Technology expertise opens new frontiers

As an internationally recognised premium brand, Meyer Burger offers its customers highly efficient precision products and innovative solutions, such as for the manufacture of solar cells and solar modules. Following the sale of its wafer business to Precision Surfacing Solutions, which is planned to take effect end of March 2019, Meyer Burger is directing its focus in photovoltaics on cell coating and connection technologies within the value chain; thereby, creating significant customer value and setting itself apart from competitors.

At the same time, the company is also applying its expertise and technologies in areas of the semiconductor and optoelectronic industries, as well as in other selected high-end markets for semiconductor materials.

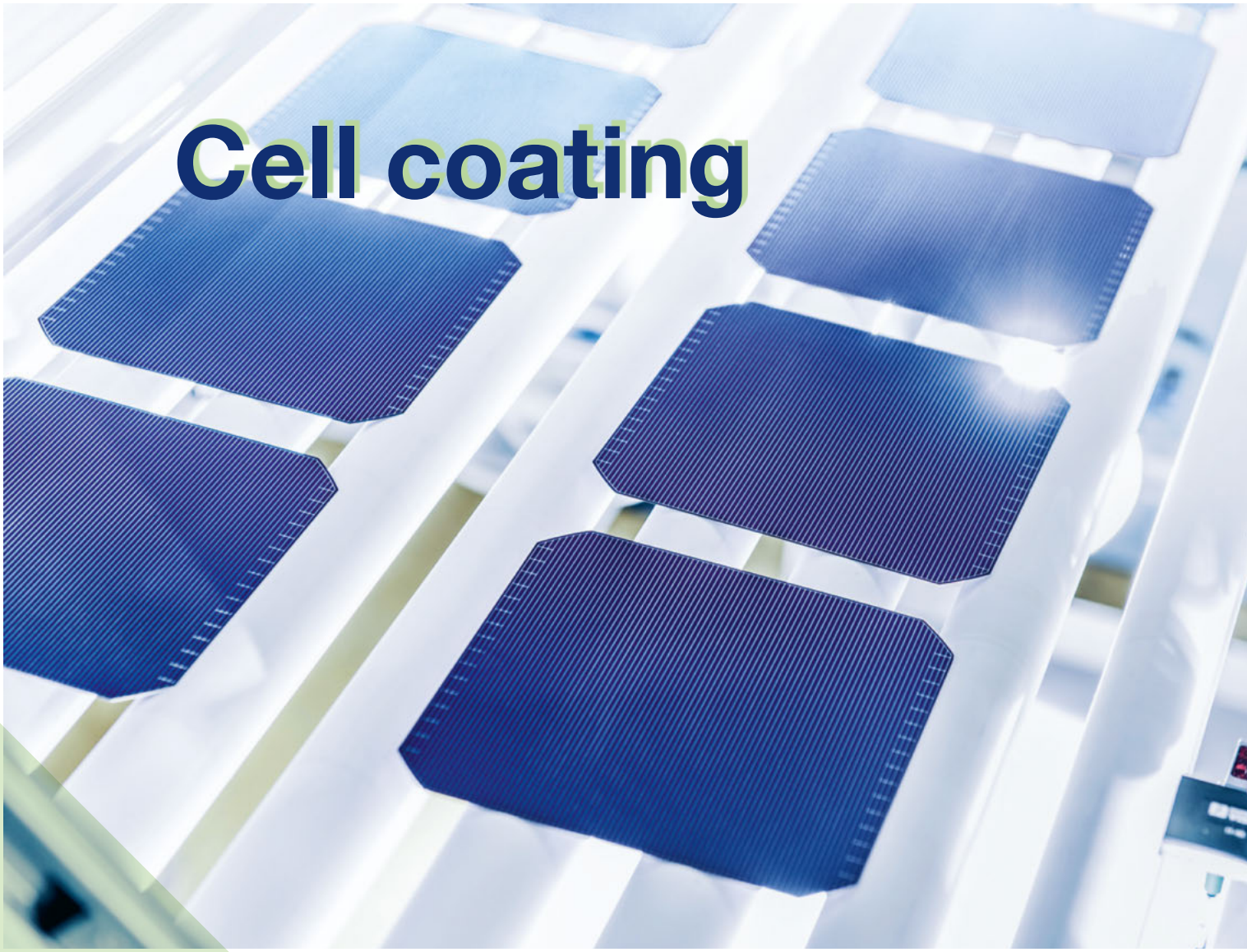
Presenting a record-breaking module

Especially in the PV industry, innovations from Meyer Burger are redefining the state-of-the-art. In May 2018, in cooperation with Meyer Burger, the renowned research institute CEA INES (Alternative Energies and Atomic Energy Commission), produced a new heterojunction (HJT) 72–solar cell module that reached a record module performance of 410 watts. It integrated HJT cells, which were manufactured on the industrial 2,400 wph Meyer Burger cell production equipment within CEA INES' pilot line and were connected together in Thun on Meyer Burger's SmartWire Connection Technology (SWCT™) equipment.

