suitable for rack and barrel operation. The deposits have optimum electric conductivity values and a low contact resistance. Good soldering and bonding properties.	99.9	-	110-130	White	>100	30 (25-35)	12.5	0.5-1.5	0.65	18-25	Ag	■	■	■										
ARGUNA® ET-S* High-speed electrolyte for selective deposition of fine silver in continuous lines using flow or spray techniques. Semi-bright coatings with very good soldering and bonding properties. Soluble anodes permitted.	99.9	-	110	White	20	100 (80-120)	12.5	10-150*	12-90*	35 (30-75)	Ag, Pt/Ti	■	■											
ARGUNA® CF* High-speed electrolyte without free cyanide for selective deposition of fine silver in continuous lines using flow or spray techniques. Semi-bright coatings with very good soldering and bonding properties. No immersion silver plating. Electrolyte works with insoluble anodes. For pretreatment ARGUNA® Flash Silver CF to prevent immersion silver plating in the main electrolyte.	99.9	-	100-130 HV 0.015	White	20	120 (60-120)	8.3 (8.0-8.6)	30-100*	18-60*	75 (65-75)	Pt/Ti	■	■											

*) For use in special high-speed equipment; applicable current density and plating speed depend on the equipment.

Silver Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications										
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery
Silver Electrolytes																						
ARGUNA® 621 Bright silver electrolyte for rack and barrel with wide applicable current density range and very good throwing power which can also be used at relatively high temperatures. Brilliant white colour without a blue cast. No silver strike required on nickel.	99.9	-	80-110	Brilliant white	>100	40 (35-45) or 25 (25-30)	Alk.	0.5-5 or 0.5-4	0.64-2.56	Room temp. (20-45)	Ag				■	■	■	■	■	■	■	■
ARGUNA® 629 Bright silver electrolyte for rack and barrel with wide applicable current density range and very good throwing power which can also be used at relatively high temperatures. Light white colour without a blue cast. No silver strike required on nickel. High tolerance to carbonate. Can also be used in reel-to-reel equipment.	≥99.8	-	80-110	Light white	>100	30 (20-40)	12.0 (11.5-12.5)	0.5-4	0.64-2.56	25 (18-40)	Ag				■	■	■	■	■	■	■	■
ARGUNA® 630 Bright silver electrolyte for (electro)technical and decorative applications. Depending on the operating parameters suitable for continuous lines, rack and barrel operation. Coatings with very good electrical properties and high hardness. Reflection density (GAM value) about 0.6 - 2.5.	98	-	120-140	White	5-10	30 (25-25)	12.5	0.5-50	0.66-13	25-40	Ag	■	■	■	■	■	■	■	■	■	■	■

Silver Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications										
												Printed circuit boards	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Accessories	Cutlery	
Silver Electrolytes																						
ARGUNA® 4500* High-speed electrolyte with little free cyanide for selective deposition of fine silver in continuous lines using flow or spray techniques. Bright coatings with very good soldering and bonding properties. The electrolyte works with insoluble anodes.	99.9	-	100-130 HV 0.015	White	5-10	90 (60-120)	9.0 (8.5-11)	50-250*	30-156*	60 (50-70)	Pt/Ti, MMO PLATI-NODE® 167	■	■									

*) For use in special high-speed equipment; applicable current density and plating speed depend on the equipment.

Brush Plating Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Voltage	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery		
Brush Plating Electrolytes																							
AURUNA® 250 Electrolyte ready for use for selective decorative pencil gold-plating (brush gold-plating). The metal is deposited by means of a wiping touch with a soaked brush. Works at room temperature, application preferably for the direct gold-plating of stainless steel.	99.5	Co	170	Yellow approx.3 N	0.1	20	0.6	10 V (8-15 V)	0.07	20-30	Plating pen	■		■	■	■	■	■	■	■			
AURUNA® 261 Electrolyte ready for use for selective decorative pencil gold-plating (brush gold-plating). The metal is deposited by means of a wiping touch with a soaked brush. Works at room temperature.	99	Different	-	Pale light yellow approx.1 N	0.1	20	7.0	10 V (8-15 V)	0.1	20-30	Plating pen			■	■	■	■	■	■	■			
AURUNA® 262 Electrolyte ready for use for selective decorative pencil gold-plating (brush gold-plating). The metal is deposited by means of a wiping touch with a soaked brush. Works at room temperature.	99	Different	-	Neutral yellow approx.2-3 N	0.1	20	3.0	10 V (8-15 V)	0.1	20-30	Plating pen			■	■	■	■	■	■	■			

Brush Plating Electrolytes

	Metal content in the deposit wt.%	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Voltage	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery		
Brush Plating Electrolytes																							
AURUNA® 263 Electrolyte ready for use for selective decorative pencil gold-plating (brush gold-plating). The metal is deposited by means of a wiping touch with a soaked brush. Works at room temperature.	99.5	Different	-	Rich deep yellow, fine gold colour	0.1	20	7.0	10 V (8-15 V)	0.1	20-30	Plating pen				■	■	■	■	■	■	■		
AURUNA® 264 Electrolyte ready for use for selective decorative pencil gold-plating (brush gold-plating). The metal is deposited by means of a wiping touch with a soaked brush. Works at room temperature.	90	Cu	-	Rose approx.4-5 N	0.1	20	9.0	6 V (2-8 V)	0.1	20-30	Plating pen				■	■	■	■	■	■	■		
RHODUNA® 271 Electrolyte ready for use for selective decorative pencil rhodium-plating (brush rhodium-plating). Abrasion-resistant, light and bright coatings. High plating speed, fast covering.	99.9	-	800	White	Up to 1	20	<1	8-10 V (max. 12 V)	Up to 0.2	20-40	Plating pen				■	■	■	■	■	■	■		
RHODUNA® 275 Black Electrolyte ready for use for selective decorative pencil rhodium-plating (brush rhodium-plating). Abrasion-resistant, dark, bright coatings. High covering power and plating speed.	Approx. 95	-	-	Anthracite-black	0.2	20	<1	8-10 V (max. 12 V)	Up to 0.1	20-40	Plating pen				■	■	■	■	■	■	■		

Brush Plating Electrolytes

	Metal content in the deposit wt. %	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Voltage	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications												
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow Jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery			
Brush Plating Electrolytes																								
RUTHUNA® 279 Black Electrolyte ready for use for selective decorative pencil ruthenium-plating (brush ruthenium-plating). Abrasion-resistant, dark, bright coatings. High covering power.	>95	-	-	Anthracite-black	Up to 0.08	20	<1	10 V (8-12 V)	Up to 0.01	20-40	Plating pen									■	■	■	■	■

