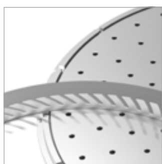
Semiconductor materials for a connected world.



As functionality and reliability of electronic devices progress, requiring changes in systems development and integration, materials, chemicals and auxiliaries are undergoing significant adaptions in performance, cost-efficiency and reliability.

In order to respond to such market needs, Umicore´s business unit Metal Deposition Solutions offers innovative patented additives for copper electroplating in the advanced packaging industry together with Copper(II)oxide and Electrode solutions for ECD tools.

www.mds.umicore.com

IntraCu® Electrolytes

IntraCu® SC-2

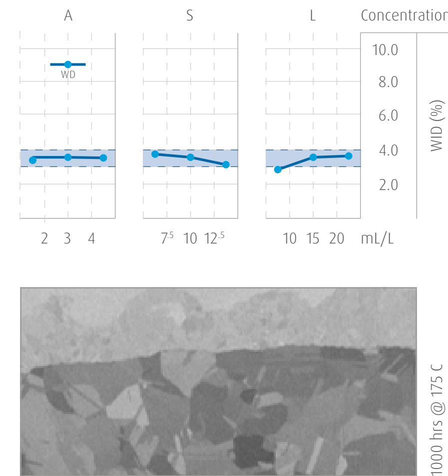
System provides customers the opportunity to reduce total cost of ownership by extending their process window. In addition, it is a true 2in1 procedure that produces no or only a small number of Kirkendall-voids (KV-less). The system is a drop-in replacement for current POR offerings.

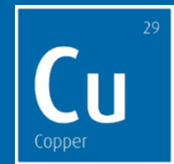
SYSTEM FEATURES

- Bright Cu, Ra < 0.03 µm
- ±50% process window for Cu pillar and RDL
- Total in-film organics < 11 ppm
- Excellent KV-less performance

SYSTEM APPLICATIONS

- 2-in-1 bright Cu (Cu pillar and RDL)
- 2-in-1 with KV-less requirement

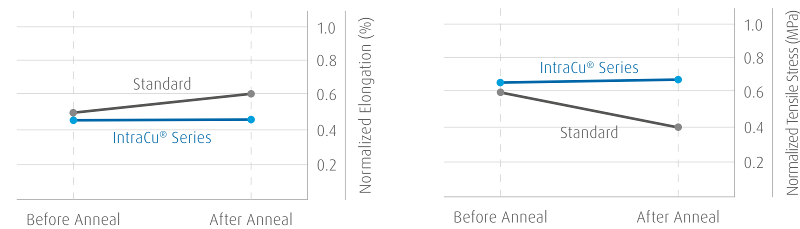


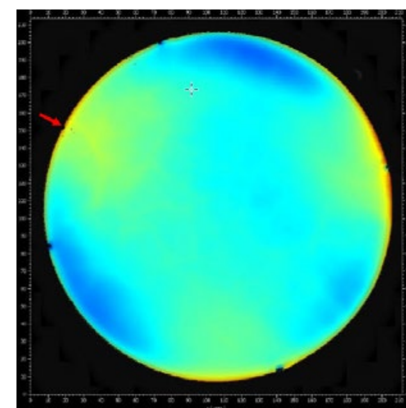


Our modular additives are designed to meet the highest requirements of the semiconductor industry in advanced packaging and offer the foundation for depositing customized material properties e.g. for Microbumps in IC packages, RDL in wafer level packaging and Pillar in flip-chip packaging

IntraCu® SC-6

System provides customers the opportunity to make products that require thermal and mechanical stability in future, so that fine lines/structures will not break during subsequent packaging and assembly operations. Especially for TAIKO wafers the process ensures no warping/damage. On glass or ceramic substrates IntraCu SC 6 Cu layers provides best adhesion due low internal stress of the Copper layer.

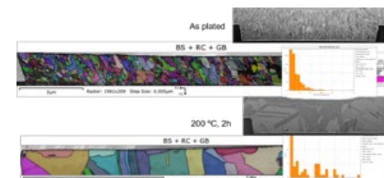




No/low stress of IntraCu® SC layers: 8 inch blanket wafer, plated on one side with 20 µm, warpage < 10 µm.

IntraCu® SC-4

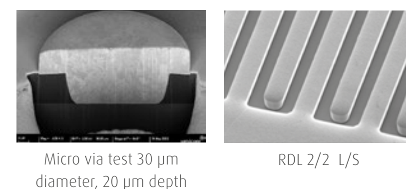
System has be specially designed for addressing morphological requirements for "Cu2Cu direct bonding" in 3D due the unique grain structure obtained. Its morphology remains largely unchanged after thermal excursions providing the basis for best pad height uniformity to allow further interconnect pitch scaling in W2W bonding.