Meyer Burger presented the bifacial (double-sided) glass-glass version of the record-breaking module at the Intersolar trade fair in June 2018. Assuming average sunlight reflection (albedo) of 17% (depending on the substrate or background) to the rear of the module, this module can deliver a record performance of 480 watt peak.

Over the course of the past year, Meyer Burger has further refined its technological expertise, providing efficient solutions for the production of solar wafers, cells and modules, as described on the following pages.

Cell coating

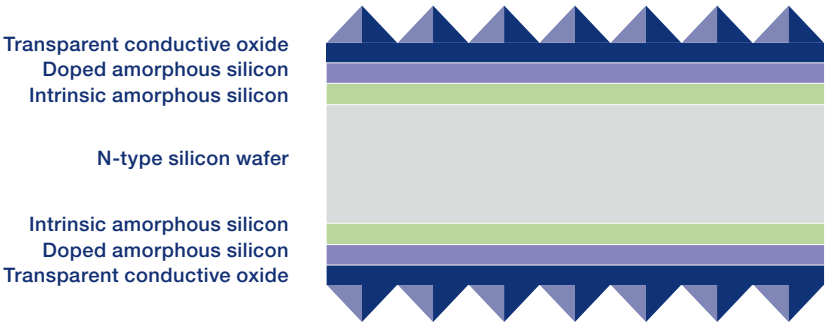


Meyer Burger has long been an industry leader in ensuring, and increasing, highest efficiencies in the industrial production of solar cells. Continuous technology enhancements in the technology roadmap for cell production are a core area of expertise at Meyer Burger; applying to both standard cell coating technologies such as PERC (Passivated Emitter Rear Cell), as well as to advanced cell technologies such as heterojunction (HJT).

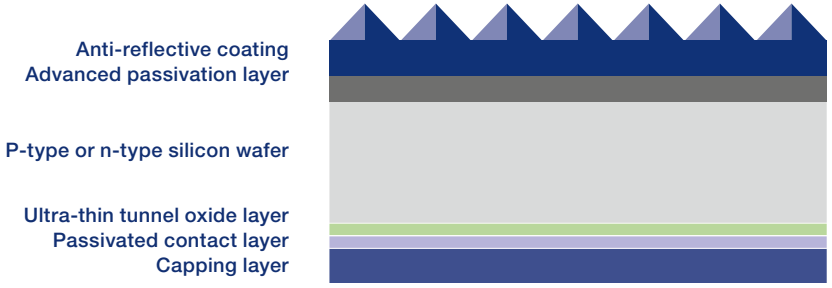
Solar cell efficiency

The efficiency of solar cells has steadily increased in recent years. This is the direct result of progress in research and development as well as the simultaneous industrialisation of newly developed technology manufacturing innovations. In both of these fields, Meyer Burger is making a significant contribution to permanently increasing the efficiency of solar cells through sophisticated coating technologies.

