Towards All-Inorganic Transport Layers for Wide-Bandgap FAPbBr₃-Based Planar Photovoltaics (PV-3)

Scientific Achievement:
We report photovoltaic (PV) devices using all-inorganic transport layers under p-i-n planar device configuration using formamidinium lead tri-bromide (FAPbBr₃) as an absorber. Efficient planar devices are achieved with atomic layer deposition grown nickel oxide (NiO) and sputtered zinc oxide (ZnO) as hole and electron transport materials, respectively. Resulted in 6.75% efficient planar FAPbBr₃ devices with open-circuit voltage of 1.23 V. Did detailed comparison of planar FAPbBr₃ devices making transition from all-organic charge-transport layers toward all-inorganic charge-transport layers.

Significance and Impact:
The PV device performance elaborates the setbacks in the widely used organic ETL-PCBM and HTM-PEDOT:PSS along with the wider bandgap absorber material FAPbBr₃. The inorganic oxide transport layers replacing them show better compatibility with this particular absorber layer primarily due to their wide bandgap, which offers effective charge blocking. Using this advantage, efficient FAPbBr₃ devices with a champion efficiency of ~6.7% were demonstrated in simple planar configuration (FTO-NiO-FAPbBr₃-ZnO-Ag). Inorganic transport layers can also work well with tandem device structures, aiding the use of large-bandgap FAPbBr₃ as top cells.


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