

Sustainable technologies

Our commitment to the future



Electronics

Sustainability

www.atotech.com

“Being global means thinking globally. It’s about looking at the bigger picture and pledging a commitment to sustainability. We are all united by our responsibility to our industries, communities and the environment at large. Atotech is committed to making a difference. Are you?”

Reinhard Schneider
President of Atotech



Our commitment to the future

At Atotech, we are committed to being an innovative and environmentally conscious company.

As the leading manufacturer of plating chemicals and equipment for the electronics and surface finishing industries, sustainability is at the very core of our business. Finding the balance between industrial innovation, sustainability and economic viability is what inspires us. It's what moves us forward.

We have set a clear goal for ourselves: to be the leading supplier of sustainable plating systems. To achieve this we rigorously invest in sharpening our expertise to offer leading-edge and cost-efficient products. At the same time, we strive to stay at the forefront of promoting environmentally sound technologies.

Ultimately we seek to remove all of the following from our products:

- CMR substances (carcinogenic, mutagenic and reproductive toxic)
- Toxic substances (e.g. cyanide, hexavalent chromium, nickel-compounds)
- Heavy metals (e.g. lead, mercury, cadmium)
- Allergenic substances (e.g. nickel)

Our systems are designed to use water, energy and raw materials very efficiently, which means less waste and greater savings for our customers.



14%

reduction in toxic raw materials since 2010
(which equals 3,163 t)

“Our goal is to not only comply with chemical regulations, but to raise the standards even higher.”

Alexander Samai
Manager Sustainable Development



12%

of revenue
was spent on R&D (2015)

We enable customers to

Produce next-generation products

Reduce production costs

Improve production efficiency

Save energy

Reduce the environmental footprint

In an ever evolving environment we add value for our customers by supplying high-performance, high-quality, and highly reliable production solutions and services.

In recent years, environmental regulations such as REACH, ELV and WEEE/RoHS focused on the chemical industry have gained immense importance. The plating industry is one of many industries to feel its direct impact. As a result, there is a growing need and demand for ecological products, creating a new set of challenges and responsibilities for our industries.

In order to meet our goals of corporate responsibility, we have developed and implemented strategic, sustainable practices across all areas of our businesses and operations. These processes enable us and our partners to remain one step ahead of the competition. Our approach to sustainability is integrated into everything we do.

We have been able to create a strong cooperative environment backed by a growing number of local TechCenters across the world. Through many successful trials and demonstrations at our TechCenters, we have built a high level of trust with our customers and industry partners. Today, we are recognized in our industry for distinct sustainable technologies.

Our chemical processes, plating equipment and auxiliaries are aligned with the latest industry roadmaps. We are constantly working on the development of green and efficient solutions to accommodate future industry requirements.

Working together to ensure sustainability

Businesses that focus on short-term gains often fail to see the substantial, long-term merits of sustainability. We have been able to demonstrate measurable cost savings for many of our customers with the help of sophisticated systems such as wastewater treatment technologies, waste reduction, and recycling processes. We also provide a complete factory design concept to our customers, including state-of-the-art sustainable production technology.

Development of sustainable technologies is a lengthy and complex process. Hence, the entire value chain – suppliers, customers, communities, and government bodies alike – needs to work in close collaboration. We have cultivated strong partnerships with the industry in order to keep pace with emerging technology, its cost demands and raising environmental local regulations.

Similarly, close collaboration with our customers helps us expedite the product development process – be it chemistry, plating equipment, or auxiliaries. We also invest heavily in joint projects with the Tier I-III, OEMs, and universities. This gives us a valuable insight into various industrial and theoretical fields – accelerating the development of the next generation products.

