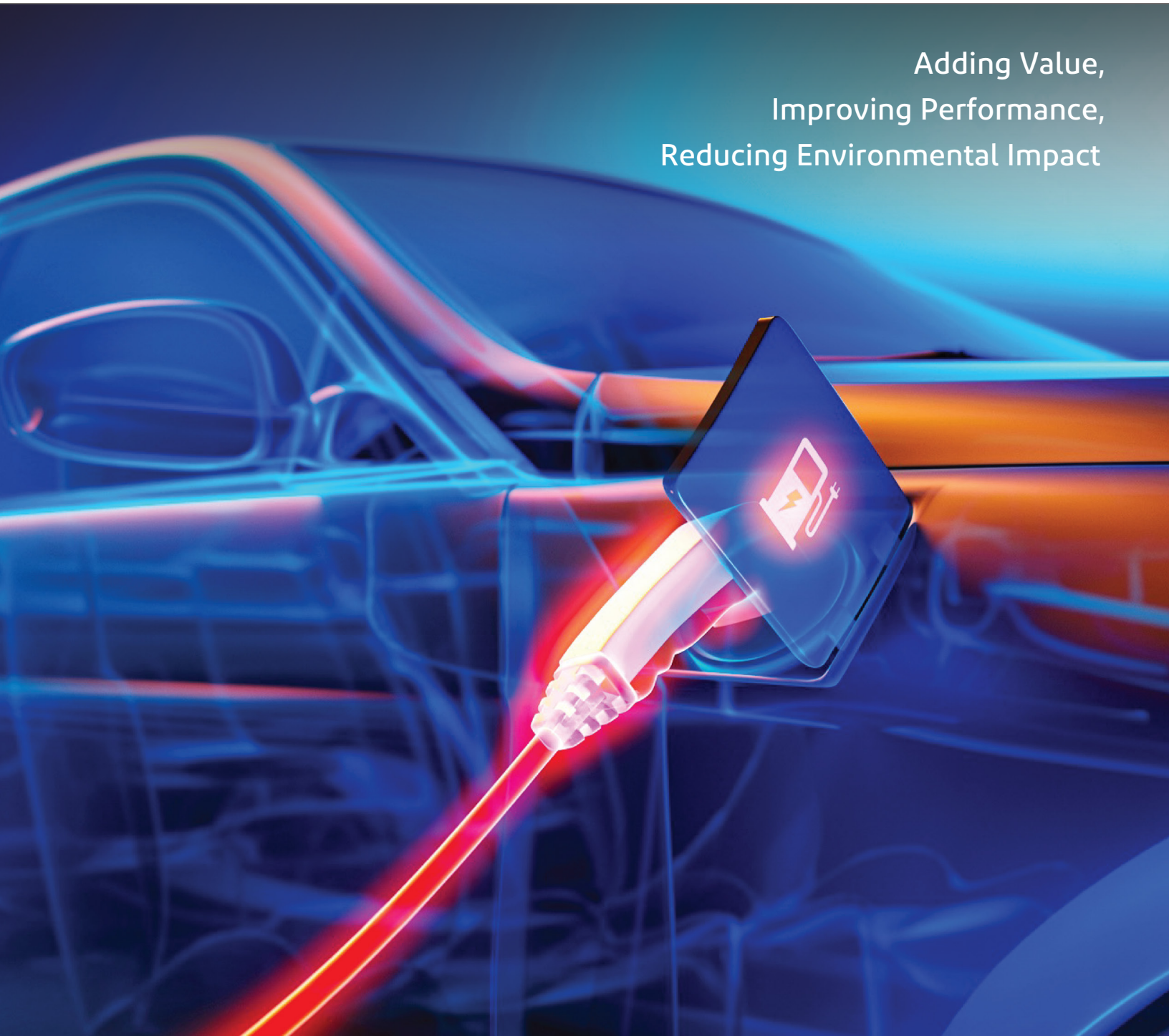
Electronics & Industrial

DUPONT™

Making Connections

Novel Technology Solutions



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Introduction

Electronic Interconnections are critical to almost every aspect of products and their use.

Emerging markets and applications are changing the design, function and operating environments for electronic components.