Top – fine grained Copper layer (grains < 100 nm); bottom: grain growth after annealing by factor > 5

IntraCu® VF-9

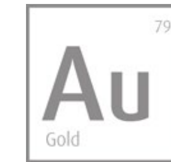
A copper plating process for simultaneously filling blind vias and reproducing fine line RDL with outstanding thickness distribution. In addition, the VF-9 can be seen as a real 3 in 1 process to be able to plate vias, RDL, as well as pillars.



Micro via test 30 µm diameter, 20 µm depth

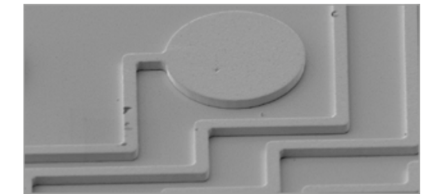
RDL 2/2 L/S

Umicore Electrolytes

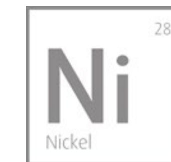


Umicore AURUNA® SC

A cyanide-free gold electroplating electrolyte for plating Gold with a purity of 99.99 %. The process is suitable for fine-pitched RDL wafers and Bump Plating. With the neutral pH range AURUNA® is compatible with most common resist types for this application. The process offer a very wide current density range and is very stable (up to 1.2 A/dm²).

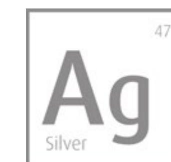


Gold plated lines and pad



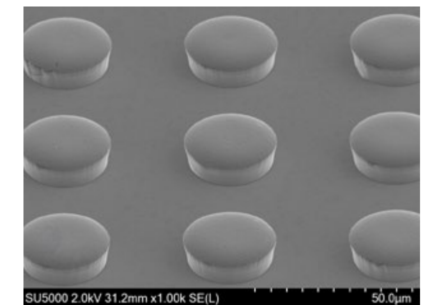
Umicore NiRUNA® SC

A sulfamate based system with very low stress, boric acid free version available.



Umicore ARGUNA® SC

Is a mild alkaline cyanide-free pure Silver plating. ARGUNA® layers exhibit purity > 99 % providing resistivity and solderability in cyanide systems. The process features a wide compatibility with most resist types.



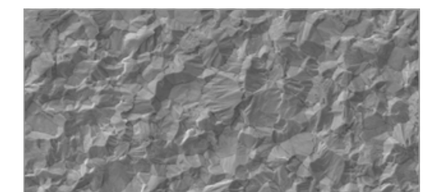
Bumps plated with NiRUNA® SC (boric acid free version of electrolyte)

Umicore Tin SC

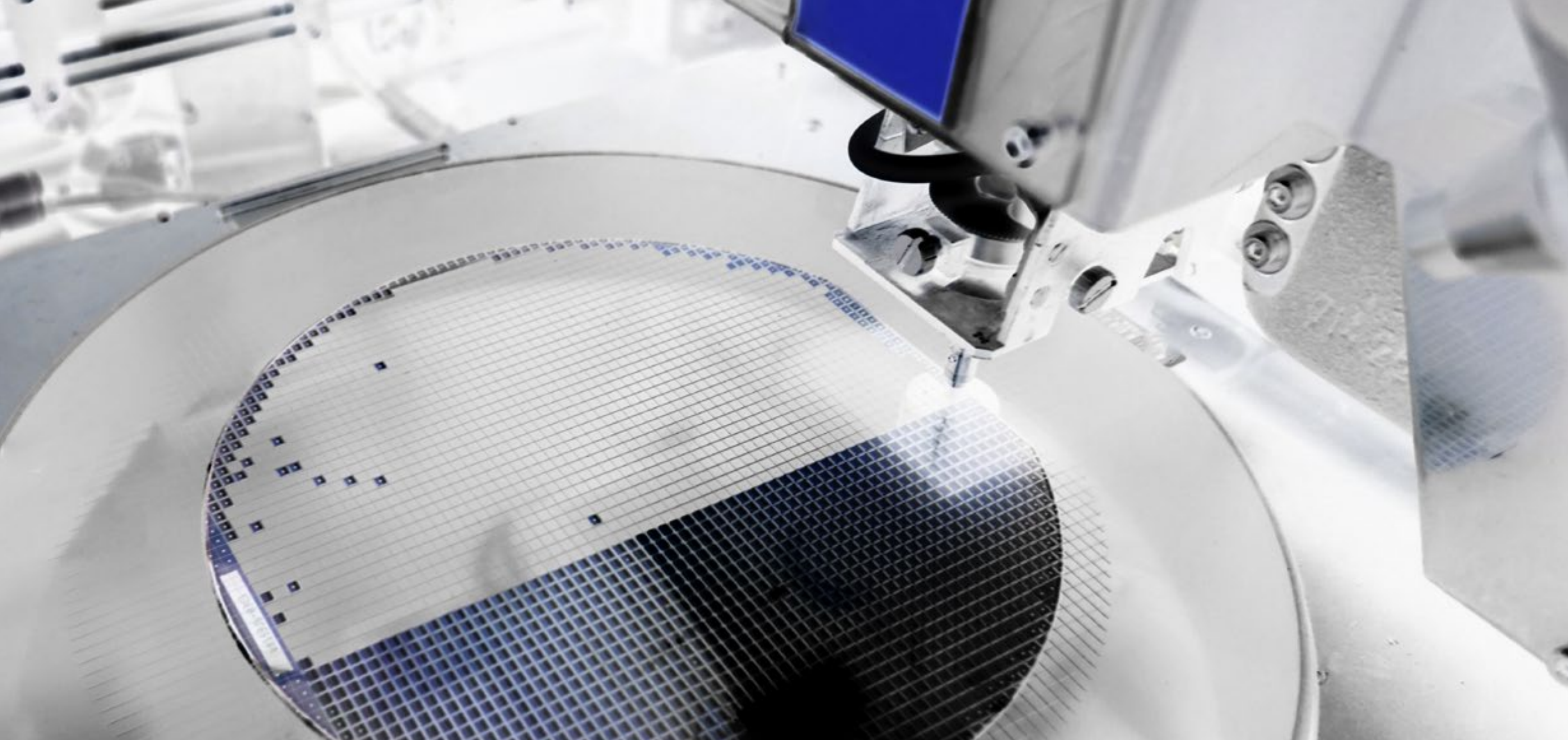
Pure Sn plating process operate with a wide current density range. The Sn coatings are very pure and have low tendency for whisker growth. Very stable electrolyte system based on MSA.

Umicore Indium SC

Umicore Indium SC systems deposit pure Indium layers over a very wide current density range. The stable electrolyte system is fully analysable and shows very good covering properties and uniform grain size.

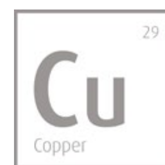


Typical grain structure Umicore Indium SC



ADVANCED PACKAGING

PRODUCTS FOR PERFECT ELECTROCHEMICAL DEPOSITION IN THE SEMICONDUCTOR INDUSTRY



Cu(II)Oxide high purity metal salt

Umicore copper oxide high purity metal oxide powder are developed, manufactured and quality tested in accordance with the demanding requirements of the semiconductor advanced packaging industry. In combination with ancosys DMR® concept (Direct Metal Replenishment) clean room usage is possible enabling lower cost of ownership for Cu replenishment along with a boost in performance of the electrolyte through higher Cu concentrations.

Picture: Courtesy ancosys GmbH

	Umicore CuO PG	Umicore CuO HG	Umicore CuO 4N
Application	RDL and panel level substrates	Panel substrates	Fine line RDL and Pillar
Purity	99,9 %	99,9%	99,99%
auto-dosing compatibility DMR	✓	-	✓
Dissolution speed	★	★	★★
High Speed Plating	✓	✓	✓
Clean room packed / compatible	✓	-	✓

NO VMS NEEDED

- H_2SO_4 concentration remaining consistent. Stable electrolyte volume, feed and bleed not needed.
- Several grades (4N, Packaging)
- Full traceability, only one source for Cu

COST EFFICIENCY

- Reduction tool down time, supporting maintenance-free plating chambers
- 50% lower cost per kg Cu compared with VMS
- 15% higher speed through higher Cu^{2+} (60g/l i/o 50g/l)

