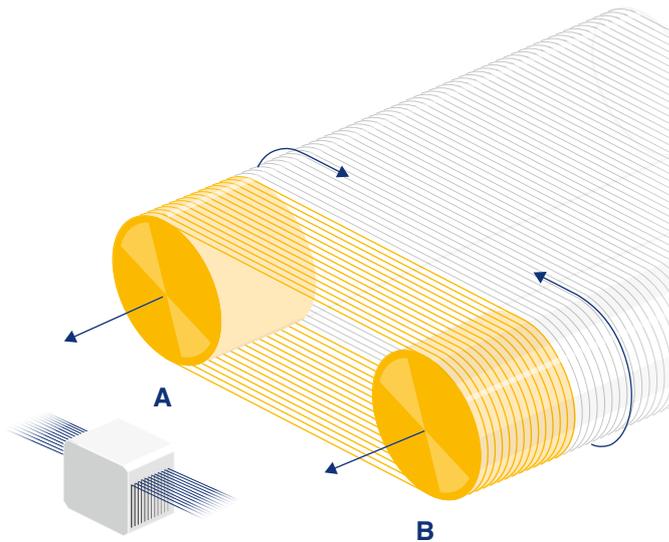


Photovoltaics

Diamond Wire Cutting Technology



The cutting of ultra-thin, high-quality mono- and multi-crystalline n-type and p-type silicon wafers for the manufacture of high-efficiency solar cells requires exacting precision and refinement. Meyer Burger's water-based environmentally friendly diamond wire cutting process sets the technology standard in the solar industry using ultra-thin wires to reduce silicon usage to under 2 g/W_p to significantly increase the manufacturing volume of wafers.

Diamond wire is the biggest cost driver in manufacturing silicon solar wafers. Meyer Burger's vanguard diamond wire cutting equipment offers versatile solutions and processes to lower overall cost of ownership for wafer manufacturers.

Throughput significantly increased, equipment productivity maximised

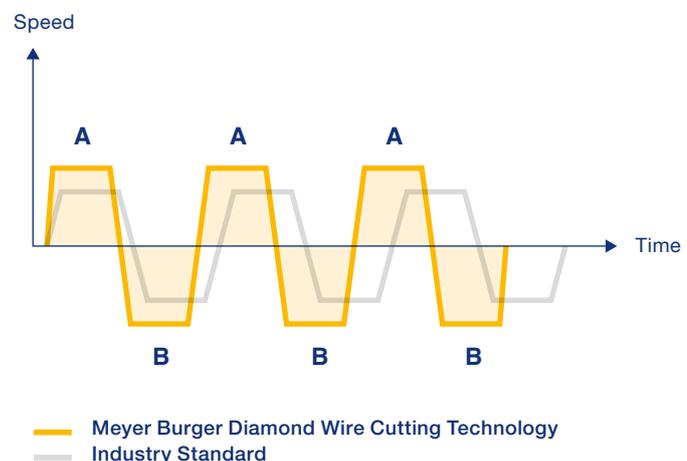
Longer wire web

By significantly increasing the length of the wire cutting web within its next-generation diamond wire saws, Meyer Burger offers manufacturers the flexibility to cut longer silicon bricks which significantly increases machine throughput and maximises the capacity utilisation of the cutting platform.

