PEAI Boosts the Efficiency of All-Perovskite Tandem Solar Cells to 26.81%

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Lead perovskite solar cells (Pb-PVK-PV) currently boast an efficiency exceeding 25%. Tandem solar cells, featuring Pb-PVK-PV as the top cell and silicon (Si) solar cells as the bottom cells, have garnered interest for surpassing the efficiency of standalone Pb-PVK-PV. The certified efficiency for such tandem cells has reached 32.5%. Notably, all-perovskite tandem solar cells offer an advantage over configurations with Pb-PVK-PV (top) and inorganic solar cells (bottom) in terms of flexibility, as a low-temperature printable process allows the fabrication of both top and bottom cells. Research has reported an efficiency of 28% for these all-perovskite tandem solar cells.

In perovskite/Si tandem solar cells, the top layer typically possesses a bandgap of around 1.6 eV. However, for all-perovskite tandem solar cells, a wider bandgap of 1.7-1.8 eV is required, surpassing the bandgap of Pb-PVK-PV, which is around 1.55-1.6 eV, to achieve an efficiency exceeding 25%. To address this, a re-optimization of the solar cell structure was undertaken. In this study, we utilized PEAI to simultaneously modify the upper and lower interfaces of the perovskite layer. The discussion encompasses the impact of introducing PEAI on carrier transmission and non-radiative recombination in the device. The quantified non-radiative recombination provides insights into how PEAI influences various photovoltaic parameters. Ultimately, an all-perovskite solar cell with an efficiency surpassing 26.81% was successfully achieved.