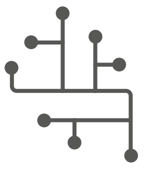
Electroplating

Leading production solutions for PCB and package substrates



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Electroplating at a glance

Leading-edge chemistry, equipment, and process solutions for printed circuit board, package substrate and panel level packaging

- Conformal plating
- BMV filling
- Through hole filling
- Pillar plating
- RDL plating
- Pretreatment
- Metal resist, electrolytic final finishes

Presence in 40 countries
Serving more than 1,000 customers

209 registered patents
worldwide

Highly trained plating
and application experts
in all key markets

Dedicated panel and pattern plating TechCenters
in Japan, Korea, Taiwan, China, and Germany

Cost advantage due to
significantly reduced
number of process steps

Market leader
With our Uniplate® InPulse 2 plating equipment, we are a true global market leader for horizontal conveyorized production

Electrolytic copper plating solutions with proven reliability

925

Uniplate® Cu plater installed ww

MKS' Atotech electrolytic plating solutions combine superior chemistry, robust equipment and in-depth expertise

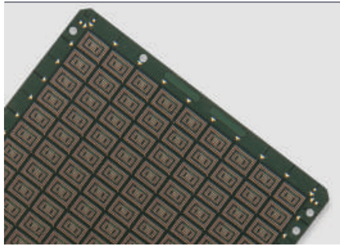
Our portfolio consists of chemical processes and equipment solutions that range from horizontal to vertical plating technology, from conformal high current density to copper filling of blind micro vias and through holes. Electrolytes and the corresponding pre-treatment are available for copper and tin as well as for electrolytic nickel and gold. We have advanced the concept of horizontal plating for all key market segments including MLB, HDI, advanced HDI, flex / rigid-flex and the package substrate board production. Our flagship production solution is the horizontal Uniplate® Cu InPulse system, which supports leading manufacturers by achieving lowest possible surface copper plating and highly reliable filling of through holes and BMVs as well as conformal plating. Recently, we launched a new vertical process series, the InPro® product family, that is designed for vertical equipment with insoluble anodes. Our latest development is the MultiPlate® tool, designed for RDL and pillar plating for fan-out panel level packaging.

We understand the goals of our customers

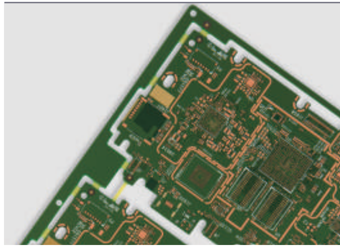
Providing highest reliability and productivity is our primary focus while developing new solutions.

Our broad solutions portfolio

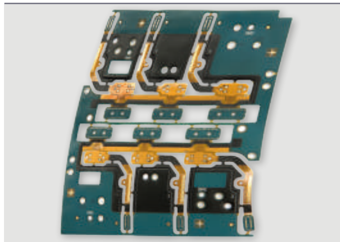
Panel level packaging



Package substrates



MLB / HDI



Flex / flex-rigid

Systems

Uniplate® Cu InPulse 2

Integrated production solution for panel conformal plating and BMV filling

Uniplate® Cu InPulse 2 Advanced

Advanced plater was specially designed for void free TH filling

Uniplate® Cu InPulse 3

Advanced plater for pattern plating BMV and TH filling

MultiPlate®

Innovative ECD system for next generation packaging technologies

	Uniplate®	VCP	Hoist type	MultiPlate®
RDL				Innolyte® PLP
Pillar				Innolyte® P
Conformal	Inpulse® 2HFU, Inpulse® 2HT	InPro® VLF	Cupracid® TP3	
BMV filling	Inpulse® 2HF, Inpulse® 2HF9	InPro® SAP3, InPro® SAP6, InPro® VLF	Cupracid® VF	
(a)mSAP	Inpulse® 2HFU, Inpulse® 3MSAP	InPro® THF, InPro® THF2, InPro® VLF	InPro® THF, InPro® THF2, Cupracid® TP3	
TH filling	InPro® THF, InPro® THF2	InPro® THF, InPro® THF2	InPro® THF, InPro® THF2	
Pillar plating		InPro® PI, InPro® CPF	InPro® PI, InPro® CPF	
Conformal	Inpulse® 2H7, Inpulse® 2HT	Cupracid® AC, InPro® VLF, Cuprapulse® IN	Cupracid® TP3, Cupracid® TLC, Cupracid® AC, Cuprapulse® XP7, Cuprapulse® IN	
BMV filling	Inpulse® 2HF, Inpulse® 2HF9	InPro® MVF, InPro® MVF2	Cupracid® VF, InPro® MVF, InPro® MVF2	
(a)mSAP	Inpulse® 2HFU, Inpulse® 3MSAP	InPro® THF, InPro® THF2, InPro® VLF	InPro® THF, InPro® THF2, Cupracid® TP3	
Conformal	Inpulse® 2H7, Inpulse® 2R8	Cupracid® FP, Cupracid® FLEX, InPro® FLEX	Cupracid® FP, Cupracid® FLEX, InPro FLEX®	
BMV filling	Inpulse® 2HF, Inpulse® 2HF9	InPro® RA	InPro® RA	