High-efficiency heterojunction (HJT) solar cell



Advanced PERx solar cell



Heterojunction – Cutting-edge technology for solar cells

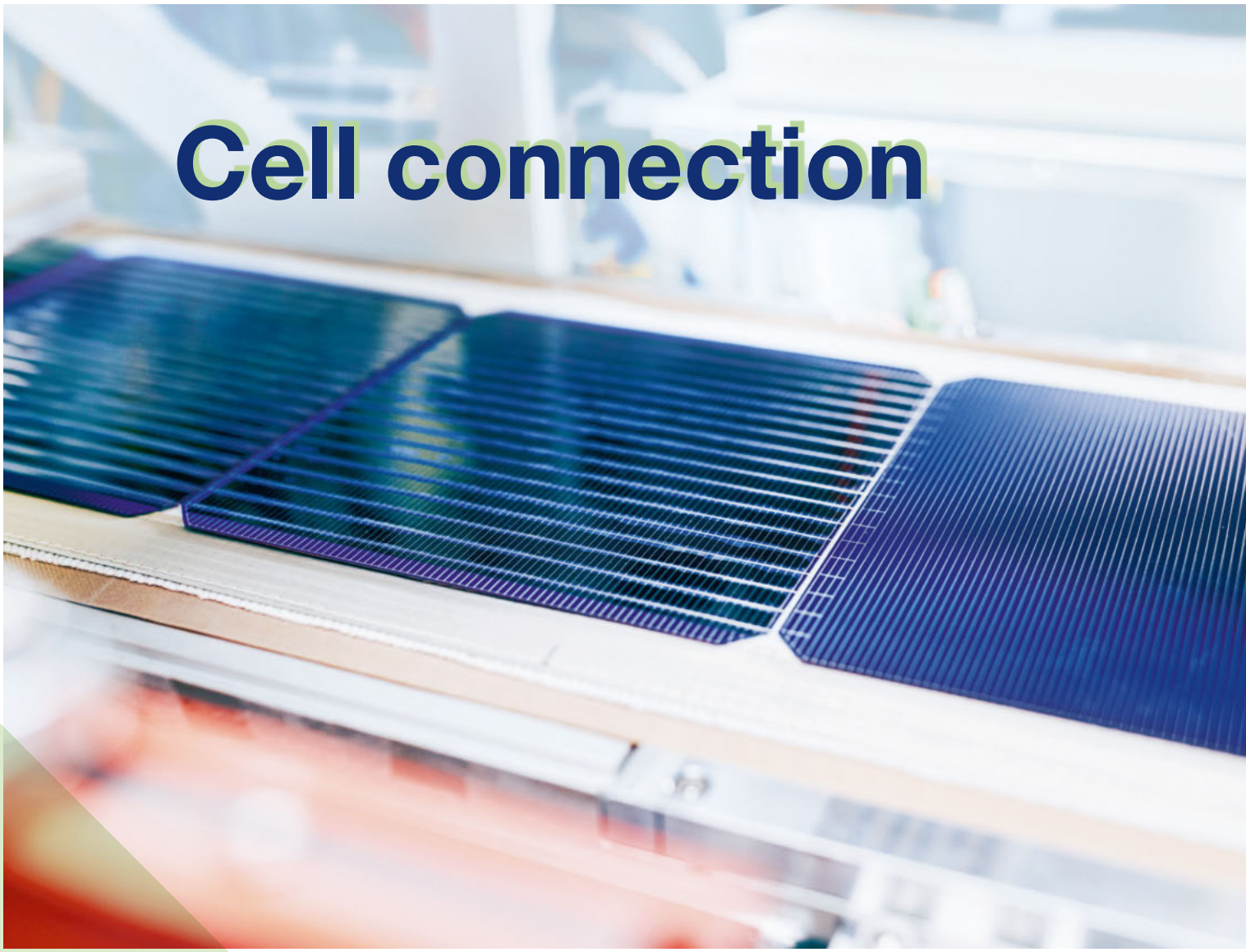
The term “high-end technology” applies, in particular, to heterojunction (HJT) cell coating technology, which combines the benefits of crystalline silicon solar cells with those of thin film technologies. As a result, solar cells can achieve efficiencies in excess of 24%, while lowering production costs. Further cost advantages can be achieved through the comparatively simple low-temperature manufacturing concept, which consists of only six production steps, thus saving energy and making the process economically attractive for manufacturers. In combination with the markedly higher electricity yield that HJT modules deliver compared to conventional silicon solar cells, this translates into the lowest levelized cost of energy (LCOE).

Upgrade for PERC cells

Based on many years of development work, Meyer Burger’s PERC technology has now become the standard solution for the industrial production of highly efficient solar cells. Meyer Burger’s production platform enables the integration of anti-reflective front cell coating and rear cell passivation coating in a single system. Several industry-proven process steps in the same platform increase both throughput and yield.

