

Solar power, pure water, and CEDI

By Steve Willis*

The production of photovoltaic cells for solar power, in common with other semiconductor devices, demands process water of the very highest purity. It is an established fact that the removal of organic and inorganic contamination directly influences the quality of the end product and the efficiency of the manufacturing process.



Ionpure VNX-50

In recent times, the demand to increase water purity for processing and cleaning silicon devices has driven the use of a relatively new technology - Continuous Electro-Deionization. CEDI, pioneered and provided by **Siemens Water Technologies** under the Ionpure® brand, not only delivers ultrapure deionized water with greater than the 16+ megohm resistivity required by the solar cell industry, but also reduces both operating cost and environmental impact, when compared with a conventional deionization system.

With high water quality assured, the absence of regeneration chemicals and the low energy consumption of CEDI take on real significance, as the quantity of water used in solar cell production can be considerable. This is true particularly in Thick Film cell manufacture, in which mono-crystalline or multi-crystalline silicon ingots are processed.

Ingots are first sawn from silicon blocks, or pillars, by water-cooled saws, during which chemical treatments precipitate the silicon sawdust from the cooling water. In turn the ingots are divided into separate wafers, just 0.15mm to 0.30mm in thickness, using a wire saw and a fine slurry of silicon carbide. Further ultrapure water is then required in the etching, texturing, and cleaning of the wafer surface, which removes saw marks and maximizes light absorption.

This way, high performance cells are processed in batches, using high quality wet benches similar to those used in silicon chip production. At each stage the purity of water for cleaning and making up process solutions is critical to the ultimate performance of the solar cell.

A conventional water treatment system typically uses municipal water as a starting point. A system of pre-treatment and filtration feeds a 2-pass RO stage, which is then followed by

mixed bed deionization (MBDI). The DI water is stored and distributed to the wet bench processing lines.

However, by replacing the traditional, chemically regenerated MBDI step with a chemical-free CEDI module, the operation benefits in several ways. The module is very small in comparison to the steel vessels of an MBDI system, offering a greatly reduced plant footprint. Operation is continuous, extremely low-maintenance and produces no regeneration waste for disposal. Moreover the CEDI module uses just DC electric potential to achieve deionization. In fact a CEDI typically consumes electricity at only half the rate of a reverse osmosis booster pump.

With these advantages in its favor, Siemens Water Technologies – Ionpure CEDI is making an impact on the solar cell industry worldwide. System integrators are now using Ionpure VNX modules to provide the high-flow rate CEDI performance demanded in this field of semiconductor technology.

For example, Ionpure VNX-50 modules are the latest modules in service with Q-Cells, one of the world's leading solar cell manufacturers, based in Germany. They were provided by Ionpure's distributor in the Netherlands, Pure Water Technologies, and are installed in water purification systems capable of producing a total of 170 m³/hr.

VNX modules were designed for use in semiconductor fabrication, or wherever flows of above approximately 30 m³/hr are required. When using VNX, or any other Ionpure modules, OEMs can tap into the full technical support network of a Siemens-owned company.

Consistent and predictable water quality is ensured, with better than 99% salt removal and a reverse osmosis (RO) feed water conductivity of less than 40 µS/cm. The Ionpure VNX device uses ion-permeable membranes, ion exchange resins, and DC electricity, which drives the removal of ions from the feed stream, while continuously regenerating the resins. Modules may be connected end-to-end or stacked using the Flexmount endblocks, which greatly reduces the cost associated with the piping and support structure of conventional CEDI systems. In addition, VNX is an improvement on the already proven LX technology, which uses a plate and frame configuration for enhanced flow distribution of both fluid and electrical current rather than a spiral wound configuration, to produce superior performance and longevity. A double O-ring seal at each end of every module guarantees leak-free service, up to the 7 bar feed water pressure rating. ■

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تتطلب صناعة الخلايا الفوتوفولطائية، المستخدمة في مجال توليد الطاقة الشمسية، مياه معالجة ذات نقاوة عالية خالية من الملوثات العضوية وغير العضوية لتأمين نوعية جيدة للمنتج وتأمين فعالية عملية التصنيع. دفع مؤخراً الطلب على نقاوة المياه المستخدمة لتنظيف المعدّات المصنوعة من السيليكون إلى استخدام تقنية CEDI الجديدة لإزالة التآين الكهربائية بشكل متواصل. كانت شركة Siemens Water Technologies الرائدة في هذا المجال من خلال منتج Ionpure، الذي يسمح بتأمين المياه الفائقة النقاوة وأيضاً بخفض تكاليف التشغيل وتأثير هذه العملية على البيئة المحيطة بالمقارنة مع الأنظمة التقليدية.

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