Auxiliary equipment

vPlate®

Vertical continuous copper plating system for advanced technologies such as mSAP and IC substrate

Redumat

Regeneration unit for electrolytic copper

Electrolytic copper plating for highest reliability and challenging dimensions

> 80%

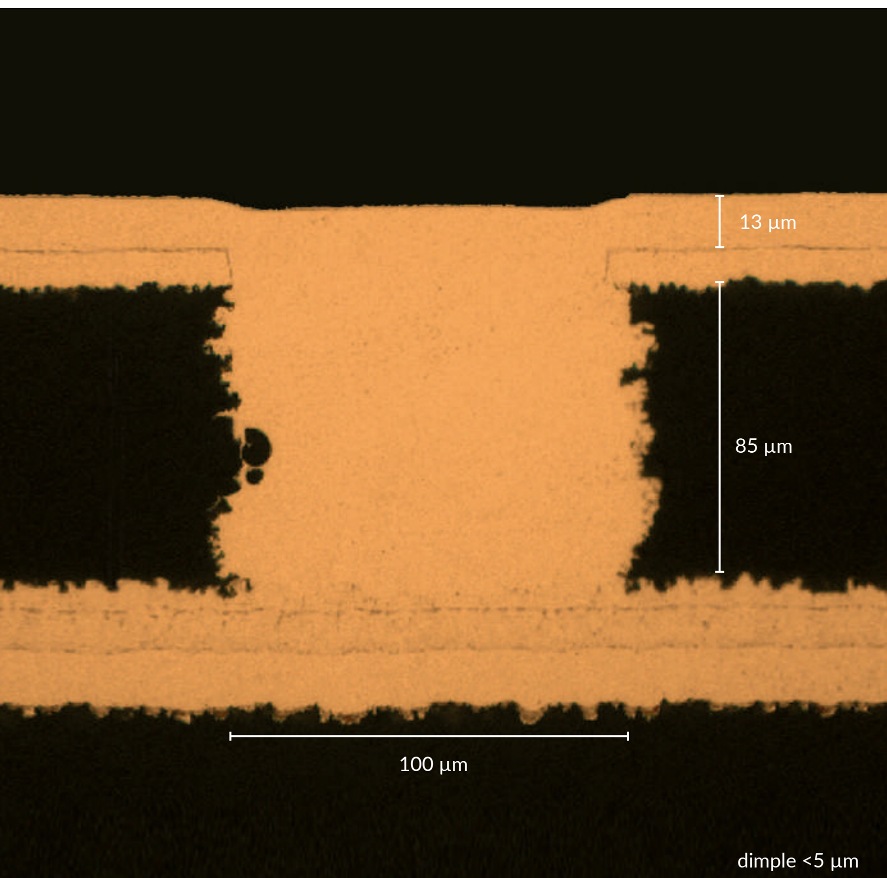
throwing power at 2.2 A/dm² in BMV with Cupracid®

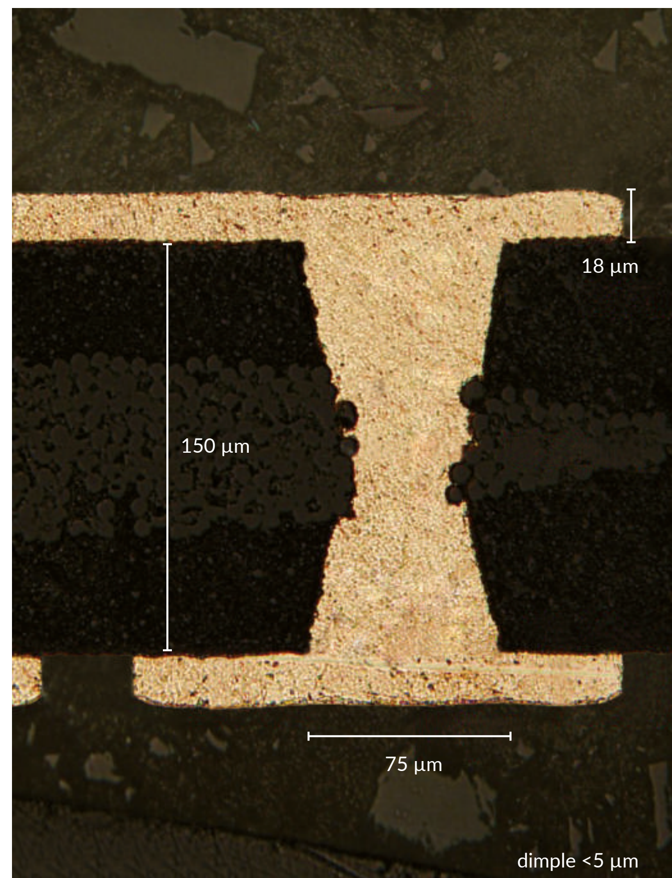
Best process solutions for all kinds of equipment

The panel and pattern plating team at MKS' Atotech provides the right solutions for electrolytic plating such as through hole filling (THF), filling of blind micro vias, pillar and conformal plating. Backed with years of experience, we serve the market with processes that are compatible not only with our line of equipment Uniplate® InPulse and MultiPlate® but also conventional hoist type equipment and vertcial conveyorized plating (VCP) systems.