Current developments in PERC technology continue to focus on passivated contacts (PaCo) technology. This reduces the transfer resistance within the silicon cell and boosts efficiency. Based on pilot projects with industry partners, Meyer Burger has developed the CAiA® coating system, which will be launched in 2019 and will make PaCo technology available for the serialised production of solar cells. CAiA® can be integrated into existing PERC systems as an upgrade and enables cell efficiency to be increased to ~23% (+1%).

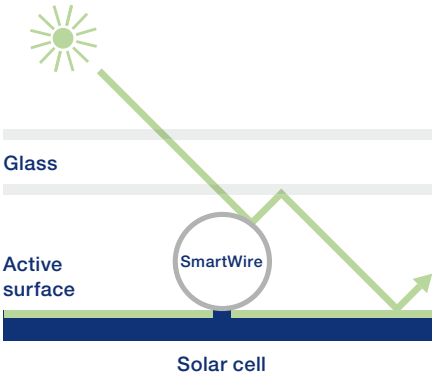
Cell connection

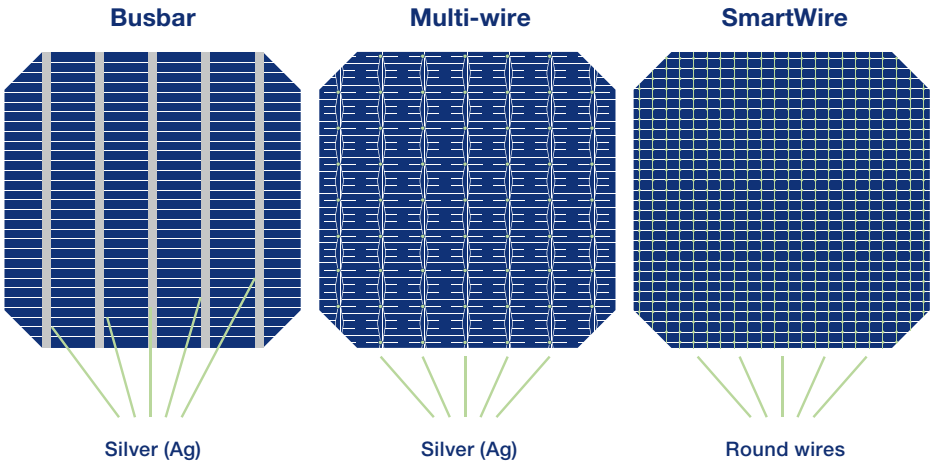


The connection of individual solar cells is key for achieving the maximum possible energy yield from a solar module. Even highly efficient solar cells can only realise their full performance potential if the generated power is transferred with as little energy loss as possible to achieve maximum energy output per module. With its SmartWire Connection Technology (SWCT™), Meyer Burger is setting new industry standards – also from a cost perspective.

SmartWire Connection Technology

SWCT™ encompasses the electrical and mechanical connection of solar cells; encapsulating them into strings. An overall increase in solar module output of about 2% is possible using SWCT™. This technology addresses the most important technical requirements of cell connection: minimal shading of the active cell surface and low electrical resistance. Compared to conventional square busbar connections, the round, thin SWCT™ wires reduce shading of the solar cell by up to 20% thanks to their significantly smaller contact surface. The active surface of the solar cell – the area that can absorb light and convert it into electrical energy – is thus considerably larger.





Reduced silver consumption

SWCT™ has a further plus point with regard to silver consumption. Only 0.095 g of the precious metal is required for the metallisation of a bifacial heterojunction cell with SWCT™. This reduces silver consumption by up to 66%, and module material costs by 6%, compared to other technologies.

In order to connect the solar cells, SmartWire Connection Technology uses an innovative foil wire electrode that comprises up to 24 impeccably aligned wires. The electrodes are aligned in parallel and fixed in position by means of an electrode foil, which is alternately attached to the front and rear sides of the cells and on both sides at the end of the cell row. The result is a series-connected set of cells – a “string”. The lower process temperature of SWCT™ encapsulation also prevents thermal stress on the strings. Heterojunction cells, in particular, react sensitively to temperatures over 200 degrees Celsius. The winning combination of higher energy yield and lower production costs currently makes SWCT™ the most cost-efficient connection method for solar cells.