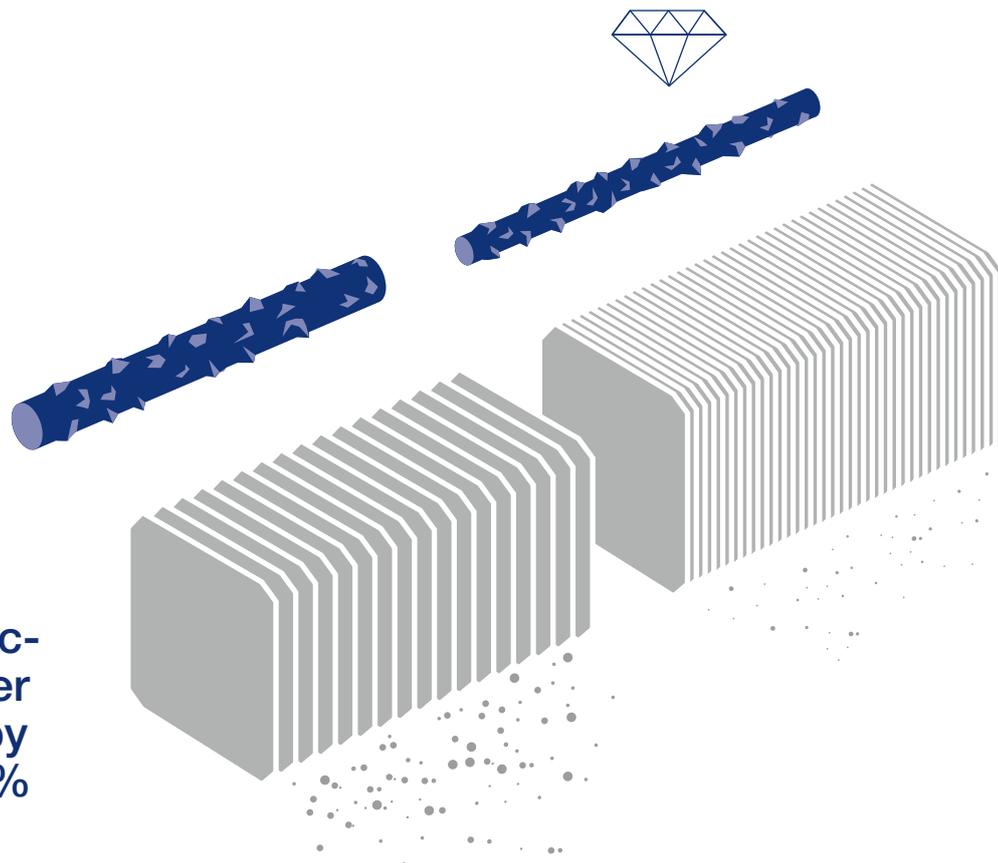
Faster cutting speed

By increasing the wire speed and acceleration, Meyer Burger's DW platform achieves superior cutting times which, combined with longer web lengths, enables a leading industry manufacturing capacity of 50 MW per tool. Impressive cutting speed and increased wafer production capacity with less production equipment translates directly into lower cost of ownership.

Setting new industry standards for fastest wafer cutting times



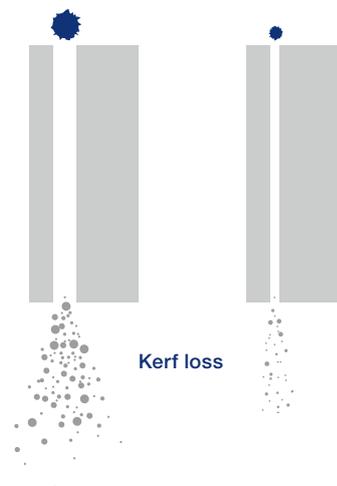
Overall manufacturing costs per wafer reduced by up to 20%



Thin wire handling capability

Meyer Burger is driving the development of diamond wire wafer cutting technology with ultra-thin wires equal to or smaller than 60 μm in diameter. As thin as a human hair, they are capable of delivering more yield per kilo of silicon and reducing kerf loss by 5% to 10% compared to today's industry standard.

Best-in-class wire tension control ensures exacting wafer quality perfectly suited for application in high-efficiency PERx and HJT cell processes. A patented thin wire management system ensures lowest wire breakage rates and extends the lifetime of the diamond wire.