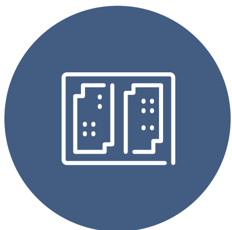
New installations in vertical conveyorized systems for electrolytic copper plating are mainly made with insoluble anodes, not only for blind micro via (BMV) filling but for conformal plating as well. For electrolytic plating with insoluble anodes our InPro® offers cost and performance advantages. It can be deployed for HDI and package substrate applications.

Our Cupracid® family product range is designed for plating with soluble anodes. With the Cupracid® range of products we have established a clear market leading position in conformal plating for flex, MLB and HDI application.

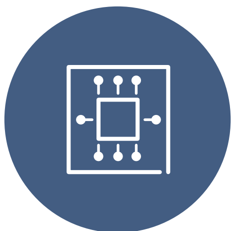




Innovation for next generation HDI and packaging technologies



Solutions for next generation HDI PCBs



Solutions for next generation package substrates and panel level packaging

We offer chemicals along with appropriate equipment to address all key performance requirements

Since the introduction in 1987, more than 925 of MKS' Atotech platers have been deployed at customer locations worldwide. The latest Uniplate® Cu InPulse 3 (IP3) enables pattern plating capabilities through a newly developed fluid delivery system. The controlled fluid distribution enables a stable and „touchless" panel transport of pattern boards down to 20/20 µm lines/spaces. Apart from that our Uniplate® platers offer several features like segmented anodes, a modular transport system, inline filtration for particle reduction, a special clamping system and a high level of automatization.

With the development of MultiPlate®, MKS' Atotech took a huge step forward in the field of panel level packaging. MultiPlate® ensures significantly faster (≥20 ASD) deposition compared to traditional fountain platers (≤10 ASD). The overall voiding performance is also enhanced.

High purity chemistries and careful monitoring of the bath components during plating help achieve pure Cu depositions. This is a critical criterion to measure the reliability of deposited structures and to avoid voiding at the intermetallic phase on copper pillars after reflow.

Sophisticated innovations and technically superior design allow for an excellent distribution of deposition to enable fine pitch interconnects.

End markets and industries we serve

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Smartphone

Automotive electronics

Computing

Big data infrastructure

Consumer electronics

Communication infrastructure

Atotech an MKS Brand

info@atotech.com

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Cupracid® TP5

Advanced conformal DC plating for vertical hoist type systems

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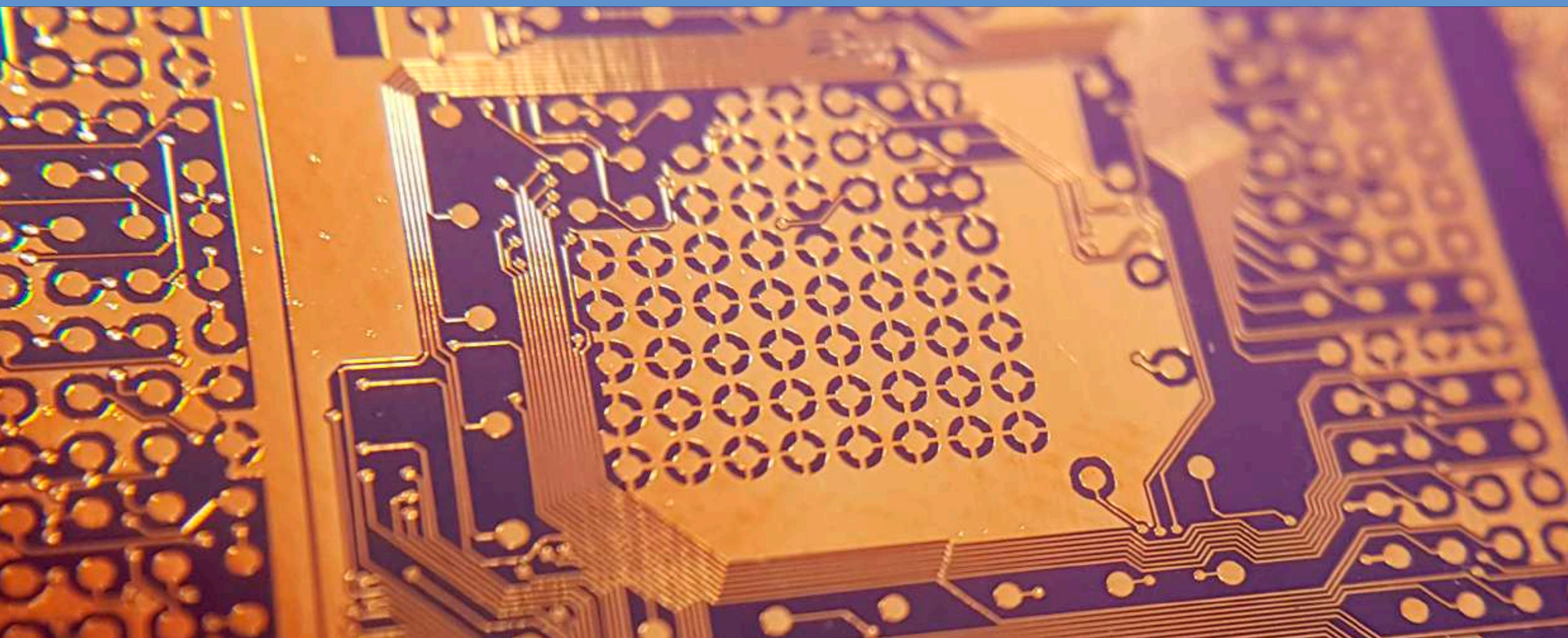

