Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information for

Over 800% efficiency enhancement of all-inorganic quantum-dot light emitting diodes with an ultrathin alumina passivating layer

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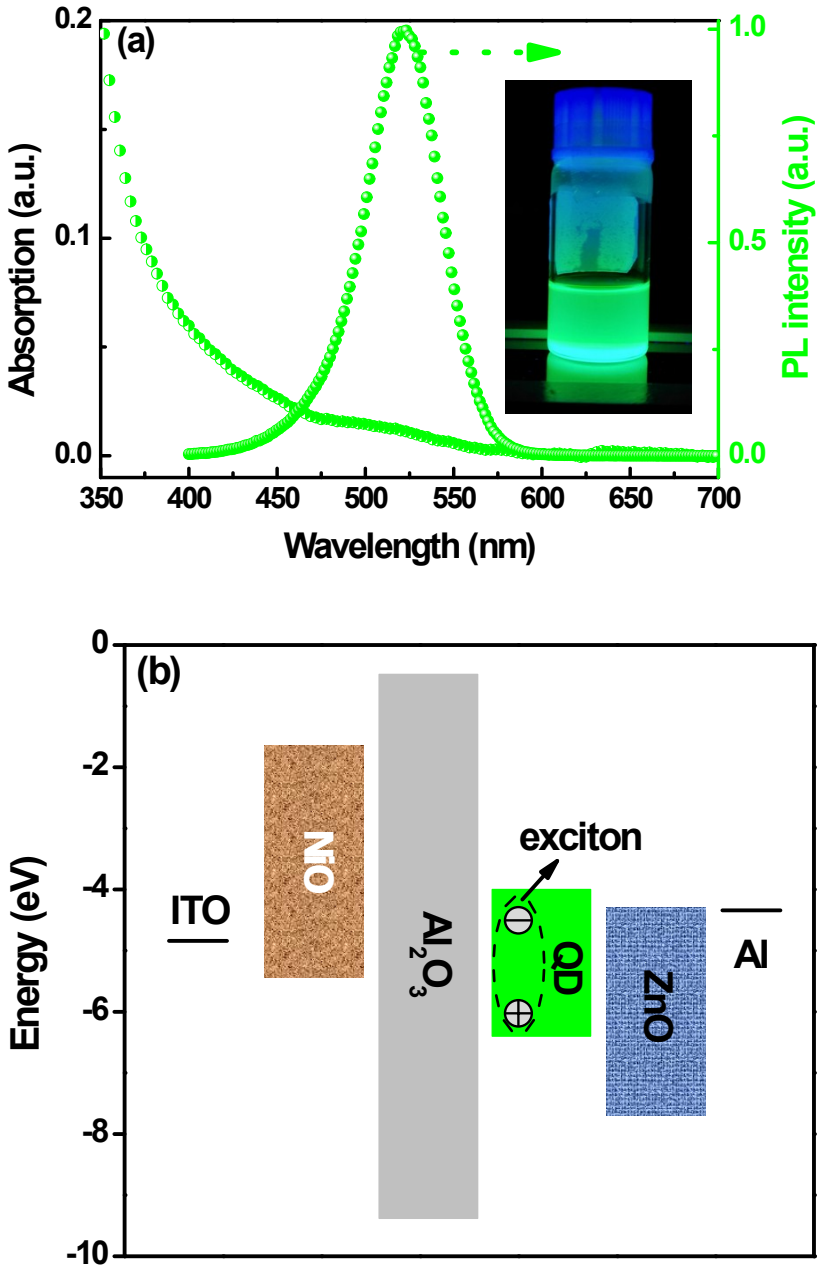

Figure S1. (a) PL and absorption spectra of QDs in toluene. (b) Schematic diagram of energy-level alignment properties for the all inorganic QLED.