Electroforming Electrolytes

	Metal content in the deposit wt.% approx. values	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications											
												Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery		
Electroforming Electrolytes																							
ARGUNA® 621 EF Bright silver electrolyte for manufacturing electroformed hollow jewellery. Heavy plating on precious and/or base metals for the jewellery industry.	Ag >99.9	-	80	Bright white	Several 100	40 Ag (35-45)	na	1-2	0.6 at 1 A/dm^2 1.0 at 1.6 A/dm^2 1.2 at 2 A/dm^2	40-45	Fine silver												
AURUNA® 5500 EF Fine gold electrolyte for manufacturing hard, semi-bright, electroformed hollow jewellery. Heavy plating on precious and/or base metals for the jewellery industry, protective gold-plating of 24 carat solid gold jewellery.	Au >99.9	-	180	Yellow	Several 100	Au 16 (12-20)	5.5 (5.0-6.0)	0.5	0.3	40 (35-45)	Ru MMO PLATI-NODE® 187 SO												
AURUNA® 556 EF-24 Fine gold electrolyte for manufacturing hard, semi-bright, electroformed hollow jewellery. Heavy plating on precious and/or base metals for the jewellery industry, protective gold-plating of 24 carat solid gold jewellery.	Au 99.9	-	200 HV 0.015	Yellow	Several 100	Au 12 (12-20)	6 (5.8-6.2)	0.5	0.23	45	Pt/Ti												

Electroforming Electrolytes

Metal content in the deposit wt.% approx. values	Alloy components	Hardness of deposit HV 0.025 (Vickers) approx. values	Colour of deposit	Max. coating thickness µm	Metal content g/l	pH-value	Current density A/dm ²	Plating speed µm/min approx. values	Temperature °C	Anode material	Applications										
											Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Hollow jewellery	Watches	Spectacle frames	Writing implements	Household articles	Cutlery	
Electroforming Electrolytes																					
AURUNA® 567 EF-14 Electrolyte for manufacturing electroformed hollow jewellery. Observance of fineness and weight distribution within narrow limits. Using an AURUNA®-Form plant is recommended. 14 carat hall-marking.	Au 60.4	Ag	220	Pale yellow	Several 100	15 Au approx. 5 Ag	10.0-10.2	Initial stage 0.6 1.2-2.0	1.0	45	Pt/Ti					■					
AURUNA® 568 EF-18 Electrolyte for manufacturing electroformed hollow jewellery. Observance of fineness and weight distribution within narrow limits. Using an AURUNA®-Form plant is recommended. 18 carat hall-marking.	Au 77	Ag	220	Pale yellow	Several 100	15 Au approx. 3 Ag	10.0-10.2	Initial stage 0.6 1.2-2.0	1.0	45	Pt/Ti					■					

Copper Electrolytes

	Hardness of deposit HV (Vickers) approx. values	Max. coating thickness μm	Specified content per 1 litre	Consumption per 10,000 Ah	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Decorative Applications	Technical Applications
Copper Electrolytes											
Umicore Copper 830 Deposition of silk-matt to bright, fine-grained and ductile copper layers in rack and barrel operation. Can be used for zinc die castings.	220 HV 0.1	50	Cu 60 g KCN 35-40 g KOH 2-5 g	BR 1 750 ml BR 2 1500 ml	10.5 (10-11)	Rack 2.0 (1.0-3.0) Barrel 1.0 (0.5-1.2)	0.8 (2 A/dm ²) 0.4 (1 A/dm ²)	58 (55-60)	Cu	■	■
Umicore Copper 836 Deposition of ultra-bright, levelling and ductile coatings, for rack and barrel operation. Simple bath maintenance, low consumption. Additives free from colourants and flammable solvents.	250 HV 0.1	200	Cu R 60 g B 30 g M 45 g H ₂ SO ₄ R 32 ml B 100 ml M 60 ml Cl 60 mg	BR 1 0.5-2.0 l Lev 1 1.0-2.3 l	<1	Rack 5 (3-8) Barrel 1 (0.5-2)	1.05 (5 A/dm ²) 0.21 (1 A/dm ²)	22 (max. 40)	Cu-P (0.04-0.06 % P)	■	■
Umicore Copper 838 Deposition of fine-grained and ductile copper layers, for barrel operation. The electrolyte is working in an alkaline medium and doesn't contain further heavy metals.	200 HV 0.1		Cu 10 (8-12)	BR 1 1.5-2.0 l Stb 1 as required	8 (7.8 – 8.2)	0.5 (0.25-0.75)	0.1 (0.5 A/dm ²)	25 (20-40)	Cu-P (0.04-0.06 % P)	■	■

B = barrel, BR = Brightener, Lev = Leveller, Stb = Stabilizer, M = mixed operation, R = rack

Nickel Electrolytes

	Hardness of deposit HV (Vickers) approx. values	Max. coating thickness μm	Specified content per 1 litre	Consumption per 10,000 Ah	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Technical Applications	Decorative Applications
Nickel Electrolytes											
NiRUNA® 6450 High-speed electrolyte on sulphamate basis for depositing brightness-retaining, ductile coatings with low internal stress and a very active layer surface. Particularly suitable for ductile intermediate layers on connectors.	300-400 HV 05	-	Ni 120 g H_3BO_3 40 g Cl 8 g	WA NF 0.3-0.5 l GR 1.0-1.5 l	3.8 (3.6-4.2)	15 (5-40)	3 at 15 A/dm^2	57 (50-60)	Pure nickel	■	
NiRUNA® 808 Ductile, brightness-retaining layers on sulphamate basis with low internal stress. Low sensitivity of the electrolyte to metallic and organic contaminants. Either product or air agitation possible. For rack and barrel operation.	350 HV 0.1	Up to 100	Ni 80 g H_3BO_3 45 g Cl 8 g	WA 0.5 l CR 0.5 l WA 1.5 l NF GR	3.8 (3.5-4.1)	Rack 5.0 (2-8) Barrel 1.5 (1-2)	1.0 at 5 A/dm^2	57 (55-59)	S-Nickel	■	■
NiRUNA® 808 S Electrolyte additives for producing ultra-bright, ductile nickel coatings with excellent levelling. Wide bright plating range. For sulphate and sulphamate electrolytes.	500	-	Ni 60-90 g H_3BO_3 40-55 g Cl 10-18 g	WA 26 0.3 l WA 27 0.3 l BR 1 0.75-1.0 l BR 2 1.5-2.2 l	3.8-4.5	1-5	0.5 at 2.5 A/dm^2 (45 $^{\circ}\text{C}$) 1.0 at 5 A/dm^2 (60 $^{\circ}\text{C}$)	40-60	Pure nickel or Nickel S	■	■
NIMUDEN 852 Weakly acidic, chemically reductive electrolyte for the deposition of a nickel-phosphorus alloy with 8-10.5 phosphorus.	600 HV 0.05	up to 100	Ni 5.0 g		4.6 (4.4-4.8)		up to 22 $\mu\text{m}/\text{h}$	90 (88-92)	na	■	

