



# PV in the SPOTLIGHT

The International Solar Technology Awards, dubbed the Cell Awards, were created to provide an independently judged platform upon which the most successful and esteemed technologies and potentials in the solar industry can be placed in the spotlight, shining light onto some of the best technologies in the PV industry. The programme is based around seven awards; each award category is judged by a panel of industry experts and the industry public who voted online for their preferred candidates.

After each award category was decided for the 2009 event, the voting began. An online poll counted for 20% of the overall vote, while the majority decision of 80% of the overall vote went to the specialists, a panel of industry experts from some of the most highly regarded photovoltaics companies in the world. The Industry Choice Award was the only award voted for by 100% popular vote.

Once the voting had finished, and the winners had been decided, the entrants were held in suspense until the Intersolar Munich event 2009 where the awards ceremony took place. Here each winner was awarded with the unique Cell Award trophy, presented to each representative by some of the most important names in the industry.

Judges:



during module assembly. In addition to eliminating the need for pre-coating of ribbon material with liquid flux, the additional metal content augments the solder joint. The method is compatible with both manual and automated assembly operations.

- Additional metal content, used at specific locations in a point-to-point soldering process, has been shown to reduce the amount of microcrack formation and aid in the verification of solder joint formation during module assembly.
- Microcrack reduction could facilitate the use of thinner wafers and improve performance over the life of the module.
- Additional solder alloy increases solder joint toughness, consistency and durability (see below).

## Runner Up

### Cookson

Cookson's Alpha PV-Ready Ribbon increases throughput by eliminating costly maintenance associated with a separate fluxing operation. Major PV assemblers have seen enhanced solder joint reliability of the PV module assembly, demonstrated by significant improvements in peel test performance. The Alpha PV-Ready Ribbon is currently being successfully run on the production lines of major global PV module assemblers and is fast becoming the new standard in reliability and productivity in PV module assembly.

### Komax

Komax's Xcell 3400 Stringer is the next generation of the company's automated stringer product line. Capable of processing all traditional mono- and polycrystalline solar cells up to 156mm x 156mm, with 2 or 3 busbars and a maximum throughput rate of 600 solar cells per hour, the Xcell 3400 Stringer is an excellent fit for solar cell stringing needs.

## BEST TECHNICAL PRODUCT FOR THIN-FILM MODULE MANUFACTURING

The nominees for this category were, the KAI 1200 PECVD system (pictured right) from Oerlikon Solar, Applied Materials' Sunfab Line and Veeco's PV-Series Thermal Deposition Sources.

And the *Winner* is:  
**Oerlikon Solar - KAI 1200 PECVD system**



Jürg Steinmann, Oerlikon Solar's Head of Marketing Communications, receives the Award from Dr. Uroš Merc, CEO, Bisol Solar at the Cell Award 2009 event in Munich.

The Oerlikon Solar KAI 1200 PECVD production system, originally used to produce TFT semiconductor devices in the LCD industry, deposits amorphous and microcrystalline absorber layers faster and at a better quality resulting in a significant reduction of the production cost of silicon thin-film solar modules. Based on



its research in partnership with the IMT in Neuchatel and the EPFL in Lausanne, dielectric lens compensation was invented which eliminates the standing wave effect. From the first concepts in early 2000, Oerlikon Solar successfully implemented this new type plasma source into mass production.

- The 40MHz VHF technology has considerably increased deposition rates and at the same improved the absorber layer quality.
- Oerlikon Solar's tool has doubled the deposition rate on its 1.4m<sup>2</sup> solar panels at best in class layer quality and improved the cycle time for the deposition of the amorphous absorber layer by over 30%.
- Amorphous single junction modules have shown an initial aperture efficiency of 9.6%.

## Runner Up

### Applied Materials

The Applied Materials SunFab Line offers customers a proven production solution to manufacture photovoltaic modules at a low cost per watt on substrate sizes up to 5.7m<sup>2</sup>. The SunFab Line is capable of producing approximately 150,000 full-sized modules (2.2m x 2.6m) per year. A combination of low cost advantages will open the market to rapid expansion by moving solar from a niche solution to an economically viable alternative to traditional electricity.