Highest throwing power with excellent reliability

>90%

Copper corner strength

Outstanding DC conformal plating performance

Cupracid® TP5 is a conformal copper plating solution with soluble anodes in DC mode designed for vertical hoist type equipment with air agitation. It provides the highest throwing power on the market in through holes while ensuring excellent reliability. It also gives excellent results in BMV plating. Compatible to a wide range of metallization processes, Cupracid® TP5 leads to a corner strength of the copper of more than 90% which is key for a reliable copper deposition.

The process has passed automotive reliability tests with outstanding results (TCT 2,000 cycles). Its high current density capability of up to 2.5 A/dm² is ideal for high productivity. For best process control, all additives can be controlled by CVS.

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Conformal DC plating for highest requirements

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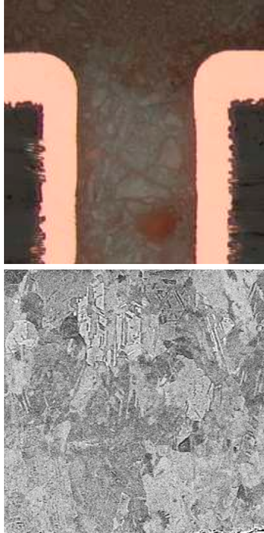


Figure 1:
Corner strength >90%.
Figure 2:
Uniform crystal structure without defects

Excellent throwing power

Cupracid® TP5 assures a stable performance within the working ranges and provides a stable, shiny surface. The line shape is comparable at 2.3 and 3 A/dm², while the ductility/ tensile strength ensures stable values independent of CD. It provides best in class throwing power in through hole, which leads to cost savings, as less copper needs to be plated at the surface.

Excellent crystal structure for outstanding reliability

Cupracid® TP5 provides a polygonal (non direct) crystal structure with some twins. The twins have a grain size of 2-5 µm. The crystal structure is also free of grain boundary defects and assures a uniform structure at surface, entrance and center. This is also key to the excellent performance in reliability test results, for example passing 2,000 cycles in TCT online test.

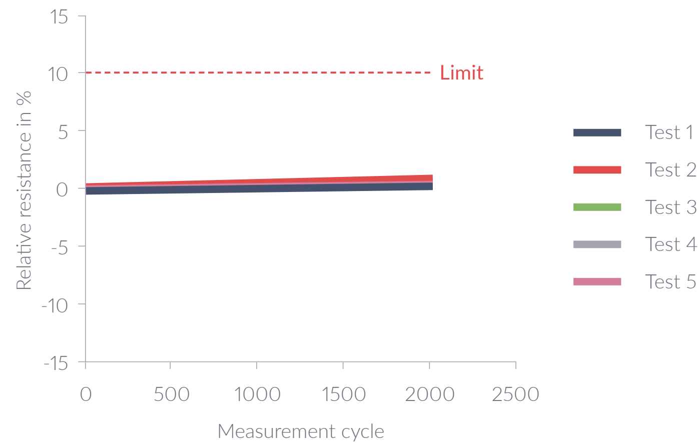
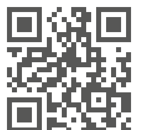


Figure 3: TCT test results: Online TCT 2,000 cycles, -40/125 °C 15/15 min.

Features and benefits

- Electrolytic copper plating process for conventional DC equipment
- Advanced throwing power with high applied current densities for increased productivity
- Excellent corner strength and physical properties for outstanding reliability results
- High current density capability for high productivity
- Compatible with all commonly used direct metallization processes
- Wide additive working range and fully controllable with CVS analysis for easy process control