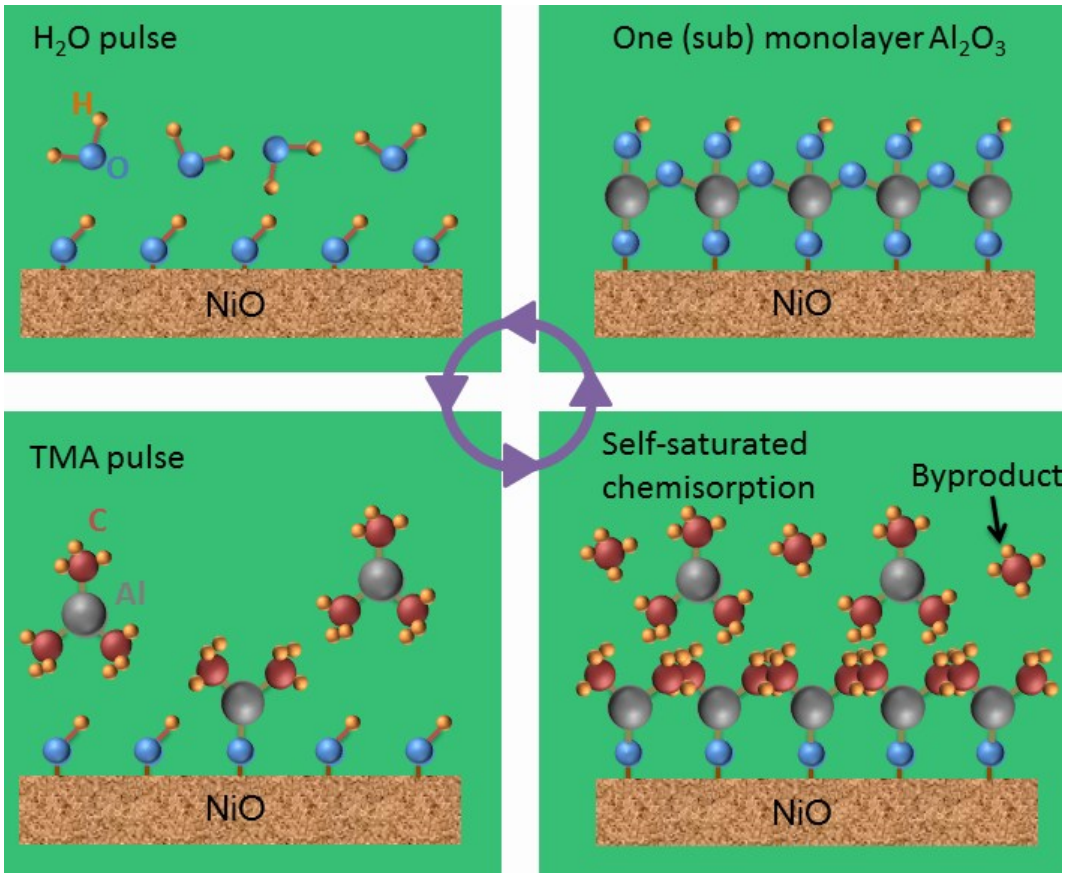

Figure S2 (a) Schematic diagram of ALD processes for the Al_2O_3.

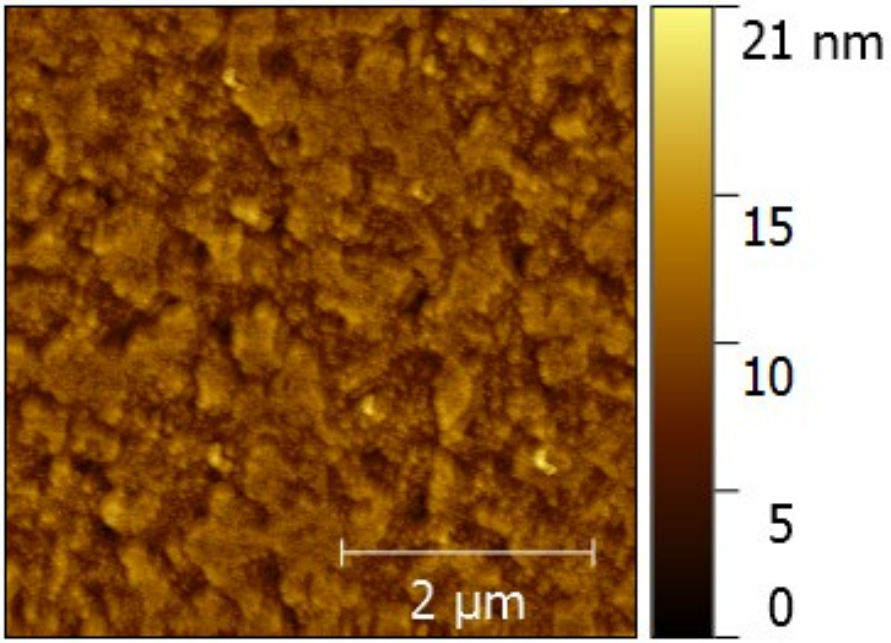

Figure S3 AFM image of pure ITO substrate. The RMS is 1.92 nm.