BA = Basic Additive, BR = Brightener, GR = Grain Refiner, WA = Wetting Agent

Nickel Electrolytes

	Hardness of deposit HV (Vickers) approx. values	Max. coating thickness μm	Specified content per 1 litre	Consumption per 10,000 Ah	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Decorative Applications	Technical Applications
NIPHOS® 960 For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content 3 %. High layer hardness, excellent tribological properties, low operating temperature. Free from chloride, ammonium and heavy metals, pH-stable, free from boric acid, for rack and barrel.	700-750 HV 0.05	-	Ni 60 g P 2.5 g	C 1 0.6-1.0 l BR 1 0.1-0.2 l ST 1 0.1-0.2 l	2.9 (2.7-3.0)	Rack 3 (2-4) Barrel 1.5 (1-2)	Rack 0.4 at 3 A/dm^2 Barrel 0.15 at 1.5 A/dm^2	40 (35-45)	Ni S, MMO PLATI-NODE® 177	■	
NIPHOS® 964 For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content 6 – 13 %, with very low internal stress and reduced susceptibility to cracking, excellent corrosion protection. Free from chloride, ammonium, boric acid and heavy metals, pH-stable, for rack and barrel.	550-600 HV 0.05	-	Ni 40 g P 20 g	C 1 0.6-1.0 l BR 1 0.1-0.2 l ASV 0.1-0.2 l	2.3 (2.1-2.4)	R 4 (3-5) B 1.5 (1-2)	R 0.33 at 4 A/dm^2 B 0.06 at 1.5 A/dm^2	50 (40-50)	Ni S, MMO PLATI-NODE® 177	■	

ASV = Additive SV, B = Barrel, BR = Brightener, C = Concentrate, GR = Grain Refiner, R = Rack, RS = Replenisher Solution, ST = Stabilizer Solution, WA = Wetting Agent

Nickel Electrolytes

	Hardness of deposit HV (Vickers) approx. values	Max. coating thickness μm	Specified content per 1 litre	Consumption per 10,000 Ah	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Technical Applications	Decorative Applications
NIPHOS® 964 HS For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content 6 – 13 %, with very low internal stress and reduced susceptibility to cracking, excellent corrosion protection. Free from chloride, ammonium, boric acid and heavy metals, pH-stable, for high-performance equipment. <u>Optimized electrolyte makeup</u> for layers with a phosphorus content of at least 10.5 % possible.	550 HV 0.05	-	Ni 60 g P 20 g (20-40)	C 1 0.5-1.5 l BR1 0.1-0.25 l ASV 0.1-0.25 l	2.3 (2.0-2.4)	25 (5-45)	0.39-2.0 (depending on operating conditions and requirements)	60 (55-65)	Ni S, MMO PLATI-NODE® 177	■	
NIPHOS® 965 For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content 6 – 13 %. Use as intermediate layer prior to subsequent hard gold plating of contact surfaces. Chloride-free, pH-stable, for continuous lines.	550-600 HV 0.05	-	Ni 100 g P 30 g	RS 1 1.0-2.0 l BR 1 0.1-0.2 l	2.6 (2.5-2.7)	20 (5-25)	0.8-3.7 at 10-25 A/dm^2	60 (55-75)	Ni S, MMO PLATI-NODE® 177	■	
NIPHOS® 966 For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content > 11 %. Use as intermediate layer prior to subsequent hard gold plating of contact surfaces. Chloride-free, pH-stable, for rack and barrel.	550-600 HV 0.05	-	Ni 80 g P 25 g	RS 1 2-2.5 l BR 1 0.1-0.2 l	2,6 (2,5-2,7)	Rack 4 (3-5) Barrel 1.5 (1-2)	Rack 0.4 at 4 A/dm^2 Barrel 0.15 at 1.5 A/dm^2	60 (55-75)	Ni S, MMO PLATI-NODE® 177	■	

ASV = Additive SV, B = Barrel, BR = Brightener, C = Concentrate, GR = Grain Refiner, R = Rack, RS = Replenisher Solution, ST = Stabilizer Solution, WA = Wetting Agent

Nickel Electrolytes

	Hardness of deposit HV (Vickers) approx. values	Max. coating thickness μm	Specified content per 1 litre	Consumption per 10,000 Ah	pH-value	Current density A/dm^2	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Decorative Applications	Technical Applications	
NIPHOS® 967 For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content > 11 %. Alternative to conventional Electroless Nickel, use as intermediate layer prior to subsequent hard gold plating of contact surfaces. Free from Chloride, Ammonium and heavy metals. PH-stable, for rack and barrel.	550-600 HV 0.05	-	Ni 20 g P 10 g	C 1 BR 1	0.8-1.1 0.1-0.2	2.6 (2.2-2.7)	Rack 4 (2-5) Barrel 1.5 (1-2)	Rack 0.4 at 4 A/dm^2 Barrel 0.15 at 1.5 A/dm^2	60 (50-75)	Ni S, MMO PLATI-NODE® 177	■	
NIPHOS® 968 For the electrolytic deposition of nickel-phosphorus alloy layers, phosphorus content > 11 %. By using a combination of NIPHOS® and hard chromium, the thickness of the chromium layer and therefore the amount of Cr 6+ can be reduced. Chloride-free, pH-stable, for rack operation.	550-600 HV 0.05	-	Ni 40 g P 20 g	C 1 BR 1	0.8-1.1 0.1-0.2	2.6 (2.2-2.7)	4 (2-5)	0.4 at 4 A/dm^2	60 (50-75)	Ni S, MMO PLATI-NODE® 177	■	■

ASV = Additive SV, B = Barrel, BR = Brightener, C = Concentrate, GR = Grain Refiner, R = Rack, RS = Replenisher Solution, ST = Stabilizer Solution, WA = Wetting Agent

Copper / Tin / (Zinc)-Electrolytes

	Hardness of deposit HV 0.05 (Vickers) approx. values	Max. coating thickness μm depending on substrate	Specified content per 1 litre		Consumption per 1 g of alloy deposited	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications							
			Cu	Zn							Electronics	Buttons/Zip fasteners	Jewellery/Watches/Spec-tacle frames/Accessories/	Mechanical engineering	Motor vehicle industry	Chemical and food-processing industries	Textile and printing industries	Other
MIRALLOY® Electrolytes for Decorative and Technical Applications																		
MIRALLOY® 1842 Non-cyanide barrel electrolyte, coating colour black. Good covering power, very good metal distribution. The layers are ideal for rubbing. Lacquering recommended.	300	3	Cu Sn Zn	0.3 g 30 g 0.6 g	CuSo 5 8 ml SnS 4 1.4 g ZnS 2 1 ml BA 1 1.75 ml RS 1 0.6 ml	11.8 (11.6-12.2)	0.3 (0.2-0.5)	0.048 at 0.3 A/dm ²	30 (28-35)	MMO PLATI-NODE® 167 type F	■						■	
MIRALLOY® 1843 Non-cyanide electrolyte, preferably for rack operation, coating colour anthracite to black. Can be used as final finish, direct plating of brass or copper possible. Good covering power, very good metal distribution.	-	2	Cu Sn	0.6 g 19 g	CuSo 5 10 ml SnS 4 1.3 g BA 1 2 ml	10.8 (10.6-11.0)	0.3 (0.2-0.5)	0.02 at 0.3 A/dm ²	60 (55-65)	MMO PLATI-NODE® 167 type F	■						■	
MIRALLOY® 2841 Rack and barrel electrolyte, coating colour white, similar to silver. Very good metal distribution, high layer hardness, high reflectivity, good wear and corrosion protection (substrate: nonferrous metals). Simple bath maintenance.	600 HV 0.025	5	Cu Sn Zn KCN	9.0 g 16.0 g 2.0 g 45.0 g	CuSo 1 5.2 ml SnS 2 0.9 g ZnS 1 0.1 g BR 1 0.8 ml BR 2 0.6 ml	12	R 0.5 (0.25-0.75) B 0.25 (0.1-0.4)	0.14 at 0.5 A/dm ² 0.07 at 0.25 A/dm ²	60 (58-62)	Ru MMO PLATI-NODE® 167, graphite	■	■	■	■		■	■	