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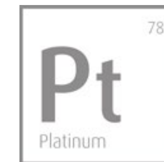
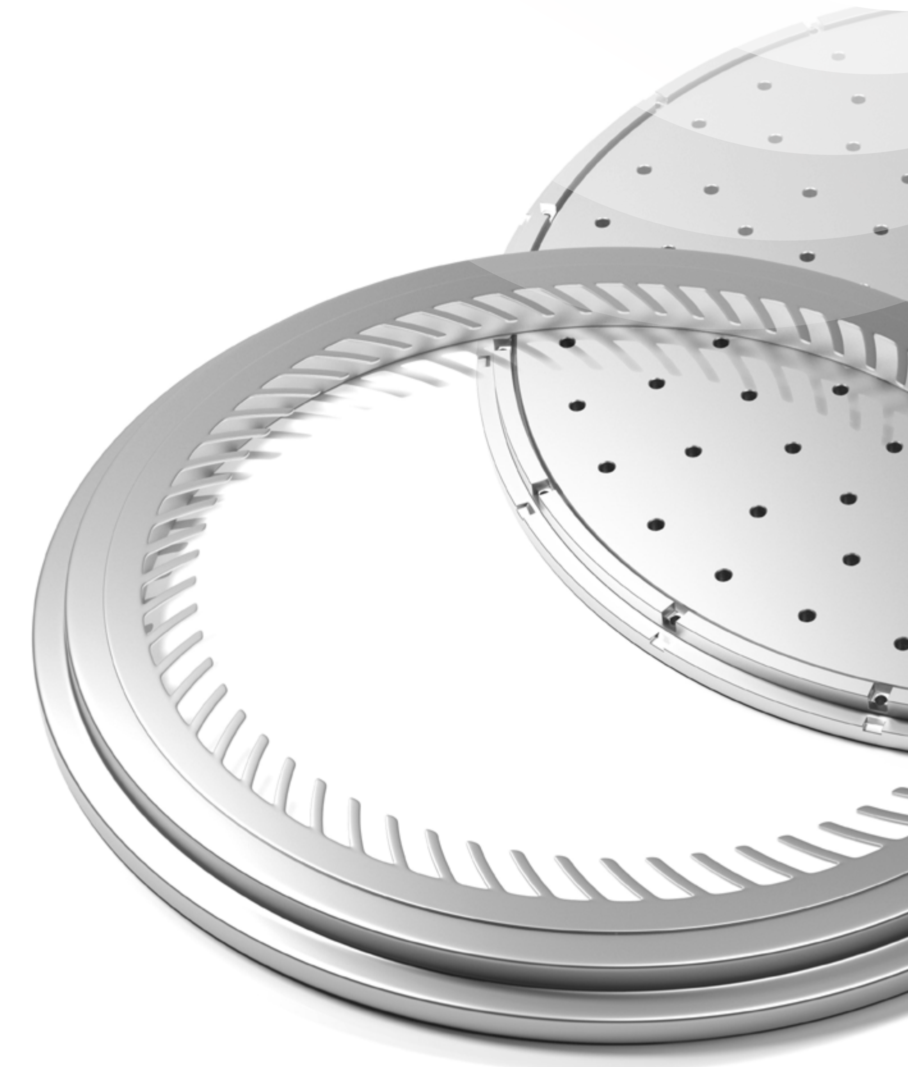


PLATINODE® SC Electrodes



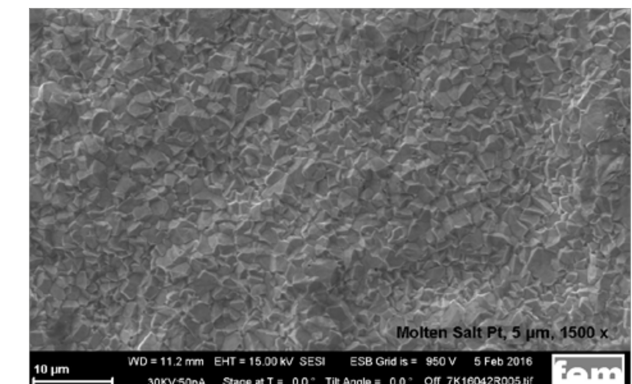
Insoluble anodes are proven to help increase process efficiency, reduce process costs, environmental impact and process control efforts in plating tools for advanced packaging. The key differentation of Umicore´s PLATINODE® is the unique layer performance due to the manufacturing method using a molten salt electrolyte allowing ultra-high purity, low porosity and best ductility even at high Pt layer thicknesses.

- Function: providing best-in-class ductility and chemical resistance due to unique HTE™ coating of electrode
- Customized designs, contact materials and coatings
- Fully integrated production and clean room packaging: Built-to-Order or series
- Insoluble anodes and cathodes in qualification for several WLP/PLP ECD Tools

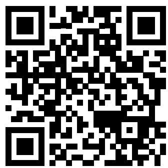
PLATINODE® SC PtTi	PLATINODE® SC MMO
Molten salt deposited Pt on Ti substrate	Developed for low organic consumption
Developed for high ASD, predictable lifetime and outmost current distribution accuracy	End of lifetime characterized by end of electrocatalytic function and wear rate
Pt thickness can be measured / correlated to lifetime	Thickness cannot be measured / correlated to lifetime

SEM

Surface morphology 5000x



Passion for perfect surfaces



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UMICORE S.A. has 11.948 employees globally, who generated revenues of €3,9 bn in 2023.

Its Business Unit Metal Deposition Solutions is a segment leader in precious metals electroplating.

International Set-Up for manufacturing, quality control, sales, marketing and logistics in the field of semiconductors.

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