The corresponding Meyer Burger manufacturing platform, the “Ibex”, connects solar cells efficiently and with absolute precision using the foil-wire combination. The extremely high output and short cycle times make the Ibex particularly efficient. With its camera-based detection system that continually monitors the cells and automatically removes any cells with defects, the Ibex guarantees high yields and flawless quality. The industry trade publication, PV Magazine, was so convinced by the Ibex that it recognised the Ibex as a “Technology Highlight” in 2018.

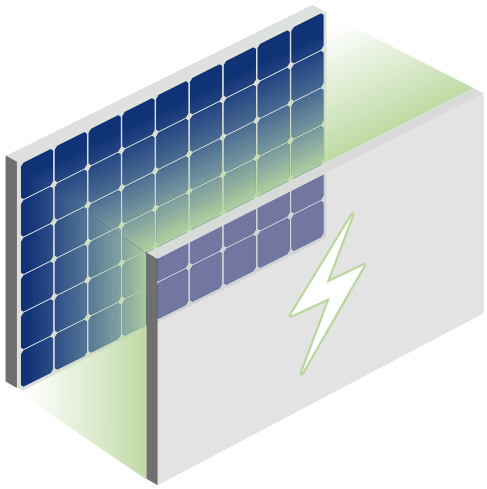
Measurement technologies

Wafer inspection systems, cell testers and module inspection systems detect quality defects and measure performance. Measurement technologies are indispensable in the production of efficient, high quality solar products.

Wafer inspection

Fully automated inspection and sorting is necessary in the production of wafers for the PV industry. Today, around 80% of all solar wafers worldwide are verified using inspection systems from Meyer Burger. With maximum precision and speed, the Meyer Burger systems check wafers for micro-cracks, inclusions, saw marks, defective edges, thickness variation and other parameters, and sort them into quality classes.

With the WIS-08, which was launched in May 2018 at SNEC, the international photovoltaic trade fair held in Shanghai/China, Meyer Burger once again underscored its technological and market leadership in the quality control of solar wafers. The WIS-08 has the highest throughput in the market at 8,000 wafers per hour, which, combined with a low wafer breakage rate, offers manufacturers maximised inspection quality and stability.



Cell and module testing

Solar modules are sold based on performance categories making the precise performance measurement of cells and modules critically important.

Meyer Burger's testing and inspection systems for solar cells and modules measure cell and module performance and identify any quality defects. The measurement technologies are renowned for their accuracy, top quality and extremely high throughput. Meyer Burger draws on its technological experience to constantly drive innovation and supply new solutions for the testing of bifacial and busbar-free cells and modules. The new generation Spot^{LIGHT} cell tester, for example, meets today's market requirements for measuring high efficiency PERC and heterojunction cells with highest accuracy and throughput, while lowering the total cost of ownership (TCO) for customers. Advanced technological processes for the individual cell technologies are developed and tested in accordance with strict industry standards. Its maximised measurement compatibility and interchangeability guarantee its integration into third party cell sorters while at the same time optimising access and interfaces. Simplified measurement processes can be easily monitored and measured in real-time, making the equipment ready for Industry 4.0. This includes automated setting and calibration for optimised machine operation and increased accuracy of measurement. The award-winning Spot^{LIGHT} solution features an integrated A+A+A+ xenon impulse which automatically calibrates the LED long pulse flash. This unique, future-oriented method of measuring was developed and qualified together with leading PV institutes.

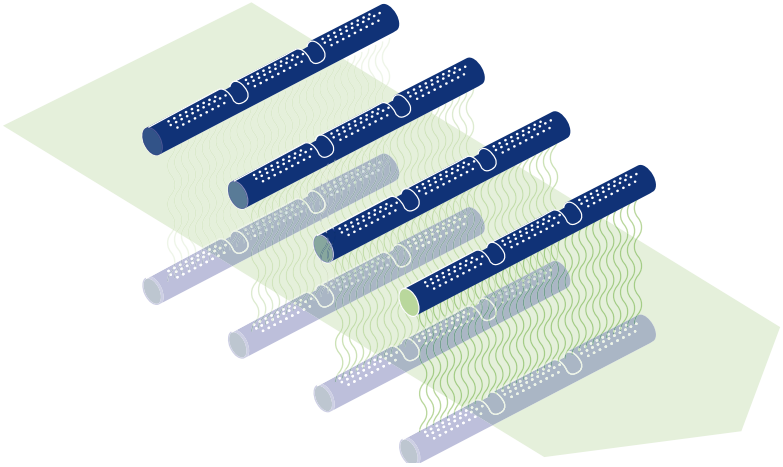
Specialised technologies

Meyer Burger applies technologies covering a broad range of applications in other markets, which have already been successfully implemented in the photovoltaic market.

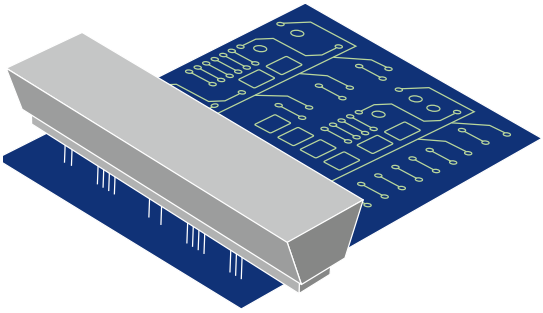
Functional inkjet printing

PiXDRO inkjet printing technology is a pioneering technology in the semiconductor and PV industries, as well as for circuit boards and printed electronics. With pinpoint accuracy, this unique technology deposits tiny droplets of functional liquid on a substrate, enabling the creation of very precisely structured coatings. It is additive, digital, non-contact, quick, resource-efficient, precise and cost-effective.

Meyer Burger is a leading global supplier of innovative inkjet systems for industrial high-tech applications. Innovative systems are available that allow inkjet printing to be scaled all the way from research to mass production. PiXDRO platforms are particularly well suited for the manufacture of semiconductor components, solder masks for circuit boards, printed electronics and etching masks, as well as numerous other applications in the areas of sensors, displays, medicine and pharmaceutics.



PECVD coating



The field of displays, windows, watches, lenses, etc. is experiencing increasing demand for hard, scratch-resistant coatings with optical antireflection or filter characteristics. For circuit boards or OLEDs, the coatings should also provide insulation and protection against moisture. Meyer Burger is pioneering the use of plasma-enhanced chemical vapor deposition (PECVD) as an alternative technology to the familiar physical vapor deposition (PVD) for large-scale, high-throughput applications with advanced coating properties.

Future-oriented automation solutions

Digitisation, networking and a steadily increasing level of automation currently represent the greatest challenges that industrial manufacturing companies will face in the years ahead. Smart IT and automation solutions that tackle these topics quickly and in an application-oriented manner are key to finding answers to future challenges. Relying on a portfolio of smart software solutions, Meyer Burger assists its customers from the industrial sector in implementing the concepts of Industry 4.0 and the Internet of Things in a solution-oriented manner, thereby equipping themselves to head into the digital future.

