Ground-breaking system for the serial connection of solar cells helps pave the way to affordable green energy

Eindhoven, 24 March 2014 - A consortium consisting of CCM, IBSPE, Smit Ovens, SPGPrints and the Solliance partners TNO and ECN has produced a prototype process station for the production of solar cells.

The process station for the serial connection of thin-film solar cells (ProDuZo) splits the rolls of photoactive substrate into sections and connects them electrically. Because the manufacturing process is continuous, the solar cells can be produced more cheaply and the design is more flexible than is achievable with conventional processes. Green electricity obtained from solar energy will become more widely available thanks to this system.

The basis of the system is the Generic Substrate Carrier developed by CCM. This is a highly accurate metal conveyor and this particular version can transport a sheet of glass plate or a roll of flexible foil of maximum 60 centimetres wide at a speed of up to 2000 millimetres per second (7.2kph). The transportation has an accuracy of 10 micrometres, or one hundredth of a millimetre, and performs a number of processes over a distance of 2 metres. A laser is used to scribe the grooves in the material that separate the individual cells. The electrical connections (known as the interconnects), which consist of an insulating ink and a conductive silver ink, are then printed on these cells using inkjet technology.

ProDuZo was developed for two reasons. First of all, ‘backend’ production processes for printing the interconnects are required in order to ensure flexible form and function of the solar cell. These backend processes start in a factory that prepares the unstructured photoactive substrate on the roll. The next step in the backend process involves cutting the cells to size – large or small, flat or curved – after which they are finished. This means that each of the production processes can be optimised separately and the desired form can be selected in the final phase. And the innovative Produzo process station makes this all possible.

The second reason for developing ProDuZo was to reduce the dead zone, which is the surface area that is lost due to the presence of the interconnects (which do not capture solar energy). Thanks to the application of precision technologies, the interconnects used in ProDuZo are much smaller than those of conventional systems, resulting in a greater total yield per solar cell. Because each of the process steps on the conveyor belt are conducted in quick succession and with the utmost of precision, the influence of impurities and movement of the roll is kept to a minimum.

The partners in the consortium each had a specific role in the ProDuZo project. CCM improved the precision of the Generic Substrate Carrier in order to achieve the required speed and accuracy. Solliance partner ECN developed an optical system that splits laser bundles in order to scribe large series of parallel grooves. SPGPrints developed the printing stations and optimised the process in which electrically insulated and conductive inks are loaded in the right cartridges in the right amounts. IBS Precision Engineering developed a monitoring system which enabled the quality of the electrical connections to be analysed in line. Solliance partner TNO provided expertise in the field of materials handling in a roll-to-roll installation and, in the role of system architect, combined the chosen design components into a total concept. Finally, Smit Ovens connected the consortium to the manufacturers in the solar industry.

ProDuZo is recognised around the world as a unique machine that can produce solar cells on thin-film at an industrial scale, both glass-based photovoltaic panels and flexible modules produced with roll-to-roll techniques.
The development of ProDuZo by the consortium was financed by the Netherlands Enterprise Agency (RVO), the Province of Noord-Brabant (including funds allocated to the Solliance alliance) and the Eindhoven Region Partnership (SRE).

The ProDuZo consortium consists of:
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ECN, www.ecn.nl, High Tech Campus, Gebouw 5, Eindhoven;
Smit Ovens B.V., www.smitovens.nl, Ekkersrijt 4302, Son;
SPGPrints B.V., www.spgprints.com, Raamstraat 1-3, Boxmeer;

ECN and TNO are partners in Solliance. Solliance is a partnership of R&D organisations involved in the development of photovoltaic cells (PV) in de ELAT region (Eindhoven-Leuven-Aaken). The Solliance partners are: