

Inorganic charge transport layers grown via atomic layer deposition for highly stable and efficient perovskite solar cell

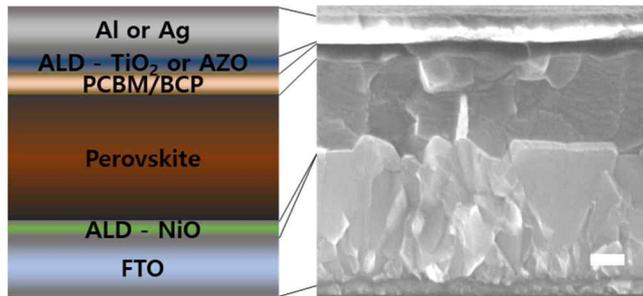


Figure S1. Schematic of the inverted PSC ($p-i-n$) structure FTO/ALD-NiO/ $\text{Cs}_{0.05}\text{MA}_{0.95}\text{PbI}_3$ /PCBM/BCP/ALD-TiO₂ or ALD-AZO/metal sandwiched by inorganic CTLs (p -NiO, n -TiO₂ and/or n -AZO) and the corresponding FE-SEM image of the PSC cross-section. The scale bar represents 100 nm.

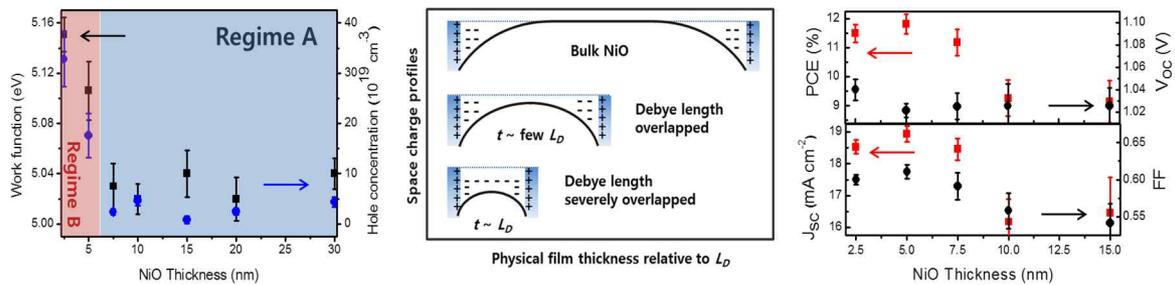


Figure S2. Plot of work function (E_{fb}) and hole concentration (N_a) vs. film thickness of NiO measured by electrochemical Mott-Schottky analysis NiO films with thicker than 7.5 nm (Regime A) show similar work function and hole concentration, while thinner than 7.5 nm (Regime B) shows an increase in the function of thickness. B) Schematic images of physical films' thickness relative to Debye length (L_D) vs. space charge profiles. C) Plot (Top) of PCE, V_{oc} , J_{sc} and FF vs. the thickness of NiO films (2.5, 5.0, 7.5, 10.0 and 15.0 nm in thickness).

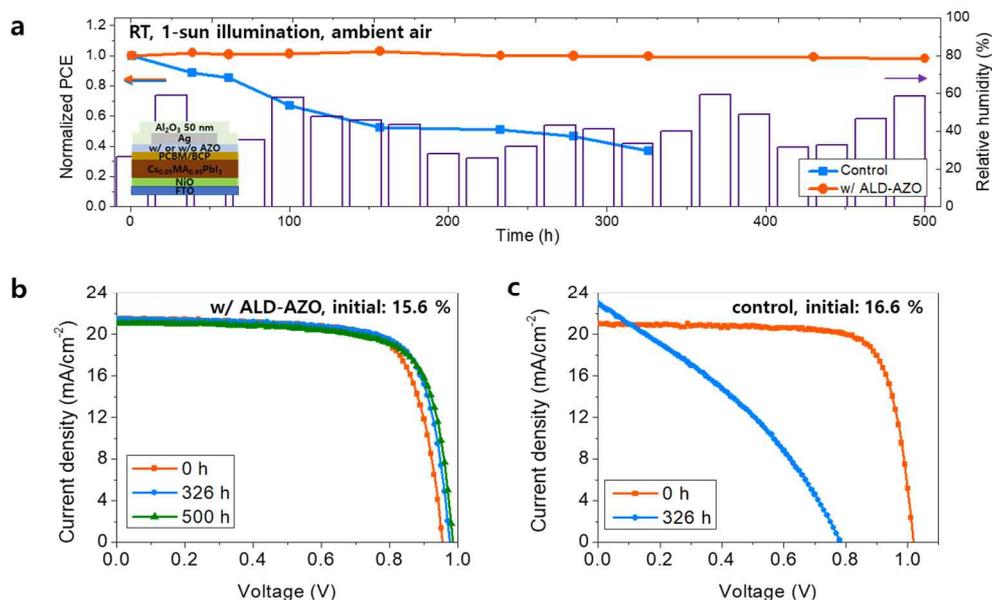


Figure S3. (a) PCE evolution over 500 hours for the control (blue) and ALD-AZO-coated (orange) PSCs passivated by an Al₂O₃ thin film (~ 50 nm). A schematic of the device structure is shown in the inset. The ALD-AZO-coated device retained 99.5 % of its initial performance, while the performance of the control device degraded rapidly during the light-soaking period.