39%

of our R&D projects were devoted to sustainable goals (2015)

> 90

collaborations with OEMs, Tiers, customers, institutes and universities (2015)

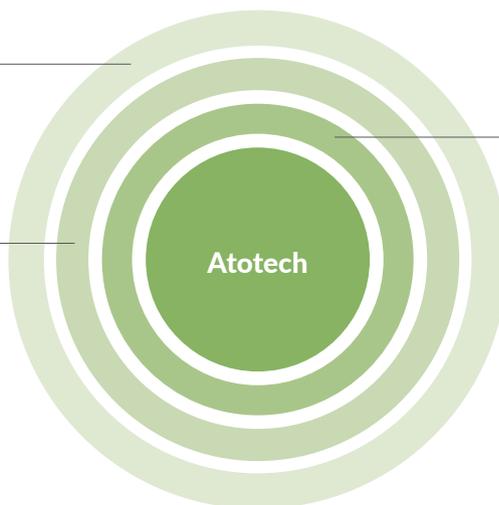
Industry environment

Industry drivers

Cost
New technology
Environment

Influence factors

Legislations
Roadmaps
Industries



Cooperations

Customers
Tier I-III
OEMs
Universities
Institutes

Accomplishments we are proud of

It is our uncompromising commitment to eliminate harmful substances from our products.

3,163 t

reduction in toxic raw materials
since 2010

Always keeping health and safety in mind, we remain critical and hungry for improvement. Since 2010, we have reduced the toxic raw material usage by 3,163 t. This is what makes us proud.

Besides reducing our carbon footprint, we also minimize wastewater, energy and chemistry consumptions. This unique approach makes our products the smart choice for eco-conscious manufacturers.

1,000 t

of copper material saved
per year, compared to insoluble
anode plating systems using
copper oxide or copper carbonate

Environmentally responsible chemical processes for today

Biodegradable NPE and PFOS-free acid cleaner

Boron-free acid cleaners

Direct palladium on copper

EDTA-free electroless copper for high-tech processes

Fluoride-free metal strippers

Formaldehyde-free electroless copper

Methanol-free passivation

Metal stabilizer-free electroless nickel

Nickel-free electroless copper

Lead-free alternatives for surface finishing

Reduction of DMAB consumptions

Cyanide-free immersion gold bath

Replacement of biocides for acid cleaners

Replacement of thiourea for NEAP alternatives

Solvent-free silanes

“We will continue to launch environmentally-responsible plating solutions in the future.”

Dr. Gerd Linka
R&D Manager Electronics



We are working to further increase the number of environmentally-responsible manufacturing alternatives and to continuously improve our expertise.

Environmentally responsible chemical processes for the future

Alternatives to nickel as a diffusion barrier

Alternatives to sodium chlorite

Alternatives to thiourea as a complexing agent

Boric acid-free ionic activator

Boron-free reducer for Uniplate

Cyanide-free autocatalytic gold bath

Dimethylformamide-free cleaner additive

Non-toxic NMP/NEP-free high performance sweller

Non-toxic stabilizers

Permanganate-free desmear

Reduction in energy consumption with optimized manufacturing equipment

TMAH-free resist strippers



Smart investments for a sustainable production

Our eco-friendly chemical products and auxiliary systems perfectly complement our production equipment – supporting our customers to achieve highest standards in sustainable production.

≥ 45%

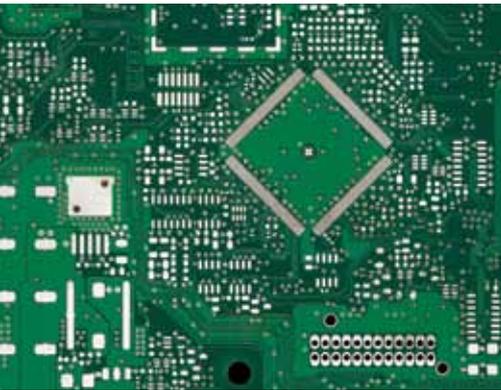
lower rinse water and
chemical consumption
compared to standard
vertical line

At Atotech, we work tirelessly to offer ecological solutions while ensuring profitability. Our products such as Uniplate and Horizon echo this philosophy. Today, Uniplate systems are used extensively for desmear, metallization and electrolytic copper plating processes. Similarly, Horizon systems are recognized within our industry for its superior surface treatment and finishing processes.

With 45% less chemical drag-out and 45% less chemical usage compared to vertical operations, our horizontal systems offer measurable benefits. Both systems provide tailor-made solutions to perfectly match our customers' production requirements. We are constantly looking for intelligent alternatives to lower the chemistry, water and energy consumption, while persistently enhancing the process stability and performance.