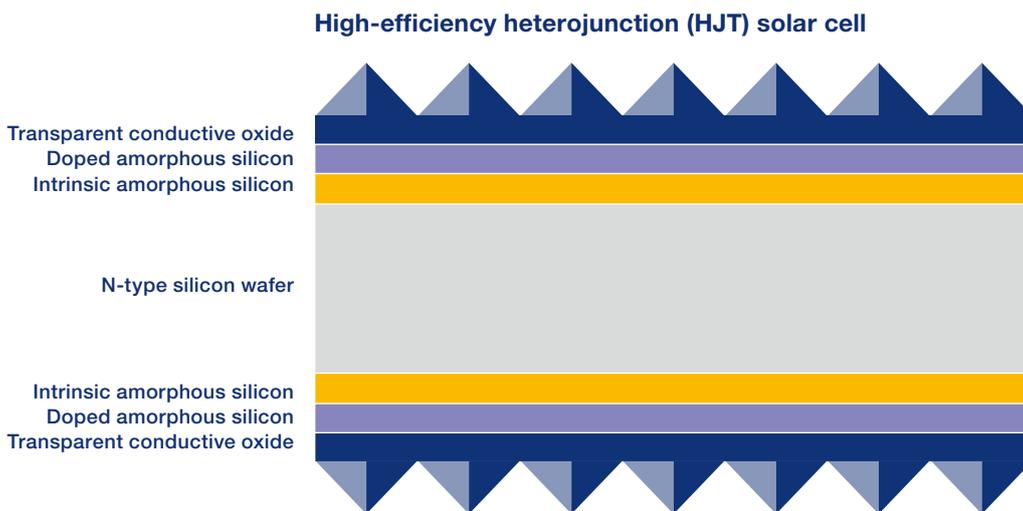
Ergonomically designed

Focusing on cost efficiency, Meyer Burger's DW cutting platform is ergonomically designed to improve operator efficiency and reduce the potential for user error. Combined with increased process automation, overall manufacturing productivity is significantly increased.

Wafer inspection system

Fully automated wafer inspection and sorting provide empirical data about wafer geometry, potential material or surface defect, conductivity and offer a wafer lifetime forecast. As global leader in wafer inspection systems, Meyer Burger is the first company in the world to succeed in measuring not only mono- but also multi-crystalline wafers cut using diamond wire on an industrial scale with its WIS wafer inspection system. The throughput rate of the WIS platform is up to 7,000 wafers per hour.

High-efficiency Solar Cell Technologies



Solar cell efficiency

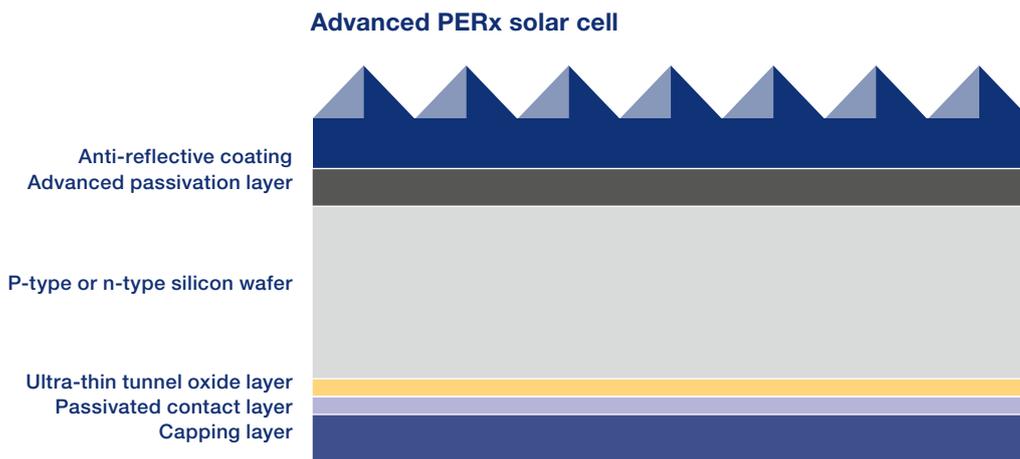
Today's solar cell efficiencies are between 21 and 22% for standard mono-crystalline solar cells. The efficiency of a solar cell is physically limited by different loss mechanisms which are called optical losses, ohmic losses and recombination losses. Efficiency loss through recombination describes the process where electrical current in a solar cell cannot be used because the material properties of the solar cell limit it from being transported to the poles of a solar cell. The charge carriers which are generated by sunlight are trapped by non-uniformities especially in the wafer material, on the wafer surfaces or at the metal contacts.

Minimising efficiency losses through recombination is a core competence of Meyer Burger and key for the success of the company's solar cell production solutions, both for mainstream cell technologies such as PERC (Passivated Emitter and Rear Cell) and especially for advanced cell technologies such as heterojunction (HJT).

Solar cell passivation

Superior passivation of solar cells will be the key criteria in the future to unfolding the full potential of solar cell efficiencies. Meyer Burger is working on both, providing evolutionarily applicable solutions for the existing capacities as well as providing best-in-class manufacturing solutions for greenfield projects with heterojunction (HJT) high-efficiency technology.

