PHOTOVOLTAICS

Easing tandem up-scaling

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Two-terminal perovskite/silicon tandem solar cell efficiencies have skyrocketed in the past few years, while also improving the compatibility of cell manufacturing with industrial processes. Despite these encouraging results, few attempts at up-scaling such devices have been reported. Among the limitations, the recombination layer or tunnel junction that connects the perovskite and the silicon sub-cells hampers the device scalability, introducing shunt paths and optical losses while adding an extra fabrication step. Now, Jianghui Zheng, Anita Ho-Baillie and colleagues in Australia and China demonstrate tandem devices where the tin oxide electron transport layer of the perovskite sub-cell also performs the function of recombination layer, thus enabling the fabrication of modules with up to 16-cm² areas.

The low-temperature solution-processed SnO₂ layer is interfaced with the front emitter of the silicon bottom cell, a boron-doped (p++) Si layer. The SnO₂ layer shows negligible lateral conductivity, thereby preventing shunt paths in the perovskite sub-cell when up-scaling to large areas, while the heavy doping of the p++ Si layer ensures good vertical conduction at the interface with SnO₂. The researchers test this approach on tandem cells with a homojunction silicon bottom cell that currently dominates the market. They demonstrate a 4-cm² area cell with a stabilized efficiency of 20.5% and a 16-cm² area module with a stabilized efficiency of 17.1%, yet leaving room for further improvements.

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