Atotech's horizontal systems need much less overall handling and interaction with potentially harmful substances, thus creating a safer environment for the personnel.

Greener PCB and package substrate manufacturing



UNIPLATE and HORIZON – horizontal systems

Reduced chemical consumption and costs

Greater productivity and improved quality

Energy efficiency

Minimum water usage and lower wastewater

Parameter	Standard vertical line	Uniplate system
Water consumption	100 %	55 %
Chemistry Consumption	100 %	55 %

Uniplate

Uniplate InPulse 2
Electrolytic copper



Uniplate LB
Electroless copper



Uniplate P
Desmear



Horizon

Horizon Stannatech
Immersion tin



Horizon BondFilm
Surface treatment



Atotech
systems

Reduce sludge (MnO_2), energy and desmear production costs

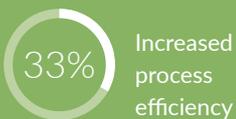


Our production proven regeneration unit Oxamat for Uniplate P systems significantly reduces the sludge of manganese dioxide (MnO_2) typically generated during the desmear process. Oxamat system regenerates manganese to permanganate, thereby preventing the accumulation of sludge and other chemical dosing.

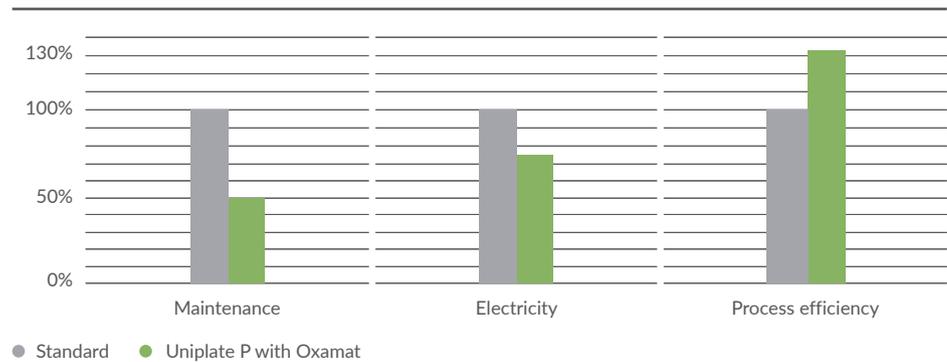
Oxamat also allows for improved efficiencies by cutting the maintenance time by almost half. Extensive cleaning cycles and make-ups which are usually needed are not required with Oxamat.

With Atotech's Uniplate P line, customers can save up to 25% of electricity costs as compared to the vertical line. This is due to the fact that while reducing heat loss Oxamat also improves the overall efficiency by close to one-third.

UNIPLATE P with OXAMAT renewing permanganate



Uniplate P with Oxamat system vs. standard vertical line



Uniplate P desmear system



Minimize chemistry drag-out, wastewater and costs



UNIPLATE LB for reliable metallization

42% Less copper*

20% Less formaldehyde*

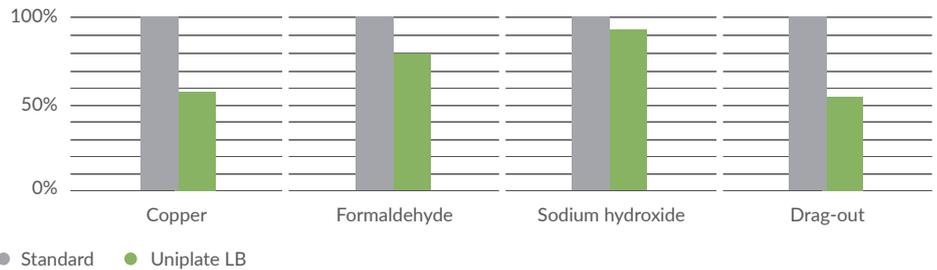
7% Less sodium hydroxide*

45% Less dragout

Atotech's Uniplate LB system for metallization meets the highest quality requirements. At the same time it consumes 42% less copper compared to standard vertical lines in electroless plating processes for high end HDI boards.*

The Uniplate LB has been given the Total Ecosolutions label – a recognition for its significant environmental advantages, which include measurable savings of copper, sodium hydroxide and formaldehyde.

Uniplate LB vs. standard vertical line



*Savings are calculated based on the following assumptions for high tech HDI manufacturing:

- Horizontal Uniplate LB system requires less electroless copper thickness (0.35m) in the through-hole plating process compared to a standard vertical system (0.7m).
- Chemical savings based on 64.5 million m² of boards p.a.

Measurably lower copper consumption and process costs

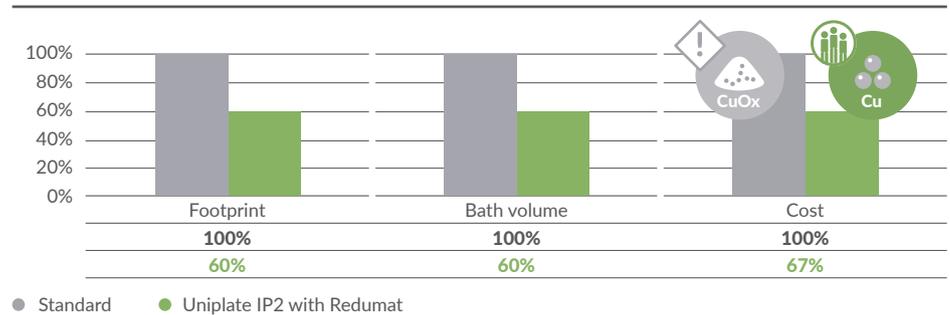


Atotech's Uniplate IP2 (InPulse 2) system for electrolytic copper deposition is based on the patented iron mediator (Fe^{2+} / Fe^{3+}).

Customers can yield the highest benefit when the Uniplate IP2 system gets combined with the Redumat regeneration unit for electrolytic copper. Reduced chemical consumption compared to insoluble anode systems using copper oxide or copper carbonate results in savings of hundreds of tons plating solution per year.

Furthermore, Uniplate IP2 combined with Redumat increases bath life and equipment availability, thus requiring minimum maintenance.

Uniplate IP2 with Redumat system vs. standard vertical line



UNIPLATE IP2 with REDUMAT copper replenishment

- Lower chemical consumption
- Longer bath life time
- Less maintenance
- Less contamination

Uniplate IP2 Advanced Plater for through hole filling



Conserve copper for blind micro via filling and through hole filling



Blind micro via filling

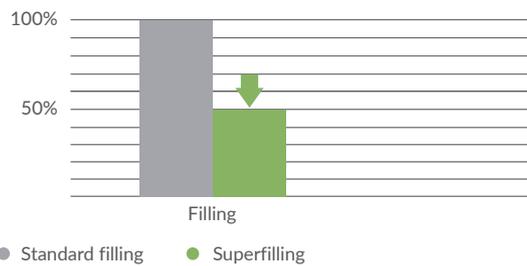
Savings on copper, solder mask and etching

Less wastewater

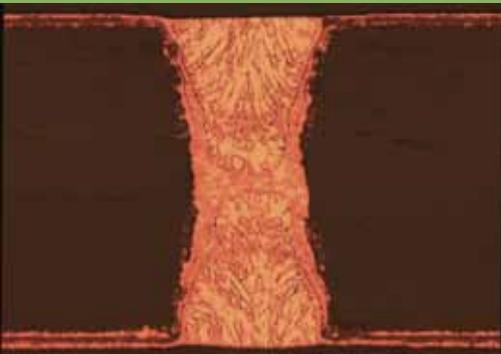
Savings on raw material

Our Superfilling technology is a unique process for blind micro via (BMV) filling with an absolute minimum of surface plated copper. This process meets all the key requirements with 50% less surface plated copper in comparison to conventional filling. The thinner copper layer requires less copper etching and rinsing during associated processes which reduces etching costs as well as wastewater.

Copper savings with Superfilling



-50% copper on surface



Through hole filling

Lower process costs

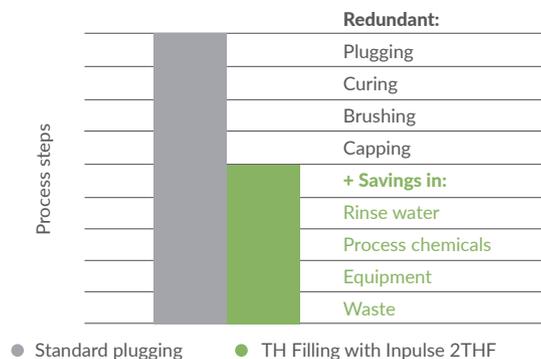
Higher yield

Savings on raw material costs

The innovative through hole filling process reduces manufacturing steps and consumes fewer plating chemicals thus conserving resources.

