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The effect of a sputter-deposited TiO_x interface modification layer on perovskite solar cells

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Efficiently suppressing non-radiative recombination within the hole-blocking layer (HBL) and at the HBL-active layer interface is critical for enhancing solar cell performance. In this study, the TiO_x layer is sputter-deposited onto a SnO_2 layer at room temperature as a buried interface modification layer. We investigate the structural evolution of TiO_x during sputter deposition using in situ grazing-incidence small-angle X-ray scattering (GISAXS). The novel HBL, achieved by depositing TiO_x with an appropriate thickness on the SnO_2 layer, exhibits favorable characteristics, including suitable transmittance, smoother surface roughness, and reduced surface defects. Consequently, this leads to diminished trap-assisted recombination at the interface between the HBL and the active layer. The incorporation of the TiO_x buried interface modification layer results in perovskite solar cells with enhanced power conversion efficiencies and stability compared to unmodified SnO_2 monolayer devices. The large data set of in situ GISAXS data will be used for machine learning applications.

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