B = barrel, BA = Blackening Agent, BR = Brightener, CuSo = Copper Solution, R = rack, RS = Replenisher Solution, SnS = Tin Salt, ZnS = Zinc Salt

Copper / Tin / (Zinc)-Electrolytes

	Hardness of deposit HV 0.05 (Vickers) approx. values	Max. coating thickness μm depending on substrate	Specified content per 1 litre		Consumption per 1 g of alloy deposited	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
			Cu	Zn							Electronics	Buttons/Zip fasteners	Jewellery/Watches/Spec-tacle frames/Accessories/	Mechanical engineering	Motor vehicle industry	Chemical and food-processing industries	Textile and printing industries	Other					
MIRALLOY® Electrolytes for Decorative and Technical Applications																							
MIRALLOY® 2841 HS-C Electrolyte for use in high-performance equipment for connectors, coating colour white, whiter than palladium. Extended operating range, high layer hardness, very good metal and alloy distribution, good wear and corrosion protection, low contact resistance even after salt fog test.	600 HV 0.025	1.5	Cu Sn Zn KCN KOH	11.0 g 34.0 g 2.5 g 40.0 g 4.0 g	CuSo 1 SnS 2 ZnS 1 BR 5	5.5 ml 0.9 g 0.12 g 2.7- 5.4 ml	Alka- line	4 (3.0-5.0)	Up to 0.9 at 4.0 A/dm ²	60 (58-62)	Ru MMO PLATI- NODE® 167	■											
MIRALLOY® 2841 NEO Barrel electrolyte, coating colour brilliant white, similar to rhodium. Good covering power, very good metal distribution, insensitive to handling, tarnish-resistant. Easy electrolyte maintenance.	600 HV	5	Cu Sn Zn KCN KOH	9.0 g 15.0 g 1.0 g 50.0 g 10.0 g	CuSo 1 SnS 2 ZnS 1 BR 1 BR 2	0.7 ml 0.9 g 0.09 g 0.6 ml 0.77- 0.92 ml	>13	0.3 (0.1-0.5)	0.08 at 0.3 A/dm ²	60 (58-62)	Ru MMO PLATI- NODE® 167	■	■	■	■				■	■			
MIRALLOY® 2841 LC Rack and barrel electrolyte, coating colour brilliant white, similar to rhodium. Good covering power, very good metal distribution, insensitive to handling, tarnish-resistant. Easy electrolyte maintenance.	600 HV 0.025	5	Cu Sn Zn KCN	3,0 g 8,0 g 0,8 g 30,0 g	CuSo 1 SnS 2 ZnS 1 BR 1 BR 2	5.25 ml 0.9 g 0.1 g 0.8 ml 0.67 ml	12.4	R 0.5 B 0.25	0.12 at 0.5 A/dm ² 0.07 at 0.25 A/dm ²	60	Ru-MMO PLATI- NODE® 167, Graphit	■	■	■	■				■	■			

B = barrel, BR = Brightener, CuSo = Copper Solution, R = rack, SnS = Tin Salt, ZnS = Zinc Salt

Copper / Tin / (Zinc)-Electrolytes

	Hardness of deposit HV 0.05 (Vickers) approx. values	Max. coating thickness μm depending on substrate	Specified content per 1 litre		Consumption per 1 g of alloy deposited	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
			Cu	Sn							Electronics	Buttons/Zip fasteners	Jewellery/Watches/Spec-tacle frames/Accessories/	Mechanical engineering	Motor vehicle industry	Chemical and food-processing industries	Textile and printing industries	Other					
MIRALLOY® Electrolytes for Decorative and Technical Applications																							
MIRALLOY® 2841 S Barrel electrolyte, coating colour brilliant white, similar to rhodium. Good covering power, very good metal distribution, insensitive to handling, tarnish-resistant. Easy electrolyte maintenance.	600 HV 0.025	5	Cu Sn Zn	52% 37% 11%	KS 1 ZS 2 ZnS 1 GZ 1 GZ 2	0.73 g 0.85 g 0.1 g 0.45 ml 0.9 ml	13	0.25	0.06	60	Ru-MMO PLATI-NODE® 167, Graphit	■	■	■	■	■	■	■					
MIRALLOY® 2843 Rack electrolyte, coating colour white, similar to silver. Brightening and slightly levelling, good covering power, good metal distribution, good solderability, high hardness value, insensitive to handling, tarnish-resistant, best wear and corrosion protection (substrate: nonferrous metals).	600	10	Cu Sn Zn KCN KOH	8.5 g 34.0 g 1.0 g 50.0 g 20.0 g	CuSo 1 SnS 2 ZnS BR 1-2 BR 2-1	5.6 ml 0.7 g 0.2 g 1.1 ml 0.9 ml	13	2.0 (1.5-2.5)	0.3 at 2.0 A/dm ²	60 (58-62)	MMO PLATI-NODE® 177		■	■	■	■	■	■					
MIRALLOY® 2844 Barrel and rack electrolyte, coating colour white, similar to silver. Good covering power, very good metal distribution, good solderability, high hardness value, insensitive to handling, tarnish-resistant, high reflectivity, good wear and corrosion protection (substrate: nonferrous metals).	600	5	Cu Sn Zn KCN KOH	8.5 g 27.0 g 0.75 g 50.0 g 30.0 g	CuSo 1 SnS 2 ZnS BR 1-1 BR 2	5.5 ml 0.71 g 0.16 g 0.25 ml 1.25 ml	>13	0.25 (0.1-0.5)	0.06 at 0.25 A/dm ²	60 (58-62)	MMO PLATI-NODE® 177	■	■	■	■	■	■	■					

B = barrel, BR = Brightener, CuSo = Copper Solution, R = rack, SnS = Tin Salt, ZnS = Zinc Salt