The cost-efficient process saves up to two-third of surface plated copper compared to conventional through hole plugging while achieving a higher yield.

Chemistry and resource savings with Inpulse 2THF due to reduced process steps



Saving 4 process steps

Recycle immersion tin chemistry and reduce production costs



ConStannic and Crystallizer are patented immersion tin regeneration units that guarantee highest productivity while keeping the environmental impact at a minimum.

It is composed of two individual elements. The ConStannic reduces electrolytically Sn^{4+} to the beneficial Sn^{2+} . Simultaneously the Crystallizer generates copper. Both parts combined eliminate the severe sludge formation that occurs normally in the process and replaces extensive feed and bleed dosing or frequent new make-ups.

ConStannic and Crystallizer have been given the Total Ecosolutions label – a recognition for its continuous recovery of copper and Sn^{2+} allowing for a potentially unlimited solution life-time. This results in a massive reduction of raw materials and wastewater.

CRYSTALLIZER and CONSTANNIC immersion tin regeneration



Less chemistry consumption*



Less downtime



Reduced process costs



Higher productivity

*Using additional filter press for the Crystallizer to minimize loss of process bath

Crystallizer and ConStannic vs. standard immersion tin line

	Total chemistry consumption	Tin	Thiourea	Productivity	Process cost	Down time
Standard	100%	100%	100%	70%	100%	10%
Atotech's Crystallizer and ConStannic*	10%	10%	10%	95%	70%	5%

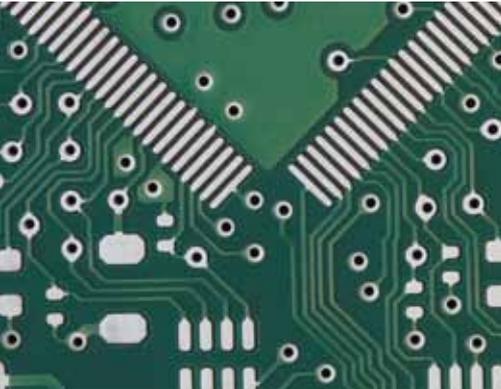
ConStannic tin regeneration unit



Crystallizer tin regeneration unit



Boost immersion tin process productivity



HORIZON STANNATECH immersion tin process

Lower energy consumption compared to the HASL process

Performance consistency

Lower process costs

Higher yield

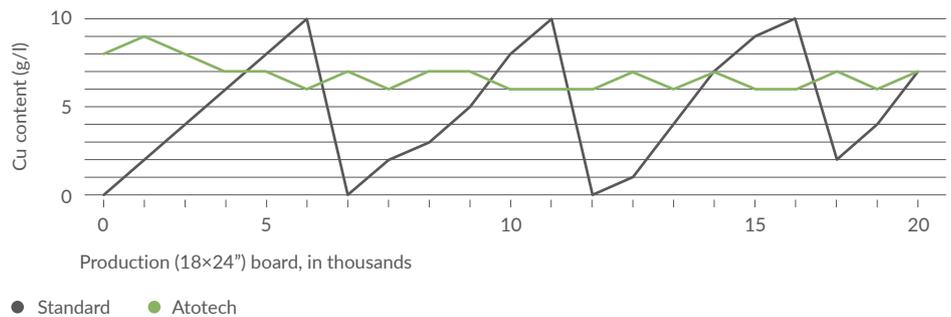
Atotech's Horizon Stannatech process combines excellent reliability with lead-free and halogen-free soldering techniques.

The applied inorganic anti whisker additive deposits pure planar tin, limiting the danger of voids and organic inclusions to nearly zero.

Horizon Stannatech operates at low temperatures, thus reducing the thermal stress on the board. The consequent lower warpage is a major advantage compared to the HASL process.