Food technology

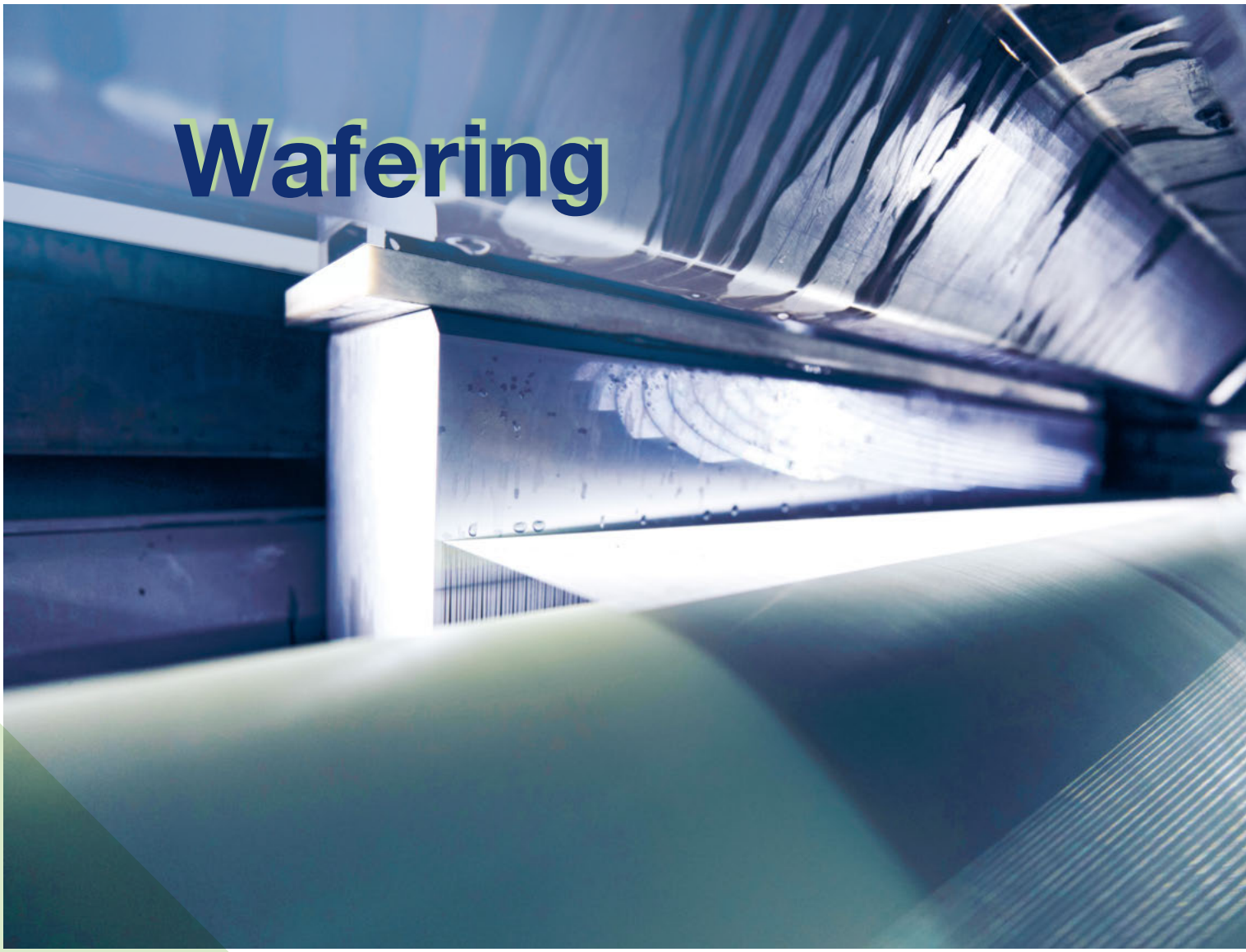
Building on its long-standing experience with industrial microwave and plasma systems, Meyer Burger is setting new standards in the food industry. The patented coaxial microwave process is a new technology that may revolutionise the way in which food is processed, as well as the quality and safety of packed goods. Compared to all other microwave technologies on the market today, Meyer Burger's coaxial microwave process reduces energy consumption, boosts efficiency and increases capacities for preparing large quantities of food.

Industrial microwave and plasma systems

Meyer Burger is a leading international supplier in the field of industrial microwave technology. Its portfolio encompasses microwave generators and components, including the related power supply technology for various applications such as industrial microwave heating and, in particular, plasma technology. The microwave systems are used to generate plasma for industrial, semiconductor and flat screen applications.

The scope of services ranges from the development of process and plant engineering systems to design, installation, commissioning and comprehensive customer care. The key products include components as well as plasma sources based on industrial microwave plasma, to be used in the semiconductor industry.