**Profitably processing
a silicon wafer into
a flawless solar cell is
a key step in photo-
voltaic manufacturing**



Heterojunction (HJT) technology

Heterojunction cell technology combines the advantages of n-type mono-crystalline silicon (c-Si) solar cells with the superior passivation characteristics of amorphous silicon (a-Si) enabling solar cells to reach significantly higher degrees of efficiency.

The manufacture of HJT solar cells requires six production steps translating directly into a smaller manufacturing footprint and a lower cost of production.

PV manufacturing leadership

Solar cell efficiencies increase at an annual rate of ca 0.5% absolute. A major boost to that evolutionary increase happened when the PV industry introduced PERC solar cell technology by adding an enhanced backside passivation. Today, the manufacturing solution of choice for the cell manufacturers globally is Meyer Burger's modular platform for the manufacture of PERC cells. By the end of 2017, Meyer Burger had received cumulative orders (since 2013) for about 30 GW of PERC upgrade/greenfield capacity making Meyer Burger the market leader in this technology.

PERC solar cell technology

As market leader for PERC mass production equipment, Meyer Burger has led the technology innovation premiering a pioneering solution for the integration of both front-side anti-reflection coating and rear-side passivation coating into a single manufacturing system. Not only the complexity of solar cell production but also operating costs and the overall manufacturing footprint are significantly reduced, resulting in a further sustainable decrease in PV manufacturing costs.

Highest HJT cell efficiency of > 24% delivering lowest levelised cost of electricity (LCOE)

SmartWire Connection Technology (SWCT™)

The natural evolution in cell connection technology

Meyer Burger's ground-breaking SmartWire Connection Technology (SWCT™) drives the energy output of solar modules to the next level beyond the limitations of standard busbar and multi-wire technologies.

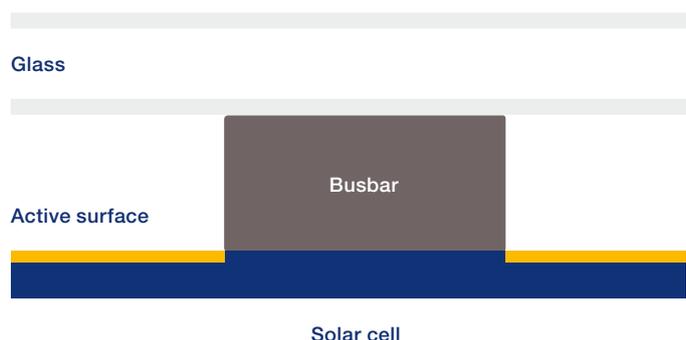
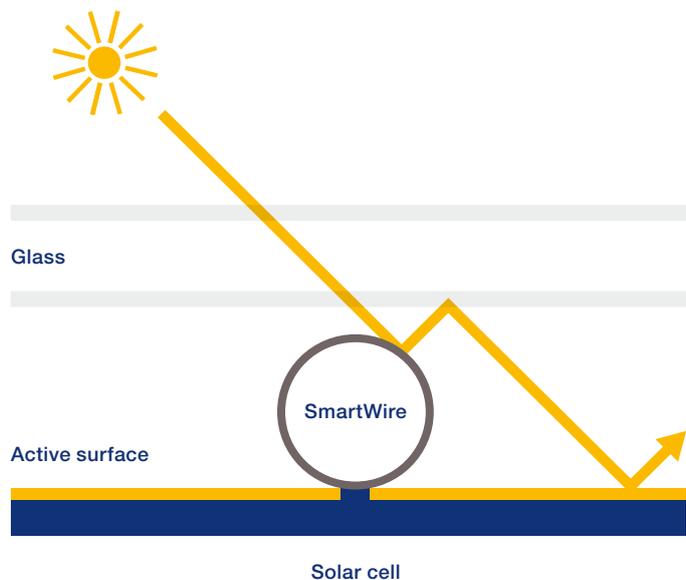
Larger active surface on solar cell