Copper / Tin / (Zinc)-Electrolytes

	Hardness of deposit HV 0.05 (Vickers) approx. values	Max. coating thickness μm depending on substrate	Specified content per 1 litre		Consumption per 1 g of alloy deposited	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications												
											Electronics	Buttons/Zip fasteners	Jewellery/Watches/Spec-tacle frames/Accessories/	Mechanical engineering	Motor vehicle industry	Chemical and food-processing industries	Textile and printing industries	Other					
MIRALLOY® Electrolytes for Decorative and Technical Applications																							
MIRALLOY® 2844 E Rack and barrel electrolyte, coating colour white, similar to silver. Good covering power, very good metal distribution, good solderability, high hardness value, insensitive to handling, tarnish-resistant, high reflectivity, good wear and corrosion protection (substrate: nonferrous metals). Low metal content.	600	5	Cu Sn Zn KCN KOH	7.0 g 8.5 g 2.0 g 50.0 g 12.0 g	CuSo 1 SnS 2 ZnS BR 1-1 BR 2	5 ml 0.64 g 0.18 g 0.25 ml 0.83 ml	>13	0.3 (0.1-0.5)	0.07 at 0.3 A/dm ²	60 (58-62)	Ru MMO PLATI-NODE® 167, graphite	■	■	■	■	■	■	■	■				
MIRALLOY® 846 S Rack electrolyte, coating colour yellow, particularly for undercoats, layer thicknesses up to 20 μm . Good covering power, very good metal distribution, good wear and corrosion protection (substrate: nonferrous metals).	400	20	Cu Sn Zn KCN KOH	16.5 g 10.0 g 2.5 g 55.0 g 10.0 g	CuSo 1 SnS 2 ZnSo 1 BR 1 BR 2	7.8 ml 0.37 g 0.08 ml 0.65 ml 0.6 ml	Alka-line	1.5 (1.0-2.0)	0.35 at 1.5 A/dm ²	50 (48-52)	Ru MMO PLATI-NODE® 167, graphite		■	■		■	■	■	■				
MIRALLOY® 2847 Barrel electrolyte with a golden coating colour, approx. 2 N. Wide operating range, good covering power, very good metal and colour distribution, good wear and corrosion protection (substrate: nonferrous metals).	400	50	Cu Sn Zn KCN KOH	10.5 g 21.5 g 1.6 g 37.5 g 20.0 g	CuSo1 SnS 2 ZnS 1 BR 1 BR 2	8.5 ml 0.23 g 0.06 g 0.2-0.3 ml 0.7 ml	>13	0.5	0.12 at 0.5 A/dm ²	60 (58-62)	MMO PLATI-NODE® 167, type F		■	■	■	■	■	■	■				

B = barrel, BR = Brightener, CuSo = Copper Solution, R = rack, SnS = Tin Salt, ZnS = Zinc Salt

Copper / Tin / (Zinc)-Electrolytes

	Hardness of deposit HV 0.05 (Vickers) approx. values	Max. coating thickness μm depending on substrate	Specified content per 1 litre	Consumption per 1 g of alloy deposited	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications							
										Electronics	Buttons/Zip fasteners	Jewellery/Watches/Spec-tacle frames/Accessories/	Mechanical engineering	Motor vehicle industry	Chemical and food-processing industries	Textile and printing industries	Other
MIRALLOY® Electrolytes for Decorative and Technical Applications																	
MIRALLOY® 2850 Rack and barrel electrolyte, coating colour white, similar to silver. Brightening and slightly levelling, good covering power, good metal distribution, high hardness, insensitive to handling, tarnish-resistant, good wear and corrosion protection (substrate: nonferrous metals).	600	15	Cu R 8.5 g B 7.0 g Sn R 34.0 g B 20.0 g Zn R 1.0 g B 0.8 g KCN 50.0 g KOH R 16.0 g B 20.0 g	CuSo 1 5 ml SnS 2 0.9 g ZnS 0.13 g BR 1 G 1.7 ml T 0.9 ml BR 2 G 0.9 ml T 0.9 ml	>13	R 2.0 (1.5-2.5) B 0.25 (0.1-0.5)	R 0.28 at 2.0 A/dm ² B 0.06 at 0.25 A/dm ²	60 (58-62)	MMO PLATI-NODE® 167, type F	■							■
MIRALLOY® 2851 Rack electrolyte, coating colour white, similar to silver. Brightening and slightly levelling, good covering power, good solderability, high hardness value, insensitive to handling, tarnish-resistant, good wear and corrosion protection (substrate: nonferrous metals).	600	15	Cu 10.5 g Sn 34.0 g Zn 1.2 g KCN 48.0 g KOH 22.0 g	CuSo 1 5.1 ml SnS 2 0.8 g ZnS 0.2 g BR 1 0.8 ml BR 2 0.8 ml	>13	1.0 (0.5-1.25)	0.25 at 1.0 A/dm ²	60 (58-62)	Ru-MMO PLATI-NODE® 167	■	■	■	■	■	■	■	■
MIRALLOY® 2852 Barrel electrolyte, coating colour white, similar to silver. Brightening, good covering power, good metal distribution, high hardness, insensitive to handling, tarnish-resistant, good wear and corrosion protection (substrate: nonferrous metals).	600	15	Cu 8.5 g Sn 34.0 g Zn 0.55 g KCN 43.0 g KOH 22.0 g	CuSo 1 4.9 ml SnS 2 0.9 g ZnS 0.1 g BR 1 0.7 ml BR 2 0.7 ml	>13	0.25 (0.1-0.5)	0.07 at 0.25 A/dm ²	60 (58-62)	MMO PLATI-NODE® 167, type F	■	■	■	■	■	■	■	■

BR = Brightener, CuSo = Copper Solution, SnS = Tin Salt, ZnS = Zinc Salt, ZnSo = Zinc Solution

Copper / Tin / (Zinc)-Electrolytes

	Hardness of deposit HV 0.05 (Vickers) approx. values	Max. coating thickness μm depending on substrate	Specified content per 1 litre		Consumption per 1 g of alloy deposited		pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material	Applications							
			Cu	Sn	Zn	CuSo 1						SnS 2	ZnS	Electronics	Buttons/Zip fasteners	Jewellery/Watches/Spec-tacle frames/Accessories/	Mechanical engineering	Motor vehicle industry	Chemical and food-processing industries
MIRALLOY® Electrolytes for Decorative and Technical Applications																			
MIRALLOY® 2852 LC Rack electrolyte, coating colour white, similar to silver. Reduced metal concentrations, good covering power, high hardness, insensitive to handling, tarnish-resistant, good wear and corrosion protection (substrate: nonferrous metals).	600	15	Cu Sn Zn KCN KOH	7.5 g 17.0 g 0.5 g 50.0 g 15.0 g	CuSo 1 SnS 2 BR 1 BR 2	5.5 ml 0.9 g 0.06 g 0.9 ml 0.9 ml	>13	0.25 (0.1-0.5)	0.06 at 0.25 A/dm ²	60 (58-62)	MMO PLATI-NODE® 167, type F	■	■	■	■	■	■		
MIRALLOY® 2884 Barrel electrolyte, coating colour brilliant white, similar to rhodium. Good covering power, very good metal distribution, insensitive to handling, tarnish-resistant, easy electrolyte maintenance.	600	15	Cu Sn Zn KCN KOH	7.5 g 17.0 g 0.5 g 50.0 g 15.0 g	CuSo 1 SnS 2 BR 1 BR 2	5.5 ml 0.9 g 0.06 g 0.9 ml 0.9 ml	>13	0.25 (0.1-0.5)	0.06 at 0.25 A/dm ²	60 (58-62)	MMO PLATI-NODE® 167	■	■	■	■	■	■		
MIRALLOY® 3849 Rack electrolyte, coating colour yellow. Wide operating range, very good metal distribution, good wear and corrosion protection.	400	2000	Cu Sn KCN KOH	15 g 17 g 35 g 25 g	CuSo 1 SnS 2 BR 1 BR 2	9 ml 0.25 g 1 ml 1 ml	>13	3.0 (2.0-4.0)	0.56 at 3 A/dm ²	55 (50-60)	MMO PLATI-NODE® 167			■	■		■	■	

