

Fully-ambient-processed Mesoscopic Semitransparent Perovskite Solar Cells by Islands-structure-MAPbI₃-xClx-NiO Composite and Al₂O₃/NiO Interface Engineering

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Here, we present fully-ambient-processed stable and mesoscopic semitransparent PSCs by non-continuous islands-structure-CH₃NH₃PbI₃-xClx-NiO nanoparticles (MAPbI₃-xClx-NiO NPs) composite and interface engineering by inserting Al₂O₃/NiO between TiO₂ and MAPbI₃-xClx-NiO composite layers in a device configuration of FTO/c-TiO₂/mp-TiO₂/Al₂O₃/NiO/islands-structure-MAPbI₃-xClx-NiO /spiro-OMeTAD/Au. Except for the islands-structure-MAPbI₃-xClx-NiO capping layer, a uniform and thicker and transparent TiO₂/Al₂O₃/NiO/MAPbI₃-xClx composite layer is formed, which can effectively reduce photocurrent density loss and interface recombination. The average visible transmittance (AVT) of MAPbI₃-xClx-NiO NPs composite film was ranged from 18% to 56% and the corresponding device PCE changed from 17.51% to 12.47%. The PSCs without encapsulation showed an excellent air stability over 270 days with retaining ~98% of its original Voc, ~96% of Jsc, ~97% of FF and ~93% of PCE under ambient condition (25-30°C and 45-50 % humidity).