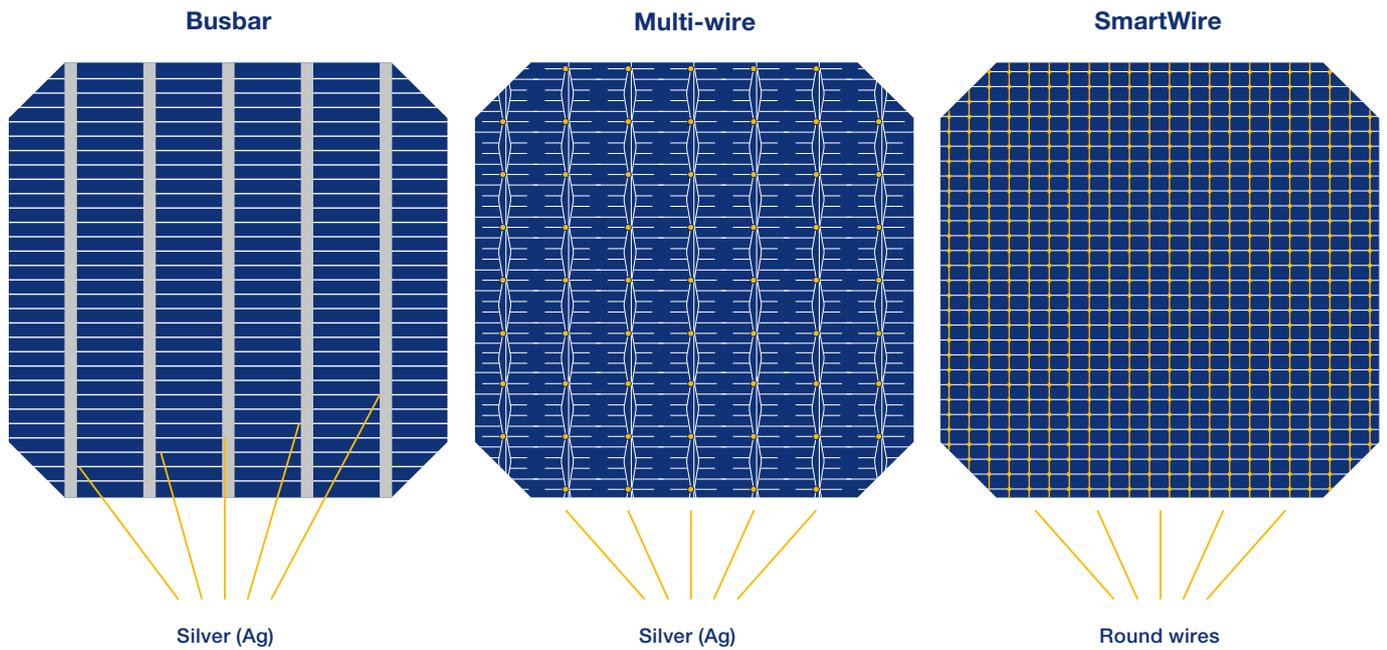
The round geometrical shape of the thin round wire used in SWCT™ dramatically reduces the effective shading on the active surface of the solar cell by up to 25% compared to standard busbar technologies. Diffuse sunlight is reflected on the round wire surfaces and trapped in the module thus significantly increasing energy performance by the solar module.

Innovative patented cell connection concept

Silver paste consumption is the second highest material cost factor in solar module manufacturing. SWCT™ employs an innovative patented foil-wire electrode with up to 24 perfectly aligned wires to connect solar cells. This reduces silver consumption per heterojunction solar module by up to 75% and per PERx solar module by up to 65% which leads to a direct reduction in production costs for solar modules. SWCT™ is compatible with bifacial heterojunction and PERx solar cells.

Maximum energy output per module when combined with high-efficiency solar cells





Higher production yield

The industrialised low temperature process for encapsulating solar cells in the SWCT™ foil-wire electrode is extremely precise in comparison to multi-wire technologies. The result is a significantly lower volume of material loss during the cell connection process and a much higher production yield compared to multi-wire processes.

The low temperature approach for SWCT™ encapsulation also prevents the thermal stress which impacts soldered multi-wire solar cell strings. The resulting structure of the SWCT™ module strengthens its stability and enhances its lifetime.

SWCT™ delivers a powerful combination of higher energy yield, longer module lifetime and lower manufacturing costs

Maximum energy extraction

Meyer Burger's SmartWire Connection Technology boosts the power output of solar modules. The dense wire contact matrix, which results from encapsulating the solar cells in the foil-wire electrode, enables SWCT™ modules to easily cope with the increased power extraction necessary for today's high-efficiency solar cells thereby delivering an increased performance yield in SWCT™ solar modules.