InPro® Pulse TVF

Vertical THF in pulse systems

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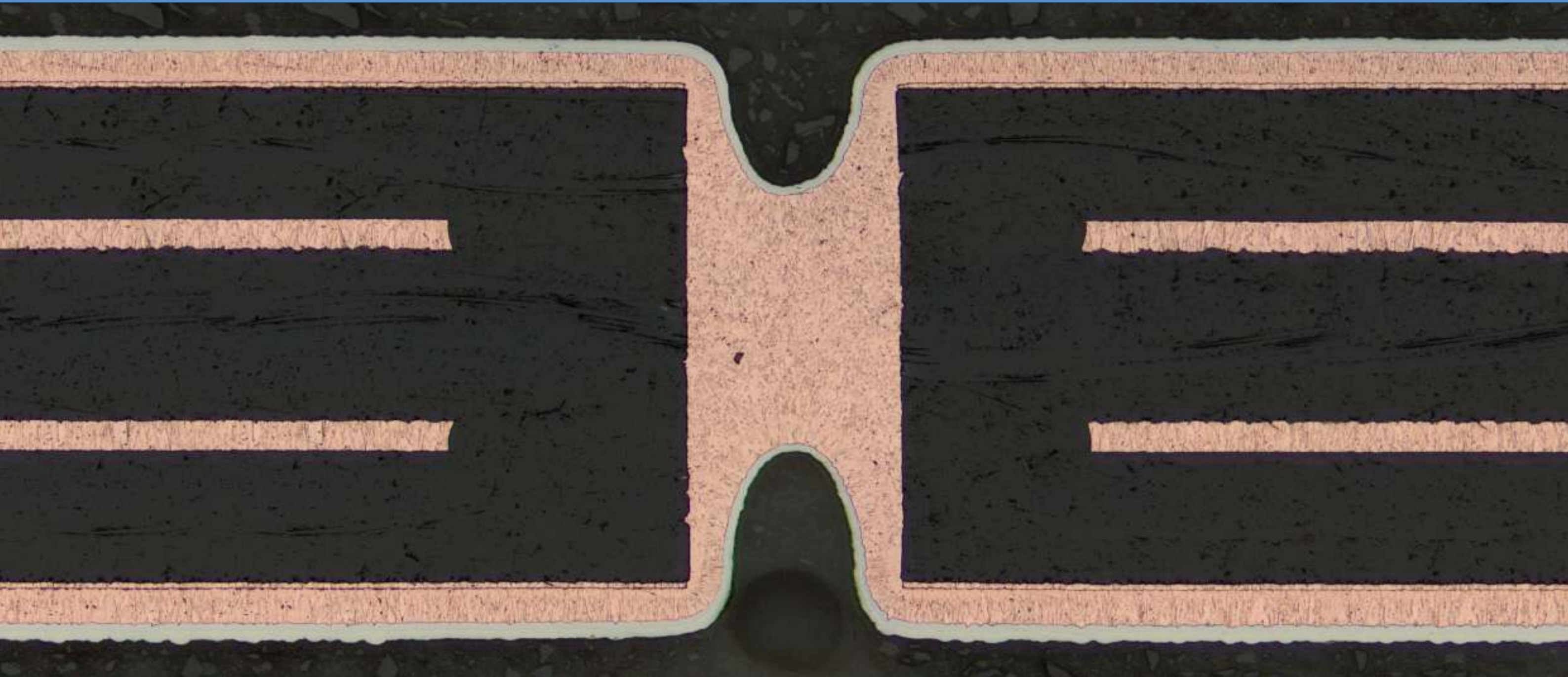

The ideal solution for high AR TH filling with best reliability

Up to

3:1

void free through hole filling at higher AR

Less plating time, higher productivity

Our new InPro® Pulse TVF tackles the growing market demand for improved thermal management in 5G and LED applications and assures a higher targeted core thickness for MTH/LTH filling.

Our patented bridge plating technology for inclusion-free core filling of through holes is now available also for pattern through hole filling in VCP mode and at a low cost. At the same time, InPro® Pulse TVF has a long lifetime with reduced activation times and can be applied at high current densities. It leads to higher productivity at less plating time and is also applicable for BMV filling.

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High throughput for void-free THF

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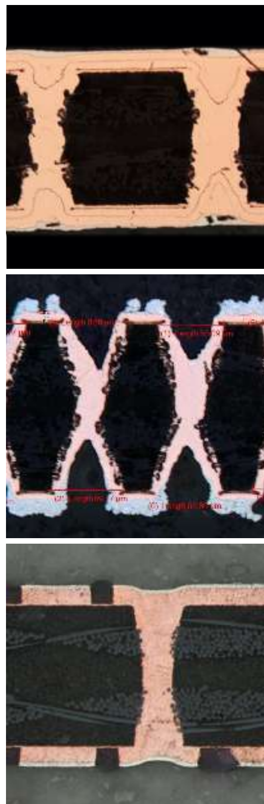

Figure 1:
Panel TH filing: 80 min
(26 µm CuT), 200 × 100 µm
Figure 2:
Pattern bridging: 30 min
(8-9 µm CuT), 200 × 75 µm
Figure 3:
Pattern TH filling: 45 min
(23 µm CuT), 200 × 75 µm

InPro® Pulse TVF

Our patented bridge plating is now available for vertical application. In contrast to through hole filling in DC mode, the bridging by pulses enables void-free through hole filling, which is critical for best reliability. InPro® Pulse TVF ensures a higher throughput for THF then comparable DC POR. This reduces the overall sustainability footprint and leads to a longer electrolyte lifetime with fewer new make-ups being necessary. The process can be operated in panel and pattern plating.

Advantages and features

As a void-free MTH/LTH filling process, InPro® Pulse TVF ensures the best reliability for TH filling and is suitable for heat dissipation because of the excellent thermal conductivity of copper. This allows for new designs to be manufactured. The process uses high current density pulse plating, which leads to less plating time, higher productivity, and higher throughput compared to DC POR. The long lifetime process provides a stable filling production at reduced costs for chemicals and maintenance. It is also applicable for BMV filling making it unnecessary to change the process. Further advantages include a reduced activation time and the capability for finer lines and spaces in pattern-plating mode.