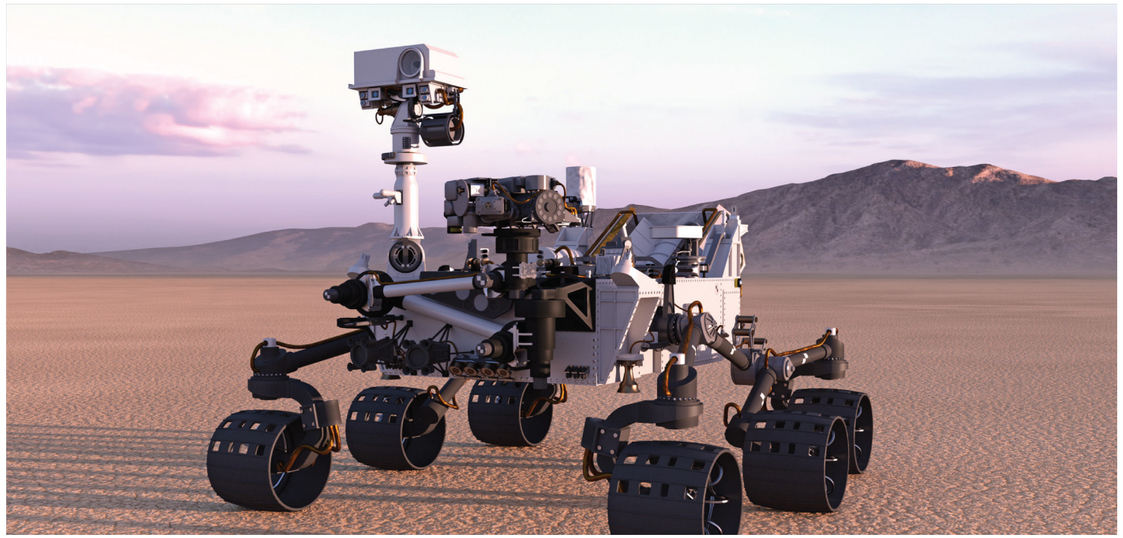
This has driven **DuPont Interconnect Solutions** to invest in novel and sustainable products and processes to meet these new market requirements. The performance of a component and its functional finish is dependent upon how the surface is prepared and how the treated surface is protected. This capability is defined by the Full Process.

Satisfying the diverse and challenging technology requirements must be delivered in a **sustainable** way.

DuPont continues to invest in the replacement of substances which can be harmful to humans or the environment, to deliver simpler, faster and greener processes. Only putting the finish where required brings together precise digital imaging and functional metallization.

Talk to DuPont about minimizing the impact of processing parts. In this brochure, you'll see examples of products and processes with a more **sustainable** footprint compared to its predecessor, or alternatives.

Electronic connector component finishing requirements are changing, driven by the need for signal integrity and reliability in new and evolving applications where operating environments and lifecycle demands require compatible finishing, from sustainable processes. What's your next frontier?



New Markets, Applications and Requirements

Electric vehicles and 5G connectivity are two examples of markets where connector finishing is changing.

With higher power, voltage and temperatures in automotive electronics, high conductivity, a stable and durable finish and consistent performance over the lifecycle become key requirements.

The use of silver and silver alloys for such applications matches the requirements and can lower costs compared to historical approaches.

The move to silver tin alloy for automotive pressfit connectors is to avoid the risk of whisker filaments associated with pure tin.

In 5G applications, high frequency creates specific needs for signal integrity and reliability, excellent electrical and thermal conductivity, low and consistent contact resistance and low wear. The signals must be protected from EMI, creating new applications for metallization of plastic housing, where high Tg and Low Df plastics are required.

Ronaclean™ CP-100S Cleaner

Ronaclean™ CP-100S is a heavy-duty, high-detergency, soak/electrolytic cleaning solution designed for substrates cleaning prior to subsequent electroplating operations. Application of anodic current to enhance cleaning capability is recommended where feasible.

Features and Benefits

- Soak and electrolytic cleaning
- Low COD
- Ease of waste treatment

DuPont's Ronaclean™ Cleaners are available for the broadest of applications. The Ronaclean™ CP-100S is popular due to the low COD, but ask your DuPont contact for the most appropriate product for your application.

Ronatab™ Acid Activator PC-1

Ronatab™ Acid Activator PC-1 is recommended for use in electronics applications to activate nickel and nickel alloy substrates, where gold, palladium, tin, etc. are deposited onto nickel plated components.

Advantages

- Low foaming
- No electrolysis required
- Easy to maintain and control
- Low acidity
- Halide-free
- Ambient operating temperature

Actronal™ 660, 550 or 988 Descaler

Actronal™ Descalers are designed for the removal of oxides and scale from copper and copper alloy substrates.

Advantages

- Minimal immersion time required for complete removal of oxides and heat scale from copper-based alloys
- Completely non-foaming, low acidity solution, with wide operating windows
- Suitable for a wide range of plating equipment

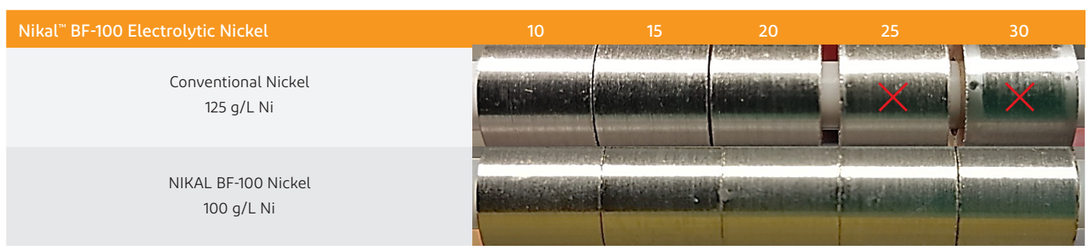
Actronal™ 660 Descaler uses separate liquid cleaner and oxidiser salt components, allowing flexible use.
Actronal™ 988 Descaler is a single salt for immersion use
Actronal™ 550 Descaler is a single salt product, but is fluoride free

Nikal™ BF-100 Electrolytic Nickel

REACH compliant Nikal™ BF-100 Electrolytic Nickel provides an enhanced corrosion resist underlayer offering superior bath maintenance and operation.

- Improved gold porosity enables use of thinner gold to achieve same corrosion resistance
- Improved thickness distribution for components with recessed or hidden areas such as trenches, blind holes, or through holes
- Suitable for barrel, rack, and reel-to-reel plating equipment
- Higher speed, fully analyzable, simplified handling, and operation
- REACH compliant Ni electrolyte

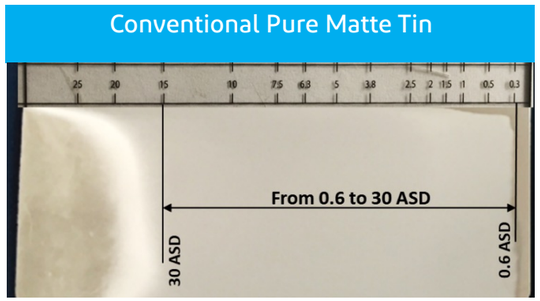
Property	Conventional Boric Acid Electrolytic Nickel Reference	Nikal™ BF-100 Nickel
Appearance	Uniform semi-bright	Uniform semi-bright, improved CD range
Ductility ASTM B489, 500X	>10% elongation	>10% elongation Optimized for Au savings:6-8%
Internal Stress	7000 lbs/ft² compressive	0-3000 lbs/ft² compressive, depending on additive levels
Gold Porosity	Standard gold porosity performance	Enables superior gold porosity performance

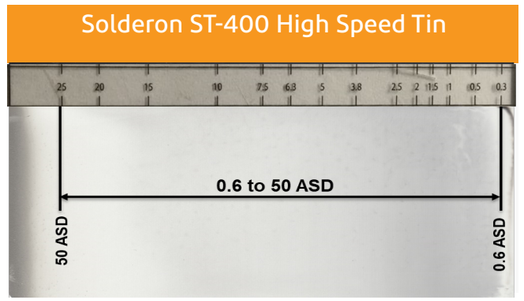


Rotating Cylinder: 10 µm nickel, 200 rpm

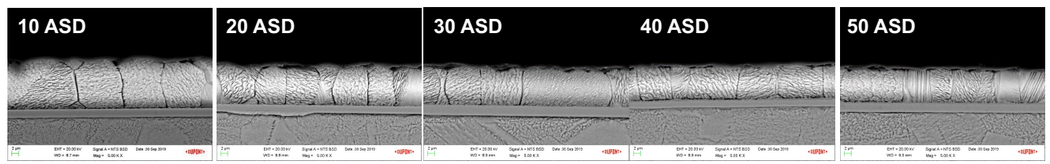
Solderon™ ST-400 High Speed Tin

- Improved CD range versus Conventional Pure Matte Tin
- Stable XRD pattern and SEM microstructure
- Single, low foaming additive for makeup and replenishment
- Solderable under aging
- Very low sludge rate
- Low whisker formation
- Sustainable and REACH compliant antioxidant





New formulation has **>40%** higher maximum current denisty



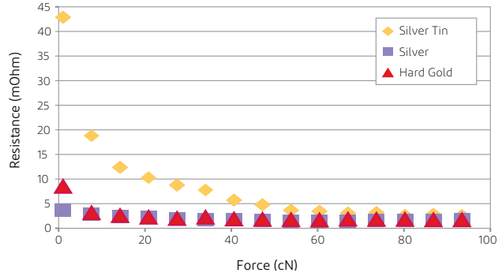
Large, consistent grain size across current density range

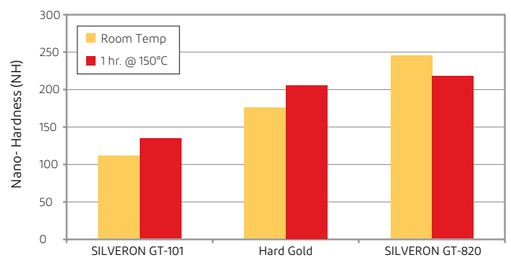
New Formulation can achieve **50%** higher maximum current density under jet agitation conditions

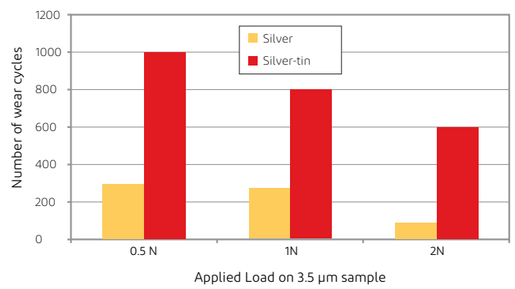
Silveron™ GT-820 Cyanide Free Silver Tin

Silveron™ GT-820 Silver-Tin is an acidic non-cyanide silver-tin electroplating product designed to deposit bright silver-tin alloy for electrical applications. The product can be used in conventional plating equipment at low speed and high speed. The silver-tin alloy can be applied to both nickel and copper or copper alloys. The electroplated silver-tin alloy contains 19-23% of tin, the remaining fraction is silver.

- Cyanide-free electrolyte
- Replacement for tin for whisker control on press fit connectors
- Chemically stable solution without metallic additives
- White, bright silver deposit over a broad CD range (0.5-15 ASD)
- Cathode efficiency ca. 100%
- Excellent adhesion over copper or copper alloys
- Plating over nickel requires a strike layer
- Deposit composition: ca. 80% silver
- Suitable for electrical/electronic applications
- Excellent contact resistance and solderability







Indiplate™ APF Electrolytic Indium

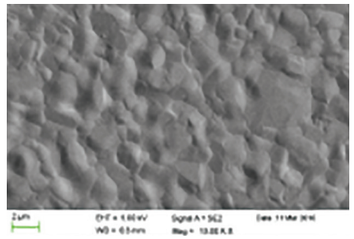
Indiplate™ APF is an acidic indium electroplating product - a new generation of DuPont Indiplate™ products. The Indiplate™ APF is designed to produce a uniform satin matte indium finish that has low friction, excellent electrical and thermal conductivity, low melting point and the capability of forming cold welding with many metals and alloys. The difference compared to the previous generation is that the process can be applied for both low and high-speed plating techniques.

