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Next – generation interdigitated back-contacted silicon heterojunction solar cells and modules by design and process innovations

NEXTBASE
THE NEXT GENERATION BASELINE

NextBase - Deliverable report

D7.2 - Demonstration of a new generation of interconnection technologies with < 6 €cts/cell material cost

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Publishable summary

Module technology partners in the NextBase project aim to demonstrate that efficient interconnection technology for back contact cells does not need to rhyme with high cost or complexity. CSEM and imec jointly with Meyer-Burger are investigating multi-wire interconnection technologies for back contact cells. Using this concept for contacting interdigitated back contact (IBC) cells has significant advantages, notably the reduction of power losses in the cell finger and the huge potential cost decrease owing to reduced material usage for cell metallization. To contact standard silicon heterojunction (SHJ) solar cells, the SmartWire Connection Technology (SWCT) is the only mature and industrial technology from the multi-wire interconnection approaches. In the last period numerous industrial module line have been installed with this technology, clearly indicating that technology leaders are starting to switch to advanced interconnection. We believe that on the heterojunction technology roadmap the gradual shift from two-side contacted to back-contact cells in the 5-year horizon will be key in the race towards >400- 450 Wp modules.

In the last 6 months joint efforts of the cell, module material and technology development in the project allow to report a module efficiency of 21.8% based on 23.1% cell efficiency using SWCT as interconnection. This module reaches a cell-to-module (CTM) power ratio of 94.2% and our performance improvement roadmap indicates that this can be further increased to above 96% with an adaptation of the bill of materials of the interconnection and the use of a novel AR-coating developed by DSM. Combined with the progress in cell development we anticipate we will be able to report a >22% module next year. In parallel imec has successfully demonstrated that 3D woven interconnection fabric with a two-level metallization using only encapsulant as insulator can be a next generation technology to SWCT. Significant reduced material use (metallization, insulation, plastic foil) and its combined solder and lamination approach make it an efficient and cost-effective technology.

Next to performance, reliability targets and competitive cost is equally important for the industrial uptake of technology. An extensive cost calculation on bill of materials for two interconnection technologies shows us that we can reach 4.98 €ct/cell for SWCT and novel 3WD weave technology from imec would enable 3.3 €ct/cell. Both partners have started to validate materials in performance and reliability testing that will enable reduction below 3-3.5 €ct/cell future material cost reduction.

This latest progress in module technology combined with the promising results in cells break the myths of IBC-SHJ being too expensive and/or too complex for industrial application. Further demonstration and upscaling of the technology must follow, and the partners are confident that the interconnection technologies can meet the combined performance, reliability and cost targets of the NextBase project. They are jointly aiming at the demonstration of a high-performance module at the end of the project.