

Micromorph tandem technology good to go

With key performance breakthroughs in amorphous silicon technology, Oerlikon Solar is set to launch the next generation thin film solar technology



The father of micromorph tandem: Dr. Johannes Meier CTO of Oerlikon Solar. A physicist by training, Meier is credited with inventing the dual utilization of sunlight by combining an amorphous and a microcrystalline silicon layer in a single solar cell.

Preparations for the unveiling of the new production solutions for micromorph tandem modules are almost complete; Oerlikon Solar sees remarkably strong and widespread interest in this new technology across the booming solar energy market. As the leading provider of turnkey solutions, Oerlikon Solar has signed the first contracts for lines with “micromorph tandem” technology. Modular upgrades to the new technology will be available for all existing Oerlikon production solutions.

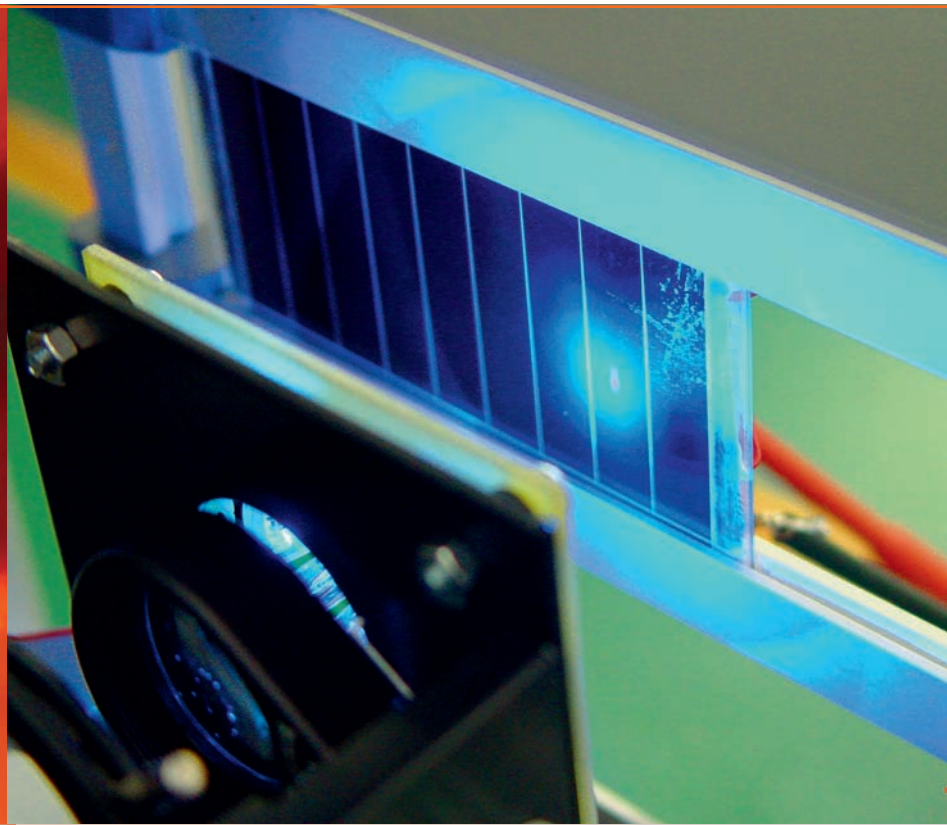
Approaching crystalline efficiency

The term “micromorph tandem” refers to the two different silicon semiconductor materials stacked in the same cell: amorphous and microcrystalline silicon. Through its dual-layered structure, the tandem cell makes optimum use of the solar spectrum, converting both the visible part in the 400–700 nanometer

range and the near infrared spectrum (700–1,100 nanometers) into electrical power. As a result, the micromorph tandem cell is about 50% more efficient than a purely amorphous cell. Many experts are convinced that this technology will emerge as the toughest competitor to today’s crystalline silicon standard since efficiencies of over 10% have already been demonstrated. Dr. Johannes Meier, the Chief

Technology Officer at Oerlikon Solar and “father of micromorph tandem” served until 2003 as a researcher at the Institute for Microtechnology (IMT) of the University of Neuchâtel, where Prof. Dr. Arvind Shah has established a solar research group. Both scientists were honored with the Swiss Solar Award in 2005 for their outstanding contributions in developing the micromorph tandem cell.

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Two are better than one: The high yield of the new micromorph tandem cell from Oerlikon is made possible by a dual approach – an amorphous layer that converts the visible spectrum, and a microcrystalline layer that traps the additional solar radiation of the near infrared range.

“In the early 1990s the photovoltaic properties of microcrystalline silicon were still unknown. It was assumed that the material would contain too many flaws to be suitable for these purposes, but we disproved that notion,” explains Meier

Oerlikon Solar hired photovoltaic expert Meier in 2003; today he is responsible for the Solar laboratory in Neuchâtel, Switzerland and he is driving the company’s R&D efforts as a CTO. Meier has earned his international reputation in the solar world through his pioneering research work, his lectures and numerous publications. Experts around the world now consider “his” micromorph tandem cell concept as the most promising breakthrough in thin film solar technology.

The Oerlikon advantage

The innovation of the micromorph tandem cell, as envisioned by Dr.

Meier, is to boost the efficiency of the amorphous silicon technology and at the same time still rely on environmentally friendly, non-toxic, and easily available materials. Compared to crystalline cells, a micromorph tandem cell requires about 200 times less silicon and significantly less “gray energy” (energy used to manufacture a solar cell). Consequently, thin film solar cells take only about two years to ‘pay back’ the energy consumed in their production. The typical mono-crystalline solutions take nearly twice as long.

The success of Oerlikon’s production solutions is not only based on the leading know-how, but also on good timing. Oerlikon Solar started way ahead of its competitors with the industrialization of this new technology. A major challenge for the micromorph tandem cell was being able to transfer the laboratory-levels of efficiency to large-area solar modules, and to uniformly deposit films across an area

of more than one square meter. To achieve this, Oerlikon relied on its extensive know-how and the technology of its deposition systems used in the flat panel displays industry to produce TVs and computer monitors. A further key element needed to obtain the required performance levels is the newly launched TCO 1200 system used to deposit the transparent conductive oxide layers. The special surface morphology of the TCO layer is responsible for an optimised light trapping in the following photovoltaic absorber layer.

The TCO 1200’s breakthrough capabilities include reliable deposition of a reproducible and homogeneous structure defining the matching “haze factor”, another reason why the mass production of micromorph solar modules is moving so quickly towards market launch. ■

For further information, please visit: www.oerlikon.com.