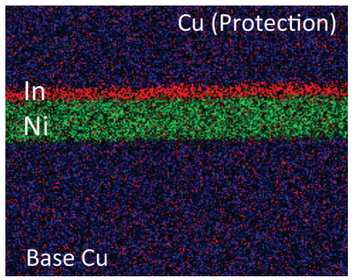
Key features of the process:

- Mixed acid system (pH ca.1.0)
- Satin matte deposit (SEM image)
- Good adhesion over copper and alloys
- Good adhesion over pre-plated nickel when using the recommended strike solution
- Suitable for reel-to-reel selective plating
- Possible to plate thin or thick layers

Applications

- Press-fit connector finish: a regulation compliant, low whisker alternative for standard Sn and SnPb press-fit finishes
- Thermal Interface Material (TIM)
- Low temperature solder (m.p.156.6 °C)
- Metallic sealing after annealing at 155°C



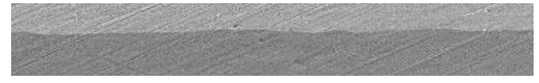


Silveron™ GT-210 High Durability Silver

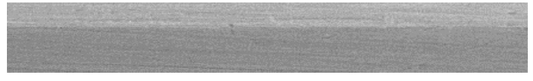
- Excellent wear with no cold welding
- Excellent thermal stability
- Good adhesion to Ni at high temperatures
- Acidic, cyanide-free electrolyte
- Excellent cathode current efficiency
- Suitable for reel-to-reel, rack, or barrel plating
- White, semi-bright deposit across CD range

Excellent adhesion with no delamination observed after 1000 hr at 180 °C

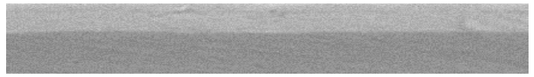
As Plated



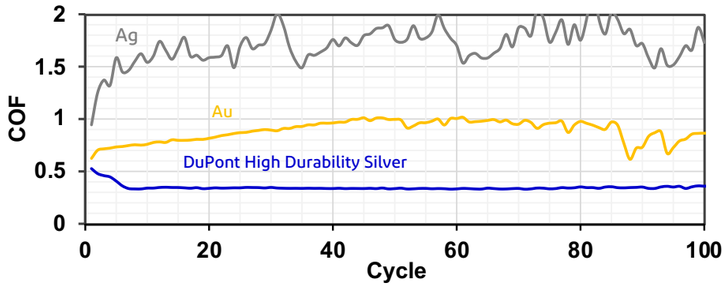
500 hr @ 180 °C

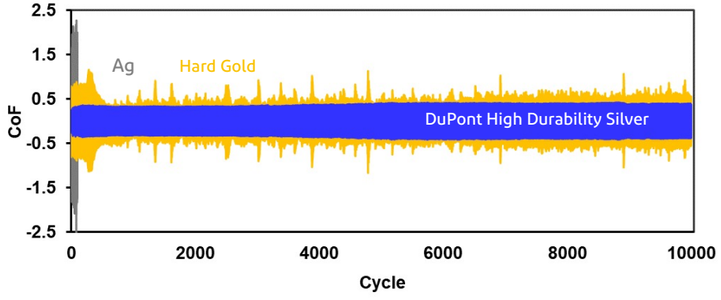


1000 hr @ 180 °C



Coefficient of Friction (COF)