Features and benefits

- High reliability for TH filling
- Copper filling for best heat dissipation
- High throughput at reduced costs
- Enabling finer lines and spaces
- Applicable for BMV and TH filling
- Higher throughput than DC POR
- Reduced maintenance and chemicals costs compared to plugging processes

Inpulse® 2HF9

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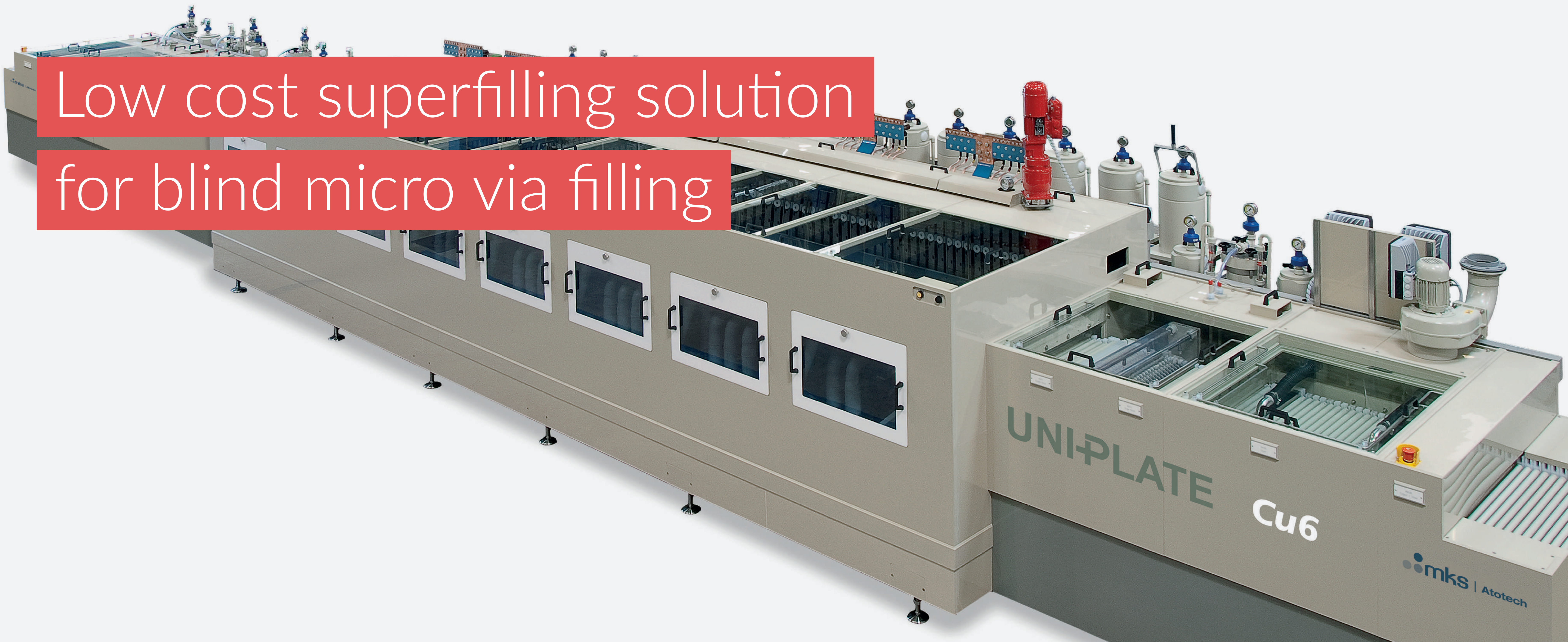
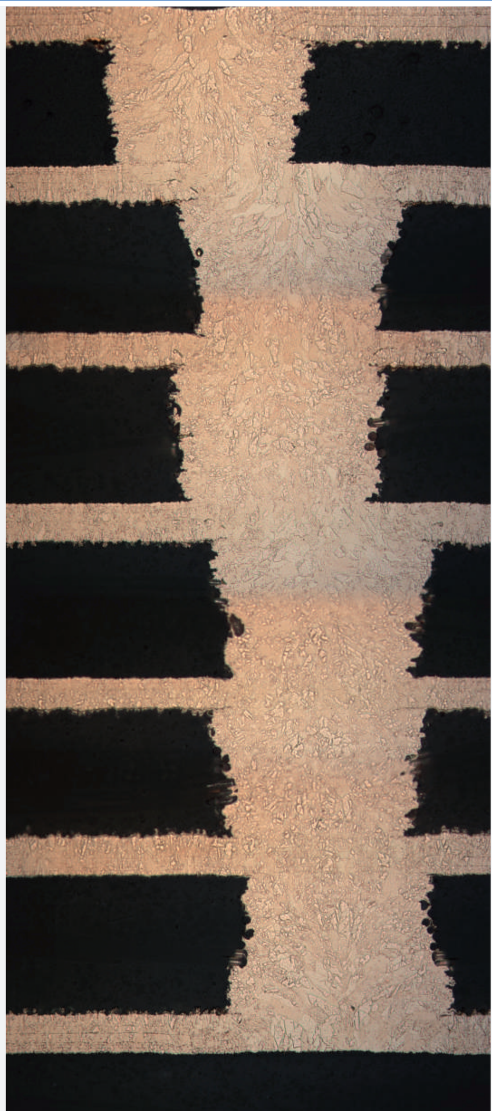
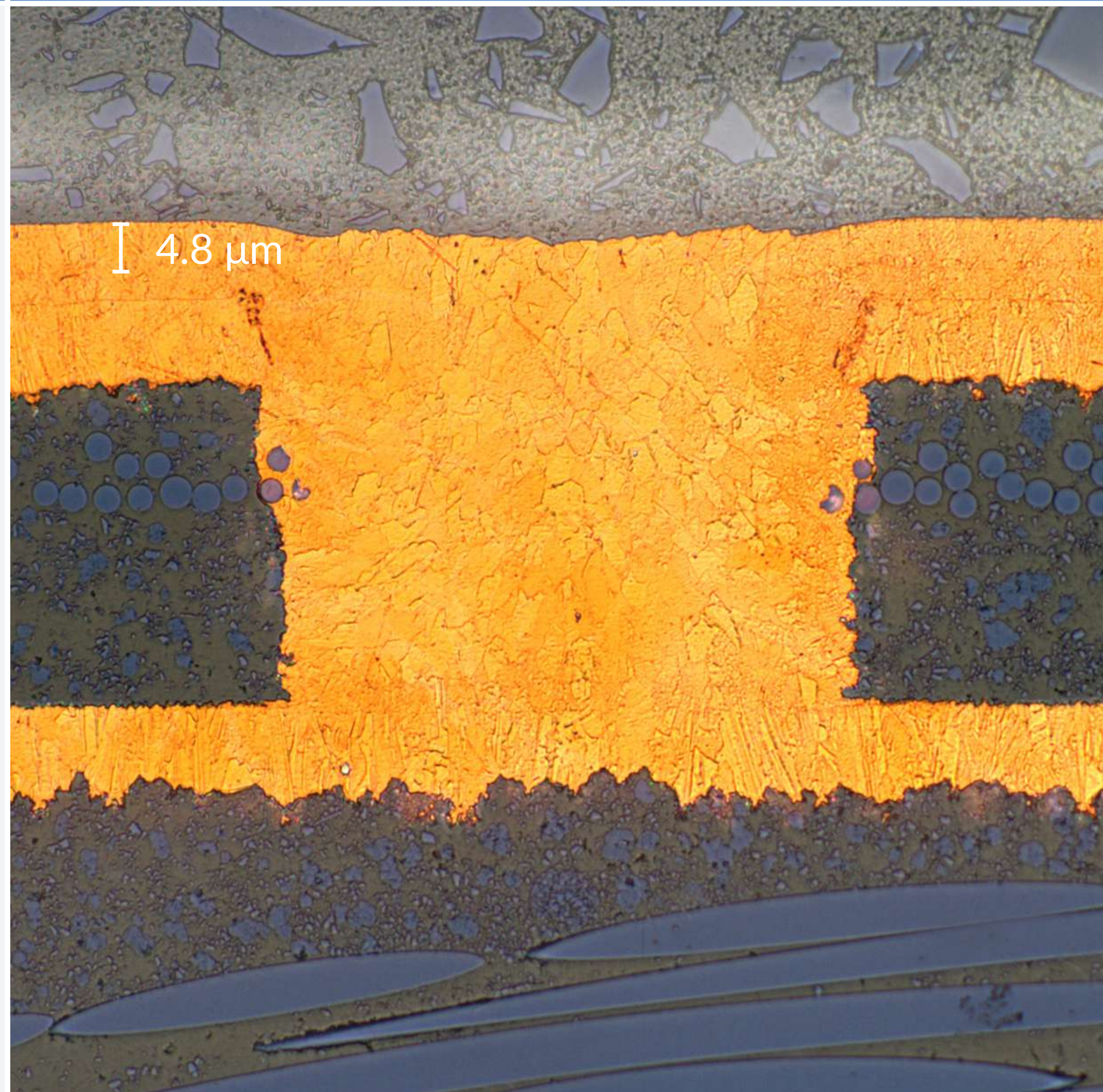