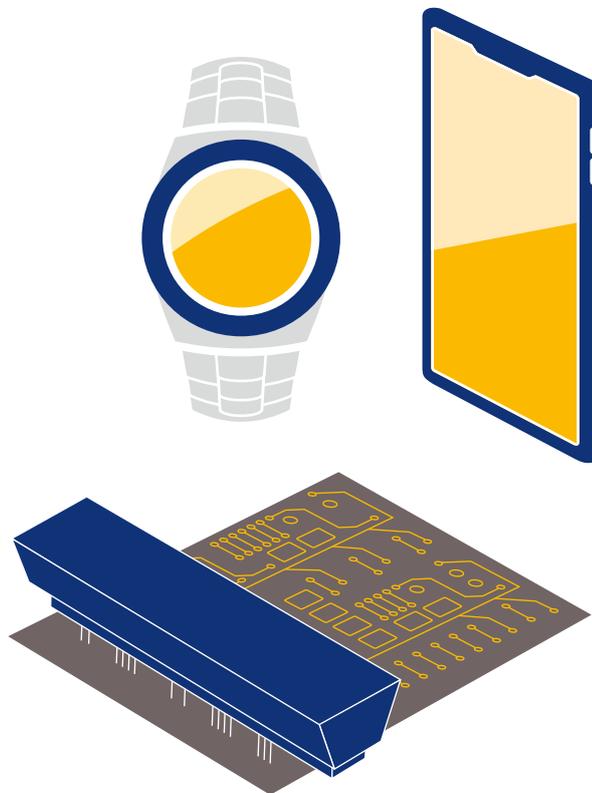
Industry standard in PV measurement technology

Solar modules are sold based on performance categories making the precise performance measurement of modules critically important. Meyer Burger sets the standard for industrial measurement technology with its innovative solutions for accurate power rating of high-efficiency modules.

Specialised Technologies

Specialised cutting technologies

Meyer Burger's high-precision diamond wire cutting platform, in combination with its long-term extensive know-how in the cutting of hard and brittle materials, is also applied to cut sapphire crystals into bricks and wafers and to slice ceramics, galls, quartz and a variety of other hard and brittle materials. Sapphire wafers used in light-emitting diodes (LED) as well as in watch glass are now also being applied in the touchscreen industry. The capability to handle ultra-thin wire optimised for thin wafers maximises material and cost savings during wafer production while increasing production output and maximising machine capacity.



Functional inkjet printing

PiXDRO inkjet printing technology is a future-oriented technology in the semiconductor and printed electronics industries. Meyer Burger offers excellent plasma and ion beam technology solutions for thin-film coating, surface treatment and sensor production.

Meyer Burger is a leading global supplier of innovative inkjet printing equipment solutions for high-tech industrial applications. An innovative range of systems has been developed which enable the scaling of inkjet printing from laboratory applications to the point of mass production. PiXDRO platforms are especially suitable for the manufacture of semiconductor packaging, devices, for OLED products (illumination, display, 3D), as well as for printed electronics (PCB).



Thin-film coating

The application of inorganic thin film to protect sensitive electronics from moisture and oxygen is increasingly surpassing classic cover materials such as glass. The excellent protective characteristics enable the manufacture of lightweight, thin and flexible OLED products, OPV modules and batteries. With its FLEx and CONx platforms, Meyer Burger offers thin-film coating systems based on PECVD and spatial ALD technologies.

Future-oriented automation solutions

The growing digitalisation of today's industrial production processes is posing new challenges for employees and companies. The increased level of automation requires the interconnection of infrastructure and IT systems as well as the end-to-end monitoring and optimisation of production processes. With its long-term extensive know-how in automation technology, Meyer Burger transforms the concept of Industry 4.0 and the Internet of Things into reality with smart software solutions for customer's industrial processes.

**Transforming
the concept of
Industry 4.0 and
the Internet of
Things into reality**



Industrialised microwave and plasma systems

Building on its in-depth experience in industrial microwave and plasma systems, Meyer Burger is now setting new standards in the food industry. Its patented coaxial microwave process is a new technology which can transform the way food is processed and revolutionise 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 usage, increases efficiency, and escalates the capacity for higher volume food preparation.

**Meyer Burger's
patented coaxial micro-
wave process is a new
technology which can
transform the way food
is processed**