Wafering

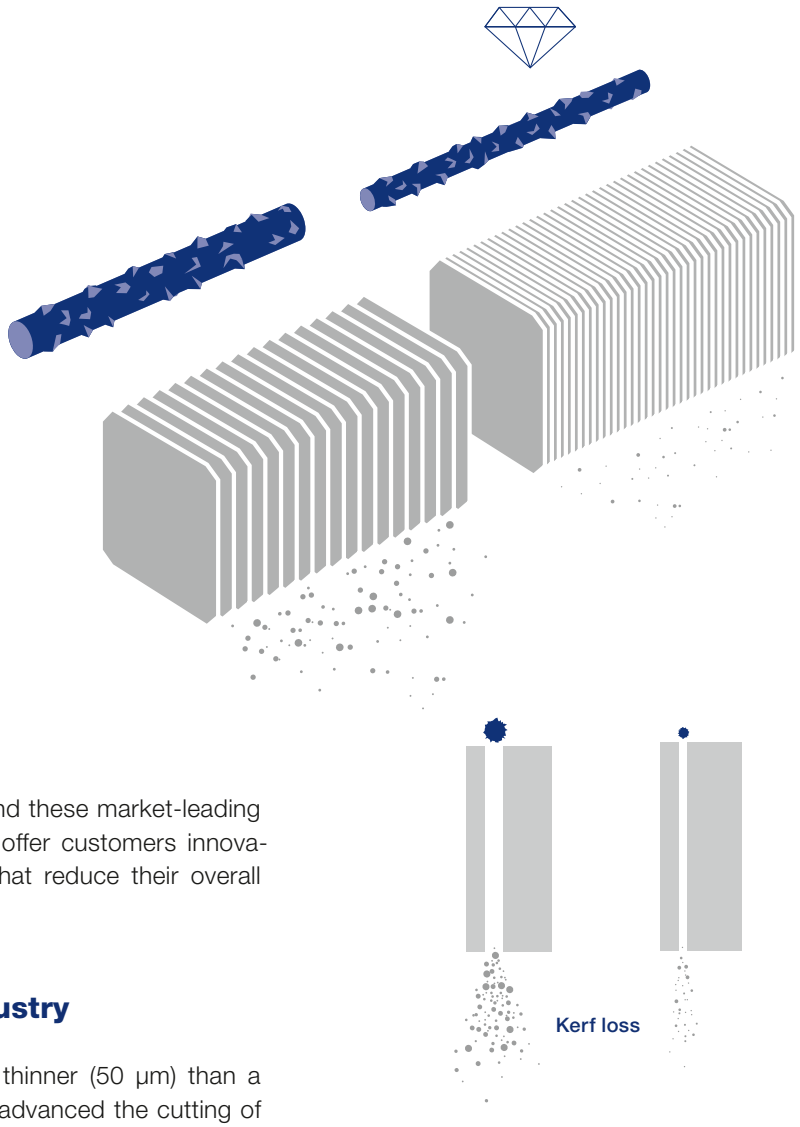


A piece of technology history comes to an end. Wafering or slicing technology, meaning the precise separation of hard and brittle materials, had a long tradition at Meyer Burger. With the sale of this division to the Precision Surfacing Solutions (PSS) Group expected to be at the end of March 2019, a piece of technology history at Meyer Burger is coming to an end. PSS will open a new chapter and continue the expertise of Meyer Burger.

Diamond wire cutting

Meyer Burger has set the technological standard for the cutting or separation of hard and brittle materials with the biggest possible material and cost savings. In the photovoltaic industry, the environmentally friendly and water-based diamond wire sawing process has helped to bring about ultra-thin, high-quality silicon wafers for the manufacture of highly efficient solar cells. Also outside the PV industry, a substantial growing list of applications use diamond wire saws.

With Meyer Burger's automated wire sawing solutions, diamond-coated wire is stretched over rollers to form a wire field that cuts material into wafers with minimal kerf loss. Higher cutting speed, a longer wire field and ultra-thin diamond wires enable increasing numbers of wafers to be cut faster, at top quality and with outstanding precision. Diamond wire is the principal cost factor



in the manufacture of wafers and these market-leading diamond wire-cutting systems offer customers innovative solutions and processes that reduce their overall operating costs.

Wafering in the PV industry

Using diamond wires that are thinner (50 µm) than a human hair, Meyer Burger has advanced the cutting of monocrystalline and multicrystalline silicon wafers in the PV industry. Silicon consumption is only around 2 g / watt peak, with a significant increase in production volume. At the same time, a sophisticated control system for process parameters such as wire tension ensures that the wafer quality fulfills the high requirements for subsequent cell coating processes.

With the DW 291 diamond wire saw, Meyer Burger launched its last wafering innovation for the PV industry, setting new standards for the production of silicon wafers. Depending on the application, the kerf loss resulting from the sawing process in standard practice is only 20–25% with the DW 291. Production volume is also increased because of the extended process window, shorter cutting times and the patented Diamond Wire Management System (DWMS) with its re-sharpening technology and optimised wire winding spacing which prolongs the life of the diamond wire in production.

Cutting technologies for special materials

Outside of the PV industry, there are also a growing number of applications that rely on diamond wire technology. This applies to the cutting of sapphire crystals, ceramics or quartz into wafers. Sapphire wafers are used, for example, in watch glasses, touch screens or light emitting diodes (LEDs). Silicon carbide also holds great potential for the future. Wafers made of this material are used in high-performance modules or as power semiconductors in the control modules of electric vehicles.