Excellent bath stability, chemistry lifetime of up to twelve month and unique multiple soldering performance provide higher yield and flexibility in production.

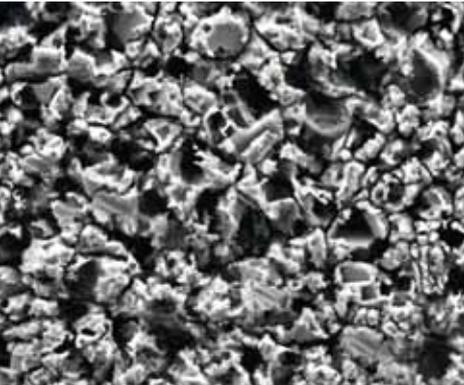
Copper content of Stannatech with Crystallizer vs. standard immersion tin line



Horizon Stannatech immersion tin system



Enhance inner layer bonding and stay cost-effective



HORIZON BONDFILM oxide alternative system

High copper loading window

Minimize waste water

Consistently high quality

Significantly lower COD values

The Horizon BondFilm is Atotech's oxide alternative system designed to promote both mechanical and chemical bonding which leads to excellent adhesion and thermal reliability performance.

Over 80 Horizon BondFilm lines are installed and more than 350 lines in total run the BondFilm process. This makes us the global market leader for inner layer bonding.

When processed through the BondFilm bath the copper structure undergoes a micro-roughening and a treatment to form an organo-metallic layer on the surface that promotes both mechanical and chemical bonding.

The high copper loading of up to 45 g/l reduces wastewater significantly lowers the environmental impact. Another advantage comes from our low chemical oxygen demand (COD) values as can be seen in the table below.

Ambitious R&D efforts by Atotech ensure that our customers will be supported with innovative, simple, sustainable and very cost-effective processes marketed under the BondFilm brand.

BondFilm vs. standard bath (comparison of chemical oxygen demand values)



Horizon BondFilm oxide alternative system



Recover copper and eliminate wastewater for SAP/MSAP



Our recovery unit combined with EcoFlash is a unique differential etch process that allows for continuous regeneration of the etching solution therefore minimizes waste by over 90%.

By utilizing the redox system of ferric and ferrous sulfate the electrolytic cells are used to regenerate the consumed oxidizing agent at the same time removing the etched copper as pure solid copper.

EcoFlash has been designed as a one-step drop-in replacement for semi additive process/ modified semi additive process (SAP/MSAP) applications with a tailor-made additive to ensure the desired performance.

Recovery unit with ECOFLASH for differential etching

Continuous regeneration of etching solution

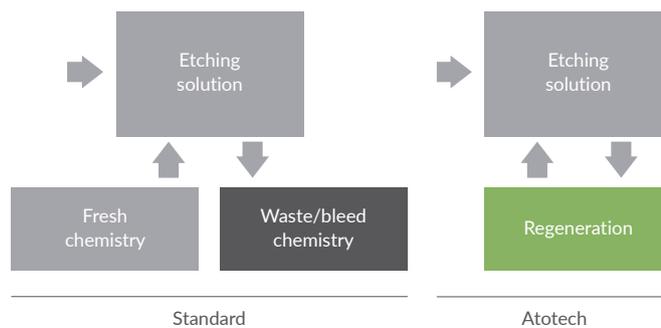
Copper recovery

Significantly reduced waste

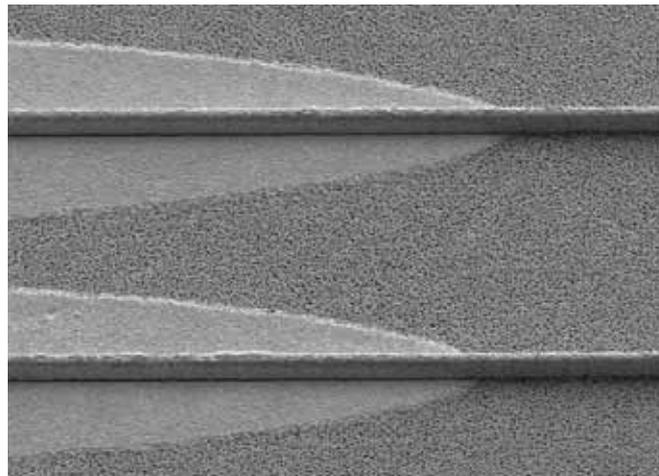
Lower production costs

Reliable performance

EcoFlash systems with recovery unit vs. standard etching system



EcoFlash - no undercut or lifting of 6µm conductors





Monitor and control the manufacturing process

≥ 25%

chemistry saved during the
desmear and metallization
processes

Atotech's online analytics enable fast, simple and direct management of all key parameters which influence the quality of the plating processes.