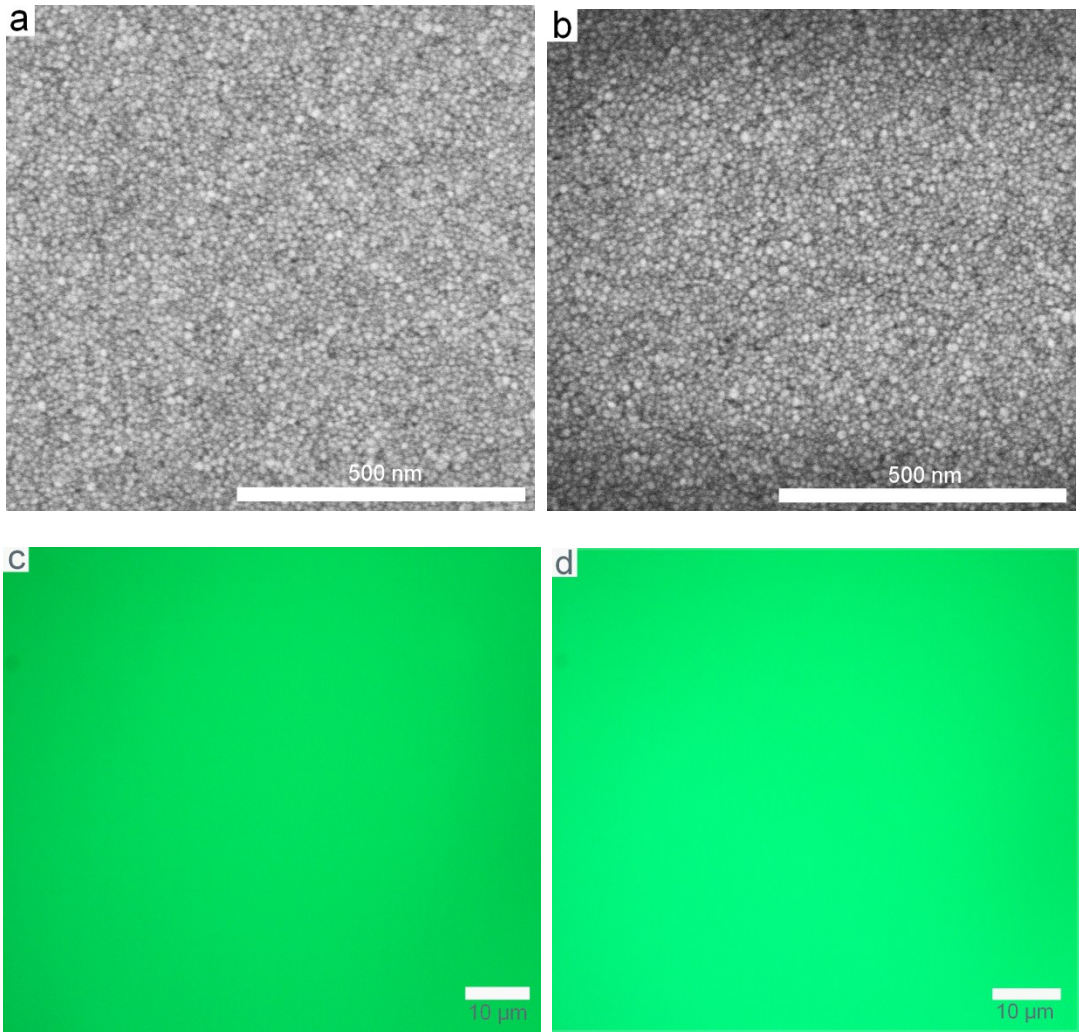

Figure S4. SEM images of QD films on (a) s-NiOand (b) s-NiO/Al_2O_3 layers; Fluorescent microscope images of QDs deposited on (c) s-NiO and (d) s-NiO/Al_2O_3 layers.