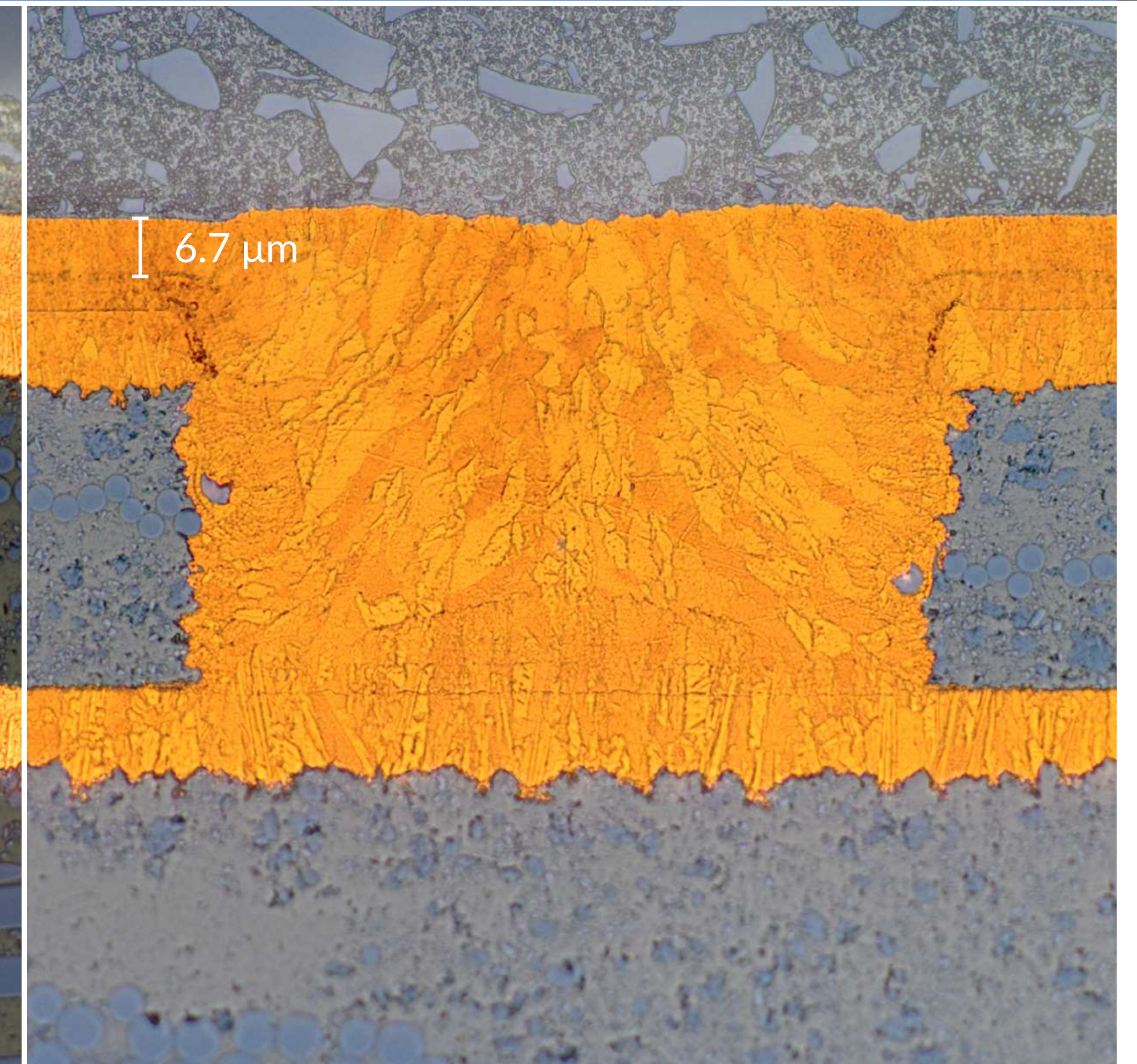
Low cost superfilling solution for blind micro via filling