B = Barrel, BR = Brightener, CuSo = Copper Solution, R = Rack, SnS = Tin Salt, ZnS = Zinc Salt, ZnSo = Zinc Solution

Tin / Zinc-Electrolytes

Hardness of deposit HV (Vickers) approx. values	Max. coating thickness μm	Specified content per 1 litre	Consumption per 10,000 Ah	pH-value	Current density A/dm ²	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature °C	Anode material
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Tin Alloy Electrolytes for Technical Applications

DIALLOY® 822 Alkaline-cyanide electrolyte for depositing silk-matt, white tin-zinc alloy layers in rack or barrel operation. A Sn/Zn alloy ratio of either 80/20 or 70/30 can be deposited. Very good metal distribution, good solderability and weldability, excellent corrosion protection for iron and iron alloys.	50	50	Sn 22 g Zn 2.4 g	ZnS 1 2 kg SnS 2 15 kg BR 1-1 5-7.5 l	>13	Barrel 1.0 (0.8-1.2) Rack 1.5 (1-2)	0.17 at 1.0 A/dm ² 0.25 at 1.5 A/dm ²	60 (58-62)	Ru MMO PLATI-NODE® 167
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BR = Brightener, SnS = Tin Salt, ZnS = Zinc Salt

Indium-Electrolytes

	Alloy components	Colour of deposit	Max. coating thickness μm	Metal content g/l	pH-value	Plating speed $\mu\text{m}/\text{min}$ approx. values	Temperature $^{\circ}\text{C}$	Anode material	Applications										
									Printed circuit boards	Connectors/contacts	Semiconductors	Jewellery	Watches	Spectacle frames	Writing instruments	Household articles	Accessory	Cutlery	
Indium electrolytes for technical applications																			
Umicore Indium 9100 Acidic electrolyte for use in high-speed equipment for deposit of matt, ductile indium layers of high purity. For coating electronic components which can be remelted after coating.	In	Silver-white	Depending on type of equipment used and achievable electrolyte agitation	40	1.5 (1.2-2.2)	1.2 bei 5 A/dm ² 2.2 bei 8 A/dm ²	50 (30-65)	Indium	■										
Umicore Indium 9200 Alkaline electrolyte for use in high-speed equipment for deposit of matt, ductile indium layers of high purity. For coating electronic components which can be remelted after coating.	In	Silver-white	Depending on type of equipment used and achievable electrolyte agitation	40	13.0 (12.5-13.5)	0.65 bei 2 A/dm ² 0.95 bei 4 A/dm ² 1.05 bei 6 A/dm ² 1.1 bei 8 A/dm ² 1.1 bei 10 A/dm ²	40 (20-65)	Indium	■										

Pre- and Post-treatments

	Specified content / bath makeup per 1 litre	pH-value	Current density A/dm ²	Time of exposure	Temperature °C	Electrode material
Pre- and Post-treatments						
Umicore Cleaner 6032* Electrolytic, alkaline, and cyanide-free cleaner working cathodically or anodically, for nonferrous metals, zinc die castings and steel. May also be used with cyanide.	Salt Mixture 60 g (50-100 g)	Alkaline	12 (5-15) cathodic	30 sec - 3 min	55 (40-60)	Anode: stainless steel 1.4301
Umicore Electropolish 6100* Strongly acidic electrolyte working anodically for brightening copper alloys. For treating plug-in contacts made from brass, bronze, copper in continuous lines and rack operation.	Ready for use, density 1.50-1.55 g/cm ³	<1	10-25 anodic	10-50 sec	18-25	Cathode: stainless steel 1.4301
Umicore Activator 6120* Good activation of steel, nonferrous metals, and nickel. Also suitable for derusting and descaling. Simple handling.	Salt Mixture 30-240 g	Acidic	-	15-90 sec	20-70	-
Umicore Cleaner 864 Degreasing of nonferrous metals and cleaning of copper surfaces (printed circuit boards). Free from strong complexing agents, good resist compatibility, simple bath maintenance.	Concentrate 100 ml (50-150 ml)	Acidic	-	4 min (3-5 min)	50 (25-60)	-
Umicore Cleaner 865 Degreasing of nonferrous metals and cleaning of copper surfaces (printed circuit boards). Contains phosphate, free from strong complexing agents, good resist compatibility, simple bath maintenance with long bath life.	Concentrate 50 ml (25-100 ml)	1-2	-	3 min (1-6 min)	40 (RT-max. 60)	-

*For use in continuous plating lines, RT = room temperature

Pre- and Post-treatments

Bath makeup per 1 litre pH-value Current density A/dm² Time of exposure Temperature °C Anode material Removal rate Max. loading of bath

Pre- and Post-treatments										
Umicore Micro-Etch 910 Cleaning and activation of copper surfaces on printed circuit boards, free from complexing agents. Uniform etch removal, constant etch rate and high copper uptake. Simple bath maintenance and long bath life.	Salt Mixture	40-120 g	1-2	-	-	0.5 - 6 min	25-35	-	0.2-0.8 µm/min	12 g/l Cu
Umicore Gold-Stripper 645 Stripping of gold from all common substrates. High stripping speed and capacity, minimal attack on the substrate. Stripper works without external current source.	Makeup Salt	20 g	Alkaline	-	-	-	RT (20-35)	-	0.5-1 µm/min	20 g/l Au
Umicore Gold-Stripper 647 Stripping of gold from all common substrates. High stripping speed and capacity, minimal attack on the substrate. Stripper works without external current source.	Concentrate	100 ml	Alkaline	-	-	-	RT (20-35)	-	0.5-1 µm/min	20 g/l Au
Umicore Palladium-Stripper 640 Alkaline-cyanide stripper for removing palladium from nickel and cooper alloys. High stripping speed and capacity, can be replenished, works without external current source.	Concentrate NaCN	100 ml 40 g	Alkaline	-	-	-	20-30	-	0.6 µm/min	20 g/l Pd
Umicore Silver-Stripper 638 Cyanide-free stripper for anodic removal of silver. Primarily used for removing thin silver coatings on strip materials plated in continuous lines.	Makeup Salt Initial Solution KOH	75 g 65 ml 25 g	10.5	1-3	-	-	20-30	Stainless steel cathodes	1.2 – 1.8 µm/min	-
Umicore NiP-Stripper 882 Strongly acidic electrolyte anodically working stripper for removal of Nickel-phosphorus layers in rack and barrel operation	Concentrate Phosphoric acid	300 ml 700 ml	<1	-	-	-	18-25	Stainless steel/MMO cathodes	0.2 – 0.7 µm/min	-

*For use in continuous plating lines, RT = room temperature

Pre- and Post-treatments

	Bath makeup per 1 litre	pH-value	Current density A/dm ²	Time of exposure	Tempe- rature °C	Anode material	Removal rate	Max. loading of bath
Pre- and Post-treatments								
Umicore Antitarnish 613 Chromium-free antitarnish protection for silver and copper. Storage protection on an aqueous basis without organic solvents for technical and decorative silver deposits. Solderability and surface resistivity will not be influenced.	Concentrate 250 ml Wetting Agent 2 5 ml	1.5 (1.0-2.0)	-	30 sec (10-120 sec)	35 (20-40)	-	-	10 m ² /l
Umicore Antitarnish 616 / 616 PLUS Process free from heavy metals based on nanobiotechnology for protecting silver against tarnishing, for decorative and technical applications. Biologically safe, kind to the skin and hypoallergenic. Antitarnish 616: Simple immersion process on aqueous basis. Antitarnish 616 PLUS: Electrolytic protection process.	616: Initial Concentrate 10 ml	6.5 (5-8)	-	5 min	45-55	-	-	-
	616 PLUS: Initial Concentrate 10 ml Makeup Salt PLUS 2.5 g	3.7 (3.3-4)	>0.1	5 min (3-10)	60 (55-65)	MMO PLATI- NODE® 187 SO	-	-
Umicore Antitarnish 617 Antitarnish process for precious metals, silver in particular. Simple immersion process on aqueous basis, for decorative and technical applications, rack and barrel.	Concentrate 25 ml	6.5 (5-8)	-	3-10 min	50 (47-53)	-	-	-
Umicore Antitarnish 618 / 618 PLUS Antitarnish process for precious metals, silver and gold in particular. For decorative and technical applications, rack and barrel. Antitarnish 618: Simple immersion process on aqueous basis. Antitarnish 618 PLUS: Electrolytic protection process.	618: Concentrate 10 ml	6.5 (5-8)	-	3-10 min	57 (55-59)	-	-	-
	618 PLUS: Concentrate Makeup Salt PLUS 10 ml 2.5 g	3.7 (3.3-4)	Voltage R 3,5 V (2,5-4,5 V) B 6,0 V (4,0-8,0 V)	3-5 min	57 (55-59)	MMO PLATI- NODE® 187 SO	-	-

Pre- and Post-treatments

	Bath makeup per 1 litre	pH-value	Current density A/dm ²	Time of exposure	Tempe- rature °C	Anode material	Removal rate	Max. loading of bath
Pre- and Post-treatments								
Umicore Sealing 691 / 691 EL* Process free from CFCs, CHCs, HCs and chromium for protecting precious metal surfaces against tarnishing. Primarily for technical components, e.g. contacts. Good sliding properties and solderability, low contact resistance; colour and brilliance will not be influenced. Sealing 691: Simple immersion process Sealing 691 EL: Electrolytic process	691: Concentrate 10 ml	Weakly acidic - neutral	-	5 / 30 sec (2-120 sec)	50 (48-52)	-	-	-
	691 EL: Concentrate 10 ml Basic Additive 5 g	3.0 (2.8-3.5)	Voltage 4.5 V (4.0-5.0 V)	5 / 30 sec (2-120 sec)	50 (48-52)	MMO PLATI- NODE®, Pt/Ti	-	-
Umicore Sealing 692 / 692 EL* Process free from CFCs, CHCs, HCs and chromium for protecting precious metal surfaces against tarnishing. For technical components such as contacts as well as for decorative applications. Good sliding properties, bondability and solderability, low contact resistance. Colour and brilliance will not be influenced. Suitable for high-speed processes. Sealing 692: Simple immersion process on aqueous basis Sealing 692 EL: Electrolytic process	692: Concentrate 10 ml	Weakly acidic – neutral	-	5 / 30 sec (2-120 sec)	55 (53-57)	-	-	-
	692 EL: Concentrate 10 ml Additive 25 ml Solution 4	9.5 (9.0-10.0)	Voltage 2.0 V (2.0-4.0 V)	5 / 30 sec (2-120 sec)	55 (50-57)	MMO PLATI- NODE®, 187 SO, Pt/Ti	-	-
Umicore Topseal 681 Topcoat free from heavy metals for colourless, well-adhering protective layers on metal surfaces, preferably copper and copper alloys, improves tarnish and corrosion resistances. For rack and barrel applications.	Concentrate 30 ml	2.0 (1.8-2.2)	-	2 min (0.1-6 min)	35 (30-40)	-	-	-

*For use in continuous plating lines, C = continuous lines, R = Rack, B = Barrel

Pre- and Post-treatments

Bath makeup per 1 litre pH-value Current density A/dm² Time of exposure Temperature °C Anode material Removal rate Max. loading of bath

Pre- and Post-treatments								
<p>Umicore Topseal 693*</p> <p>Sealing free from CFCs, CHCs, HCs and chromium for silver surfaces, thiol-free. Easy-to-use immersion process for prolonged protection against tarnishing or discolouration. For technical components such as contacts, hardly any influence on solderability and contact resistance. Suitable for high-speed processes.</p>	Concentrate	150 ml	Strongly acidic	-	R/B 20 s (10-120 s) C 10 s (2- 20 s)	50 (20-60)	-	-
<p>Umicore Inhibitor 1</p> <p>Produces water-repellent protective film on surface of parts, supports fast drying, improves corrosion resistance. Simple, non-electrolytic dip process.</p>	Concentrate	2 ml	9.5	-	30 sec (20-120 sec)	RT (20-40)	-	-
<p>Umicore Passivation 672</p> <p>Passivation for passivating zinc and zinc alloy layers. Solution for producing colourless, transparent protective layers on SnZn alloy coatings, e.g. deposited from DIALLOY® 822, free from Cr⁶⁺.</p>	Concentrate	10 ml	2.1	-	2 min (0.5-4 min)	50 (30-70)	-	-
<p>Umicore Ion Exchange Resin 1</p> <p>Ion exchange resin for removing metallic contaminants. For weakly acidic and neutral gold electrolytes without strong complexing agents and weakly alkaline palladium electrolytes. Resin can be regenerated, minor loss of precious metal.</p>	Resin	Approx. 5-10 ml/ 100 mg contaminant	-	-	Approx. 1-2 h (max. 4 h)	-	-	-
<p>Umicore Ion Exchange Resin 3</p> <p>Ion exchange resin for removing copper contaminants. For strongly acidic precious metal electrolytes, minor loss of precious metal.</p>	Resin	Approx. 3-4 ml/10 mg Cu	-	-	Approx. 1 h	-	-	-

*For use in continuous plating lines, C = continuous lines, R = Rack, B = Barrel

Pre- and Post-treatments

Bath makeup per 1 litre	pH-value	Current density A/dm ²	Time of exposure	Temperature °C	Anode material	Removal rate	Max. loading of bath
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Pre- and Post-treatments							
Umicore Ion Exchange Resin 4 Ion exchange resin for removing iron contaminants. For neutral ruthenium electrolytes, minor loss of precious metal.	Resin Approx. 10 ml/10 mg Fe	-	-	Approx. 1 h	-	-	-