### Veeco

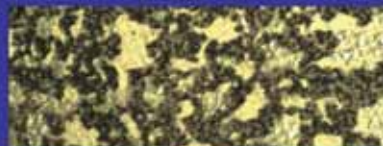
Veeco's PV-Series Thermal Deposition Sources are installed on CIGS coating systems and are capable of depositing on substrates as large as 120cm. Veeco sources have become the production standard for CIGS manufacturers because of their large capacities, high temperature operation and long term stability - all critical factors in the CIGS deposition process. Providing the largest available capacities (from 65cc to 15,000cc), the sources enable long production uptimes, minimizing material loading cycles and system vents.

### Solar Cell Solder Joint Pull Tests

#### Standard Flux-Coated Ribbon



Ribbon Fracture Surface  
No Solder Paste



Cell Fracture Surface  
No Solder Paste

Low pull force. Insufficient solder volume to make a high-quality solder joint. Fracture surface shows extensive voids within the joint.

#### Ribbon With EFD® Solder Paste



Ribbon Fracture Surface  
With EFD® Solder Paste



Cell Fracture Surface  
With EFD® Solder Paste

The addition of solder paste results in a higher pull force with minimal voiding. The higher strength solder joint moves the fracture to the silver-silicon interface.



PV in the Spotlight  
The Cell Award ceremony took place at InterSolar Munich, 2009



## Runner Up

Edwards

Edwards' Spectra-Z 3000 provides an all-dry combustion abatement solution that meets many customers' needs, adhering to environmentally-friendly practices.

The Spectra-Z is a high-capacity combustion system that provides reliable, high-performance and cost-effective abatement of hazardous gases from solar cell processes that use large flows of silane (SiH<sub>4</sub>). The Spectra-Z employs 4-stage combustion, an effective powder handling system and can be configured with up to six process gas inlets. It has low CoO, no water or oxygen required and is suitable for indoor or outdoor installation.

## BEST TECHNICAL PRODUCT FOR MODULE ASSEMBLY

The nominees for this category were: PV Cell Ribbon and Bus Bar Methodology from EFD, Cookson's Alpha PV ribbon and Komax's Xcell Stringer.

And the *Winner* is:

**EFD - PV Cell Ribbon and Bus Bar Methodology**



EFD, Inc.'s Peter Lambert (right) receives the award from Dr. Uroš Merc, CEO, Bisol Solar at the Cell Award 2009 event in Munich.

EFD's PV Cell Ribbon and Bus Bar Attachment Methodology is a point-to-point soldering process that uses a proprietary lead-free solder paste and flux mixture to attach string ribbon material to silver bus bars



[www.cellaward.com](http://www.cellaward.com)

## BEST REGION FOR MANUFACTURING SOLAR TECHNOLOGIES



Dorrit Koebke-Friedrich, Senior Manager of IMG Saxony receives the award from Nick Sarno, Senior Vice President of Manufacturing for LDK Solar.

The nominees for this category were: IMG Saxony Anhalt - Solar Valley; Silicon Border, Mexicali and the State of Oregon.

And the *Winner* is:

### IMG Saxony - Anhalt Solar Valley, Germany

The Solar Valley Center of PV Industries houses almost 16% of global production capacity. It provides the possibility for rapid project realisation with a skilled and flexible labour force as well as generous investment incentives.

- Solar Valley unifies all PV technologies and is home to around 60 of the world's leading PV companies.
- The "Made in Germany" brand quality.
- Highest R&D support within the EU, and the lowest labour costs within Germany, despite a higher productivity rate (10% higher than German average).

### Runner Up

#### State of Oregon

The State of Oregon generates interest from investors for its business energy tax credit, which covers up to 50% of the cost of a project; its low-cost hydropower; the state's proximity to California; and a semiconductor manufacturing work force that can easily transition into solar cell manufacturing.

