Novel crystalline-silicon solar cells take photovoltaics technology light years ahead

Photovoltaics (PV) technology is based on crystalline silicon (c-Si) solar cells. To corner the global market, highly efficient c-Si PV modules with improved energy conversion efficiency and reduced production costs are required.

The successful commercialisation of high-efficiency PV modules based on c-Si solar cells will depend on their cost advantage over existing conventional c-Si technology. Despite their higher efficiency compared to standard cell technology, a large-scale industrial changeover hasn't taken place yet.

The EU-funded NextBase project is developing next-generation c-Si solar cells and modules that “go far beyond the state of the art in industry-compatible approaches,” says coordinator Dr Kaining Ding. It aims at fostering the energy transition from fossil fuels to renewable energies by improving the energy conversion of PV modules while reducing their cost.
Solar cells and modules with unparalleled efficiency values

The NextBase team seeks to develop interdigitated back-contacted silicon-heterojunction (IBC-SHJ) solar cells in a cost-effective manner. “IBC-SHJ solar cells have already been proven to be the ultimate architecture for high efficiency in c-Si solar cells,” he continues. To achieve its aims, NextBase has set several targets: solar cells and corresponding modules with efficiencies that exceed 26 % and 22 %, respectively. This efficiency boost will be achieved by applying cost-effective processes to reduce module costs to under EUR 0.35/Wp.

Project partners have set out to prove that IBC-SHJ solar cells and modules can be produced at competitive costs. To date, they have demonstrated IBC-SHJ solar cells with a certified efficiency of 25 %. “In practical terms, this means that NextBase has given Europe the c-Si solar cell world record for efficiency while employing a simple process flow for this device type,” notes Dr Ding. In addition, they have demonstrated a novel interconnection technology for IBC-SHJ solar cells based on a multi-wire approach with a module efficiency of up to 23.2 %. When the targets are met, the efficiency gains will help “boost the confidence of investors to reinvest in European PV companies and PV technology.”

Driving innovation in the IBC-SHJ field

The researchers are busy producing high-quality n-type mono-c-Si wafers and an industrial prototype plasma-enhanced chemical vapour deposition reactor for IBC-SHJ solar cells. They are also examining the reliability and lifetime of IBC-SHJ solar modules for the industry, and preparing a life-cycle cost analysis for NextBase technologies.

“NextBase will revitalise the European PV industry by providing Europe with a leading position in advanced, world-class high-performance c-Si PV technology,” concludes Dr Ding. Successful outcomes would enable cost-effective high-quality PV module manufacture in Europe for the first time in an Asia-dominated market. “This would fill an important gap that’s missing in the PV system value chain in Europe.”

Keywords

NextBase, solar cells, interdigitated back-contacted silicon heterojunction (IBC-SHJ), crystalline silicon (c-Si), PV modules, wafer, life-cycle

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