Precious Metal Preparations for Plating

	Complex	Chemical Formula	Metal Content	Colour
Gold				
AURUNA® Ammonium Gold Sulphite Solution 100 For use in cyanide-free gold electrolytes	Ammonium gold(I) sulphite	$(\text{NH}_4)_3[\text{Au}(\text{SO}_3)_2]$	100 g Au/l	Colourless
AURUNA® Gold Solution CAP 50 For use in acidic gold electrolytes for direct plating of stainless steel	Potassium gold(III) cyanide	$\text{K}[\text{Au}(\text{CN})_4]$	50 g Au/l	Colourless
AURUNA® Gold Solution CAP 100 For use in acidic gold electrolytes for direct plating of stainless steel	Potassium gold(III) cyanide	$\text{K}[\text{Au}(\text{CN})_4]$	100 g Au/l	Colourless
Umicore Potassium Tetracyanoaurate(III) 57.8 % For use in acidic gold electrolytes for direct plating of stainless steel	Potassium gold(III) cyanide	$\text{K}[\text{Au}(\text{CN})_4]$	57.8 % Au	White
AURUNA® Potassium Gold Cyanide Solution 100 For use in gold electrolyte (decorative und technical applications)	Potassium gold(I) cyanide	$\text{K}[\text{Au}(\text{CN})_2]$	100 g Au/l	Colourless
Umicore Potassium Gold Cyanide 68.2 % For use in gold electrolyte (decorative und technical applications)	Potassium gold(I) cyanide	$\text{K}[\text{Au}(\text{CN})_2]$	68.2 % Au	White
Umicore Potassium Gold Cyanide 68.2 % <u>RJC CoC certified made from recycled material</u> For use in gold electrolyte (decorative und technical applications)	Potassium gold(I) cyanide	$\text{K}[\text{Au}(\text{CN})_2]$	68.2 % Au	White
Silver				
Umicore Silver Methane Sulphonate Solution For use in methanesulphonate based silver electrolytes (mainly technical applications)	Silver methanesulphonate	$\text{CH}_3\text{SO}_3\text{Ag}$	275 g Ag/l	Colourless

Precious Metal Preparations for Plating

	Complex	Chemical Formula	Metal Content	Colour
Palladium				
PALLUNA® Palladium Solution 105 For use in ammonia- and chloride-free palladium und palladium/nickel electrolytes (mainly technical applications)	Bis-(ethylenediamine)palladium(II) sulphate solution	[Pd(en) ₂]SO ₄	100 g Pd/l	Yellow
PALLUNA® Palladium Solution 460 For use in palladium and palladium/nickel electrolytes (decorative and technical applications)	Tetraamminepalladium(II) chloride solution	[Pd(NH ₃) ₄]Cl ₂	100 g Pd/l	Yellow
PALLUNA® Palladium Solution 460 <u>RJC CoC certified made from recycled material</u> For use in palladium and palladium/nickel electrolytes (decorative and technical applications)	Tetraamminepalladium(II) chloride solution	[Pd(NH ₃) ₄]Cl ₂	100 g Pd/l	Yellow
PALLUNA® Palladium Solution 460 HP For use in palladium and palladium/nickel electrolytes with special requirements in terms of impurities and pH-value (decorative und technical applications)	Tetraamminepalladium(II) chloride solution	[Pd(NH ₃) ₄]Cl ₂	101 g Pd/l	Yellow
Umicore Palladium Salt 400 For use in palladium electrolytes (mainly technical applications)	Palladium(II) sulphate hydrate	PdSO ₄ x n H ₂ O	44.5 % Pd	Yellow-brown
Umicore Palladium Salt 410 For use in palladium electrolytes (mainly technical applications)	Tetraamminepalladium(II) sulphate	Pd(NH ₃) ₄ SO ₄	34 - 39 % Pd	Yellowish

Dimensionally Stable Anodes, Wires and Ribbons

PLATINODE®

Dimensionally Stable Electrodes

Dimensionally stable Umicore electrodes are marketed at Umicore under the brand name PLATINODE®. PLATINODE® describes the refractory metals, such as titanium and niobium, coated with both purest platinum and also with mixed metal oxide. The electrocatalytic functional layers of platinum or various precious metal oxides are used throughout virtually the entire electrochemical industry.

The choice of coating - be it platinum or MMO - and specification of the required layer thickness depends on the customer's specific area of use.

Huge range of uses for Umicore Electrode Systems:

- Precious and non-precious metal electroplating
- Electronics and semiconductor industries
- Photovoltaics
- Anodisation
- Metal recovery
- Electroforming
- Chloralkali electrolysis
- Acid electrolysis
- Cathodic corrosion protection
- Chemical process engineering
- Wastewater treatment
- Drinking water treatment
- Water and swimming pool water disinfection
- Lighting industry

PLATINODE®

- Decorative and technical Cr(III) electrolytes
- Reprocessing of pickling solutions free from Cr(VI) for POP applications
- Electrolytes containing MSA
- Electrowinning
- ETL /EGL lines (electrolytic tinning lines / electrolytic galvanizing lines)
- Hard chrome plating
 - Piston rings
 - Piston rods
 - Shock absorbers
 - Hydraulic cylinders
 - Printing cylinders

Dimensionally Stable Anodes, Wires and Ribbons

PLATINODE®

High Temperature Electrolysis

The high temperature electrolysis (HTE) production division of Umicore electroplating has been involved in the development, construction and production of electrode systems for over three decades. This experience, combined with the in-depth specialist knowledge of its employees and the high technical level of production, enables the company to develop the best possible innovative system solution for its customers.

The customer-specific range of services includes:

- Skilled customer support and advice
- Development and construction of customised electrodes
- Choice of special functional layers
- Fast and documented sample processing
- State of the art, mechanised production site
- Repair and recoating of used electrodes
- Resources available for studying and developing electrode systems
- Project preparation and post-processing with customers and at customers' premises
- Damage analysis using up-to-date analysis methods
- Creation of CAD drawings
- Calculation and dimensioning of electrode systems

PLATINODE®

Mechanical Production

In addition to continuous enhancement of HTE coating, market requirements also necessitate expansion of the mechanical production facilities. Umicore in many fields acts as a systems supplier here. *"Everything from a single source"* – this is the motto of Umicore's customer service with an extensive list of products.

Increasing numbers of items have to be processed at the highest quality level with short delivery times. This is ensured by first-class skilled staff and an extensive range of machinery.

Umicore electroplating is equipped with the following machines in order to offer a high vertical range of manufacture:

- CNC punch press
- CNC bending presses (vertical/horizontal)
- Round bending machines
- Circular cutting machine
- Swing beam shears
- Surface grinding machine
- Inert gas laser welding unit
- Spot welding units
- TIG welding unit
- Pressure blasting units
- Vertical and shuttle storage equipment

Umicore's mechanical production site covers an area of approx. 500 m².

Dimensionally Stable Anodes, Wires and Ribbons

PLATINODE®

Platinized Wires and Ribbons

made of molybdenum, titanium, stainless steel, nickel and nickel alloys etc. are coated with platinum from the molten salt on two continuously operation plants. It is possible in this manner to deposit layers from 0.2 to > 50 µm with excellent density and adhesive strength.

Applications:

- Lighting industry
- Electronics
- Sensor technology
- Cathodic protection etc.

Detailed information on all products in the List of Products is available on request!

www.mds.unicore.com

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