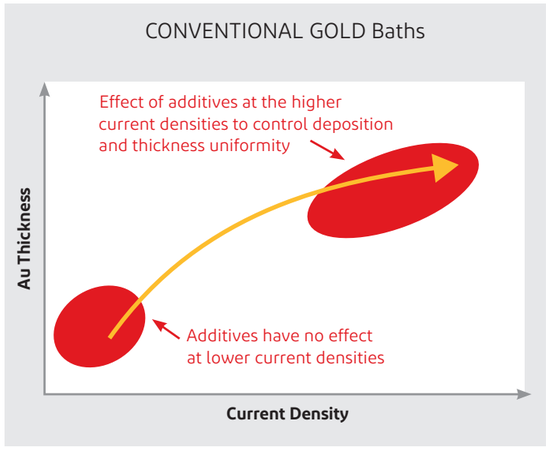


Ronovel™ LB-300 Low Bleed Gold

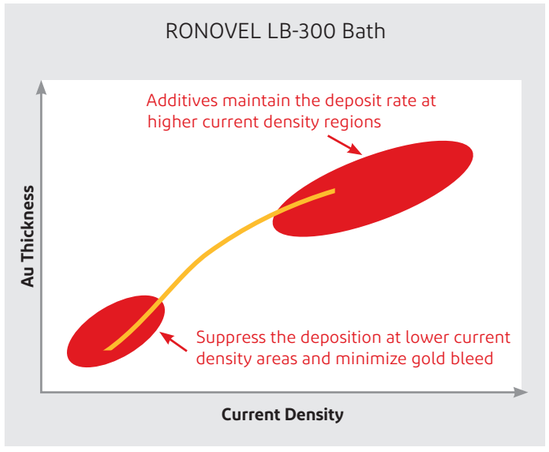
Ronovel™ LB-300 is a cobalt-alloyed gold plating product designed for high speed selective plating, achieving a uniform appearance over a wider current density range and minimizing gold bleed plating, saving money.

Features of Ronovel™ LB-300 Gold

- Minimized bleed gold deposition
- Minimized gold immersion on nickel substrate
- Improved deposition rate at the higher current densities
- Improved bath stability



Significant gold bleed



Minimized gold bleed

Auronal™ BGA-LF Pure Gold

Auronal™ BGA LF Pure Gold is a multipurpose pure gold plating electrolyte for electronic applications

Features of Auronal™ BGA LF Pure Gold

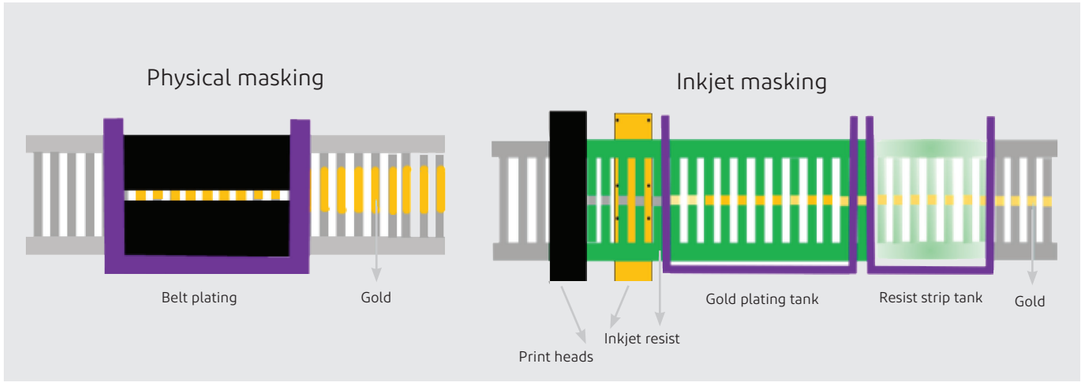
- Multipurpose pure gold plating electrolyte yielding a bright gold deposit
- Free from Arsenic, Hydrazine, Thallium and Lead
- Designed for barrel, rack and high speed reel-to-reel plating
- Can be applied on nickel, copper and copper alloys
- Contains metallic brightener
- The applicable current density can be extended up to 55 A/dm^2 by using pulse current
- 90-100% current efficiency
- Small grain structure
- Uniform deposit distribution at low deposit thickness
- Excellent wire-bondability of the deposit