#### Silicon Border, Mexicali

The Silicon Border could be described as the single largest application of PV systems in Mexico after electrification of rural communities. Over 500 luminaries have been installed, with PV panels of around 150W each.

## GREEN SOLAR MANUFACTURING AWARD

The nominees for this category were: PV Cell Ribbon and Bus Bar Methodology from EFD, Cookson's Alpha PV ribbon and Komax's Xcell Stringer.

And the *Winner* is:

### Linde - Flex F-80 Onsite Fluorine Generator

Linde's On-Site F<sub>2</sub> Generator (pictured below right) has been installed at more than 20 semiconductor, LCD and solar cell production sites. Replacing NF<sub>3</sub> with Fluorine in a 500MW thin

film Si fab results in elimination of NF<sub>3</sub> consumption with an untreated global warming potential equivalent to over 8 million tonnes of CO<sub>2</sub> per year. Linde's proven technology for generating F<sub>2</sub> on-site and on-demand eliminates the need for large volume storage and addresses all the safety requirements for handling this reactive material. In addition to its environmental benefit, F<sub>2</sub> reduces the time for chamber cleaning, thereby increasing plant productivity, through a more efficient etching process, and ultimately lowers cost per watt.

- Reduce cost per watt through reduced mass consumption, faster clean times, and reduced capital expenditure, with savings of 3c to 5c/W for a typical thin-film PV fab.
- 20% less F<sub>2</sub> is required vs NF<sub>3</sub>; for less efficient activation processes, these savings can be significantly greater.
- Cleaning with F<sub>2</sub> can reduce chamber-cleaning times by a factor of 2 to 4, and therefore greatly increase the throughput on a critical step of thin-film PV production.



Linde Electronics' Ian Travis, General Manager, Fluorine receives the award from Eleni Despolou, Policy Director and Deputy Secretary General of EPIA



And the *Winner* is:

### SiXtron - Sunbox

SiXtron's SunBox is a silane-free coating system for front-side antireflective and passivation coating processes in c-Si solar cell manufacturing. Using a unique silicon carbide-based chemistry, the SunBox is a 'plug & play' solution for crystalline silicon cell manufacturing lines that matches the efficiency of today's most advanced antireflective and passivation coating systems while completely eliminating the significant safety, reliability and cost issues associated with pyrophoric silane gas. SiXtron's SunBox's core technology is based upon a unique solid polymer source material that is safe to handle, ship and store.

- SiXtron is the first company to provide a PECVD-based AR and passivation coating system that delivers the performance of today's silicon nitride coatings without the use of silane gas.
- Up to 50% reduction in installation cost of AR coating systems for new manufacturing lines; up to 50% reduction in total operating cost of AR coating system; reduced maintenance costs.

### Runner Up

#### Advent Solar

Advent Solar's Ventura Technology is a comprehensive cell-to-module solar architecture that combines Emitter Wrap-Through (EWT) back-contact cells designed to eliminate grid obstruction with Monolithic Module Assembly (MMA) – a fully automated module assembly process. Ventura Solar Technology is designed to achieve the optimal balance between efficiency and cost – maximizing module energy output with minimal interconnect resistance, based on efficient, repeatable manufacturing processes to reduce costs.

#### BTU International

BTU International's MERIDIAN In-line Diffusion System combines the company's latest second-generation phosphorus coating technology with its flagship quartz-lined diffusion furnaces. The system is comprised of a direct spray phosphorus coater integrated with a conveyor belt diffusion furnace for processing silicon solar cells. The coater includes backside, topside and drying capability, which can translate into improved cell efficiency, while tight temperature uniformity enables uniform sheet resistance values.

## BEST TECHNOLOGY FOR SILICON FEEDSTOCK AND WAFER PROCESSES



tec5's Steffen Piecha receives the award from Jerry Stokes, President of Suntech Europe

The nominees for this category were: tec5 with its VINSPEC SP Inline process control for ARs on PV wafers and Solaicx's CZ manufacturing process.