Filled stacked BMV for smart phone production



Superfilling® technology for BMV filling





- Plating thickness on surface 4.8 µm
- Plating time ~14 min
- BMV with 100 µm diameter, 70 µm depth
- Dimple < 5 µm

- Plating thickness on surface 6.7 µm
- Plating time ~20 min
- BMV with 125 µm diameter, 70 µm depth
- Dimple < 5 µm

savings in material usage while increasing productivity and performance

50

percent less plated copper on surface

Superior filling results with minimum surface plated copper

Inpulse® 2HF9 with insoluble anodes gives longest electrolyte lifetime and is proven in high volume HDI production. The process offers a combined conveyorized metallization and plating system. Inpulse® 2HF9 enables filled BMV's with less than 5 µm dimple. Inpulse® 2 equipment with Inpulse® 2HF9 chemistry = one system from one supplier – One reliable, mass production proven system from Atotech.

Features and benefits

- Good BMV filling performance
- Very good productivity with shortest production time
- Excellent planarity with low dimple
- Proven reliability by enabling horizontal wet to wet process flow and enabling good Cu crystal structure
- Saves money by plating less copper onto the surface

Cuprapulse® XP8

mks Atotech

New vertical RPP process for high throughput applications

Excellent throwing power for HAR

With Cuprapulse® XP8 you can achieve a higher throwing power performance when compared to traditional direct current processes. The process is designed for pulse plating with soluble anodes. It achieves the desired thickness in the hole while at the same time minimizing the copper plating thickness on the surface. A lower overall plating thickness will limit manufacturing restrictions concerning line and space applications to < 100 µm.

Cuprapulse® XP8 can be operated in traditional hoist-type equipment and in VCP systems. It offers a very wide working range of organic additives. Both additives are controlled via CVS. The high applicable current density (up to 4 A/dm^2) and the improved performance (throwing power approx. 100% for TH 1.6×0.2 mm) allow for increased productivity and output. This quickly compensates higher equipment costs.

Features and benefits

- Capable for panel and pattern plating of high aspect ratio applications at high current densities when compared to standard DC plating
- Much better surface distribution resulting in cost reductions in metal and post-treatments
- Productivity is increased with simultaneous quality improvements compared to DC mode
- Applicable for VCP and hoist type equipment with soluble anodes
- Outstanding throwing power performance for high volume HDI manufacturing and high aspect ratio plating up to AR 40:1
- No change in surface appearance over wide working window
- Meets reliability requirements according to industry standards
- Less limitations for fine line plating due to outstanding surface distribution performance

>90%

throwing power for HAR boards