Lithojet™ 250 Ink

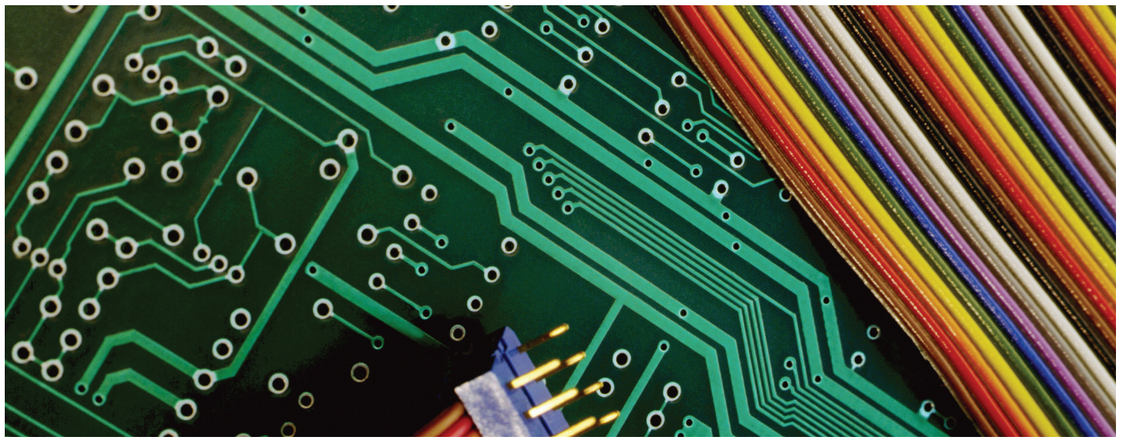
Selective Metallization or etching can be realised by using Lithojet 250 Ink in single or multiple selective plating applications.

Digital off-contact masking allows for rapid design change or prototyping as well as shorter processes and higher yields.

- Compatible with most plating and etching chemistries
- Masking of non-plating areas for metal saving and placement accuracy
- Very high chemical resistance to alkali and acid solutions
- UV curable
- Alkaline strippable



Schematic showing the difference between the conventional masking (left) and inkjet masking (right)



Eagle™ 2100 ED Resist

Selective plating becomes increasingly important to accurately plate components where the functional finish is required and to minimise the plated area to control cost.

Eagle™ 2100 ED is an electrophoretic resist, uniformly coating 3D surfaces, allowing for imaging or ablation of the required areas for plating.

Advantages

- Applicable to a wide variety of substrate sizes and geometries with three-dimensional coverage
- Provides uniform, defect-free coatings
- Resolution capability of 1:1
- Coating thickness capability up to 12.5 µm
- Good chemical resistance - withstands common acid and alkaline process chemistries

Blackbird™ 621 ED Resist

Blackbird™ 621 ED is an electrophoretic resist, optimized for laser ablation, for subsequent selective plating operation.

Advantages

- Applicable to a wide variety of substrate sizes and geometries with three-dimensional coverage
- Provides uniform, defect-free coatings
- Coating thickness from 2-10 µm
- Good chemical resistance - withstands common acid and alkaline process chemistries

Post Treatment Products

No Tarn™ PM-3 and PM-3 Plus Post Treatment

- Immersion (PM-3) or Electrophoretic (PM-3 Plus) passivation treatment
- Protects silver from tarnishing
- Tarnish protection for copper, palladium and thin gold layers
- No adverse effect on resistance, solderability or bondability
- No impact on brightness or color

Pore Blocker 200 Post Treatment

- Immersion passivation treatment
- Short Immersion treatment
- Corrosion protection of under layer through pores
- No adverse effect on resistance, solderability or bondability
- No impact on brightness or colour

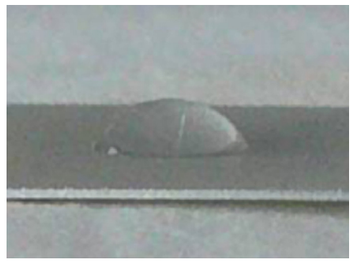
No Tarn™ SN-2 Post Treatment

- Post treatment for tin to provide uniform grain structure
- Reduces oxide layer formation
- Enhances solderability
- Reduces discolouration after heat treatment

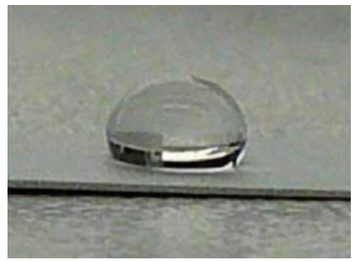
Solderguard™ 100 Post Treatment

- Creates a hydrophobic surface on tin deposits, repelling moisture
- Protects against corrosion and discoloration after reflow
- Enhances solderability
- Protection against whisker formation

SOLDERGUARD™ 100 Treatment
Before Heat Treatment



No SOLDERGUARD™ 100 Treatment
After 1 hour @ 155°C



With SOLDERGUARD™ 100 Treatment
After 1 hour @ 155°C

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