And the *Winner* is:

### tec5 - VINSPEC sp inline process control system

VINSPEC SP is designed to provide reliable contactless inline quality measurement for thickness of antireflection coating at PV wafers directly after the coating process. VINSPEC SP offers MES logging of all process and measurement data in conformity to SECS/GEM. VINSPEC SP is a joint development of tec5 from Oberursel/Germany and VITRONIC from Wiesbaden/Germany.

- Fast spectroscopic technology allowing for short sampling intervals.
- Direct method of measuring physical properties of one or more coating layers.
- Shorter cycle times, a more detailed layer characterization and more information to react to changes in product quality.

### Runner Up

#### Solaicx

Solaicx's proprietary continuous Czochralski (CZ) manufacturing process produces low-cost, high-efficiency silicon ingots five times faster and 30% longer than competitors employing equipment adopted from the semiconductor industry. The Solaicx method sees a continuous re-supply of fresh polysilicon maintain constant melt height in the crucible, and thus ingot length is determined by the height of the building or length of the pull chamber.

## BEST PROCESS TECHNOLOGY FOR C-SI CELL MANUFACTURING LINES



Bates Marshall, SiXtron's VP of Sales and Marketing, accepts the award from ersol President Holger van Hebel at the Cell Award 2009 event in Munich.

The nominees for the Best Process Technology for c-Si cell Manufacturing Lines were: SiXtron's Sunbox, Advent's Ventura and BTU International's Meridian In-Line Diffusion.



# SOLAR INDUSTRY CHOICE AWARD

The nominees for the Industry Choice Award were: the Meridian In-Line Diffusion System from BTU International, IMG Saxony's Solar Valley and SiXtron's Sunbox.



LDK Solar's Senior Vice President of Manufacturing Nick Sarno (left) presenting the Industry Choice Award to BTU International's Oliver Wehner (right), Sales Director for BTU France

And the *Winner* is:

## BTU International - Meridian In-Line Diffusion System

BTU International's Meridian In-line Diffusion System combines the company's latest second-generation phosphorus coating technology with its flagship quartz-lined diffusion furnaces. The system is comprised of a direct spray phosphorus coater integrated



with a conveyor belt diffusion furnace for processing silicon solar cells. The coater includes back-side, topside and drying capability which can translate into improved cell efficiency, while tight temperature uniformity enables uniform sheet resistance values.

- Reduced wafer handling and greater through-put than traditional batch processing translates into lower breakage rates and improved yield.
- Coating application is accomplished via a nozzle-less ultrasonic spray system, eliminating clogging typically found in nozzle type spray designs.
- Capable of applying both topside and backside coating to promote impurity gettering from the wafer, which can yield and efficiency improvement. Initial test results in BTU's laboratory have shown a 60-65% average lifetime improvement.

## Runner Up

### IMG Saxony Anhalt

The Solar Valley Center of PV Industries houses a high density of PV supply-chain companies. With almost 16% of global production capacity located in the region, it brings the possibility of rapid project realisation with a skilled and flexible labour force as well as generous investment incentives.

### SiXtron

SiXtron's SunBox is a silane-free coating system for front-side antireflective and passivation coating processes in c-Si solar cell manufacturing. Using a unique silicon carbide-based chemistry, the SunBox is a 'plug & play' solution for crystalline silicon cell manufacturing lines that matches the efficiency of today's most advanced antireflective and passivation coating systems while completely eliminating the significant safety, reliability and cost issues associated with pyrophoric silane gas.

# Cell Award 2010

In his closing address to the audience at the ceremony, David Owen, publisher of *Photovoltaics International*, encouraged the industry in these difficult times to reflect on current technologies that will help PV manufacturers achieve cost and yield goals now in the future, "It is vital that we continue to recognise and acknowledge new technical innovation in PV manufacturing now and in the future to encourage further technical developments."

Entries for the 2010 Cell Awards will open on September 28th 2009.

Further details will be available on [www.cellaward.com](http://www.cellaward.com).



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