The automated on-line analysis system can be easily implemented in pre-existing production lines providing consistent monitoring of the baths. It also ensures maximum control over the line by performing a wide range of automated analyses, from titration and spectroscopy to conductivity measurements.

If combined with dosing units, the system can also automatically adjust the composition of the baths, prolonging their life-time and preserving the high quality of the plated layers.

With prompt analysis of results, the entire plating process can be effectively maintained at consistent, optimum conditions, resulting in higher material and production yields, as well as overall lower process costs.

By measurably reducing laboratory time, automating the analytical control of process baths also allows for lower overall plating costs.

For instance, a single Uniplate P and LB line for desmear and metallization can save up to 10-25% materials, depending on the chemicals being used.

Automatical analysis, process control and dosing



ON-LINE ANALYTIC for electrolytic copper process

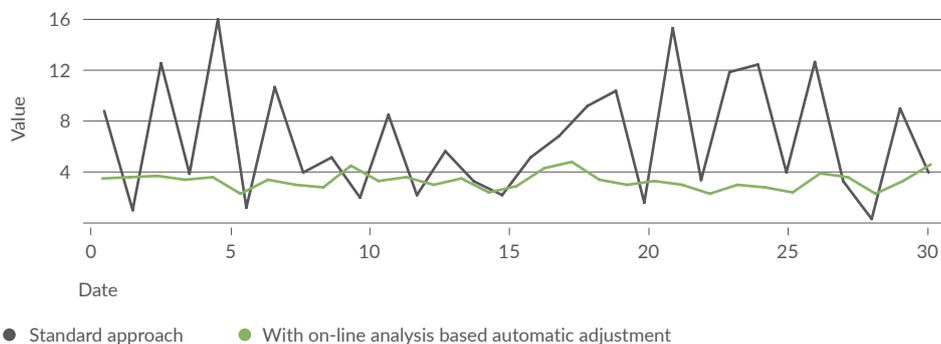
Tighter chemical control of
the essential working baths

Process stability

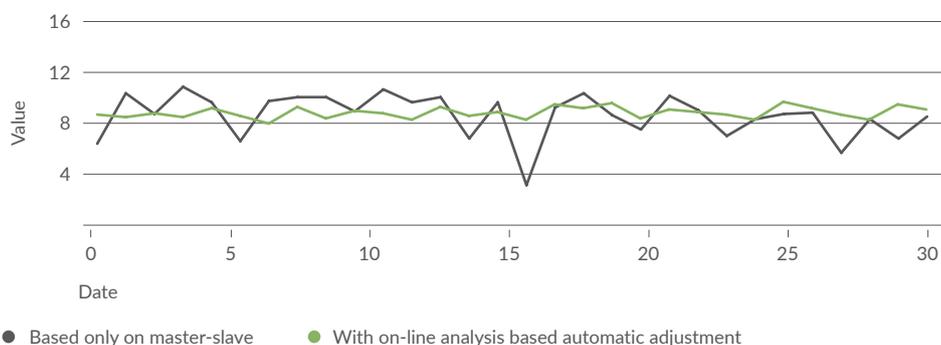
Improving concentration
distribution resulting in
tighter working window

Higher process reliability

Comparison of dosing control for reducer concentration



Comparison of dosing control for sodium hydroxide (NaOH) concentration
in electroless copper bath



Our commitment

At Atotech, we have set a clear goal for ourselves: to be the leading supplier of sustainable plating and surface finishing systems.

We are committed to removing toxic substances from our product portfolio.

Our systems are designed to efficiently use water, energy and raw materials, which reduces waste and delivers greater savings for our customers.

39%

of our R&D projects are related to sustainable technologies.

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Technology for tomorrow's solutions



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