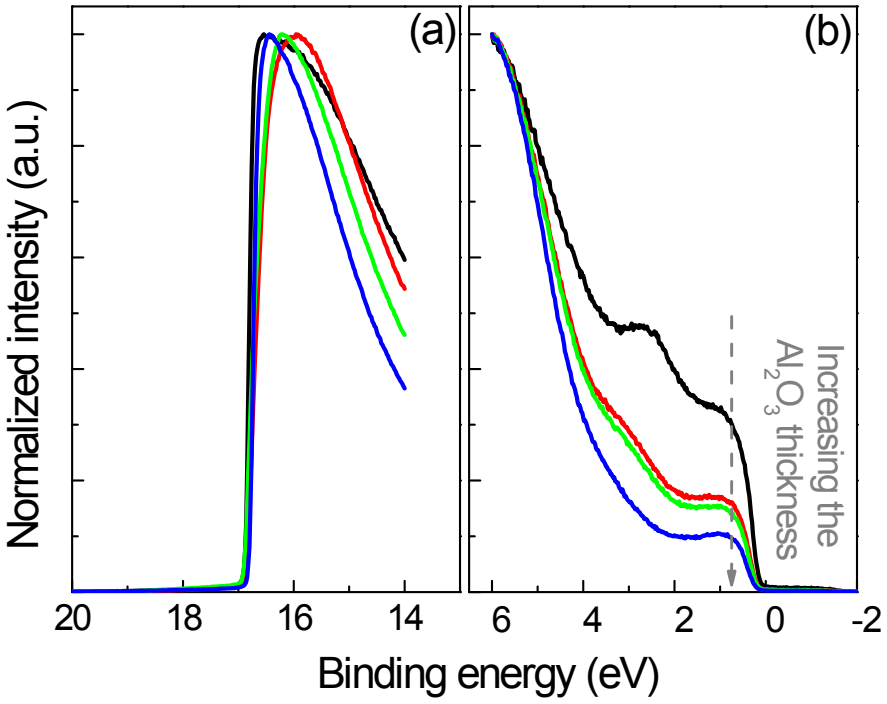

Figure S5. He I $h\nu$ = 21.22 eV valence band spectra of NiO with different thickness Al_2O_3 passivating layers (a) the secondary electron cut-off and (b) the valence band.

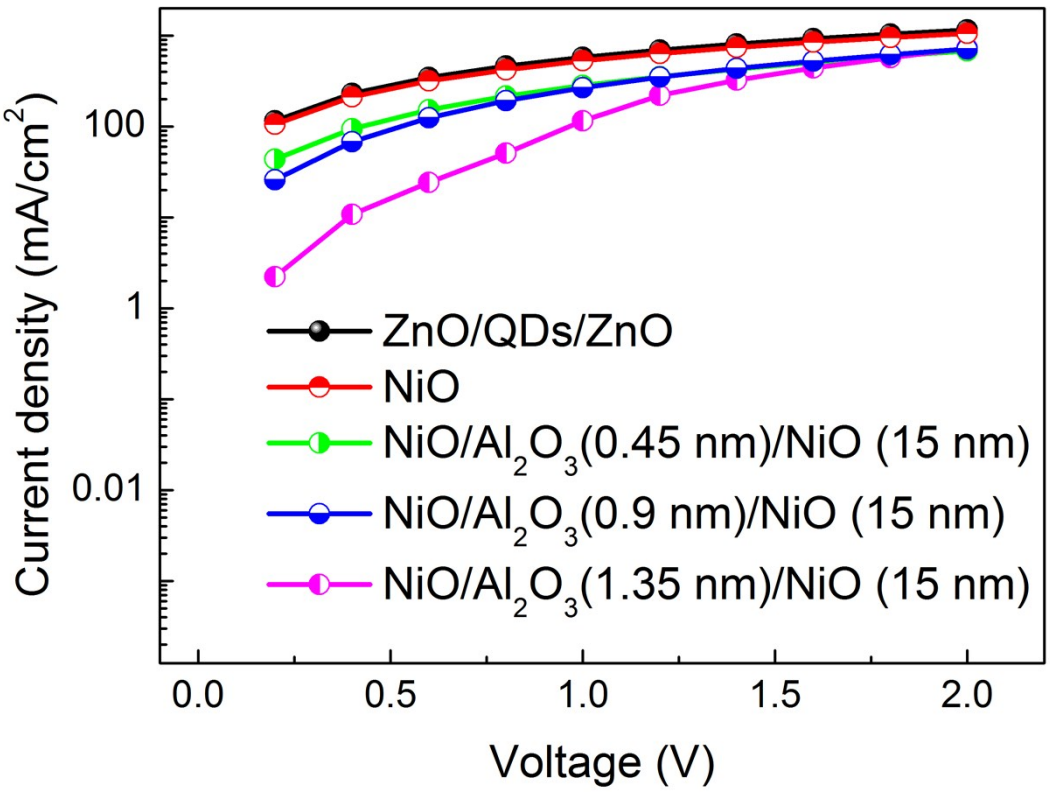

Figure S6 Current-voltage characteristics of electron (hole)-only devices. The electron-only device possesses a structure of ITO/ZnO (15 nm)/QDs (25 nm)/ZnO (40 nm)/Al (100 nm). The 15-nm ZnO on the ITO substrate is used as the hole blocking layer in order to limit the hole injection from ITO into the device. The hole-only devices consist of ITO/NiO (50 nm)/Al_2O_3 (x nm)/NiO (15 nm)/Al (100 nm). The value of x is 0, 0.45, 0.9, and 1.35 nm as depicted in the figure.

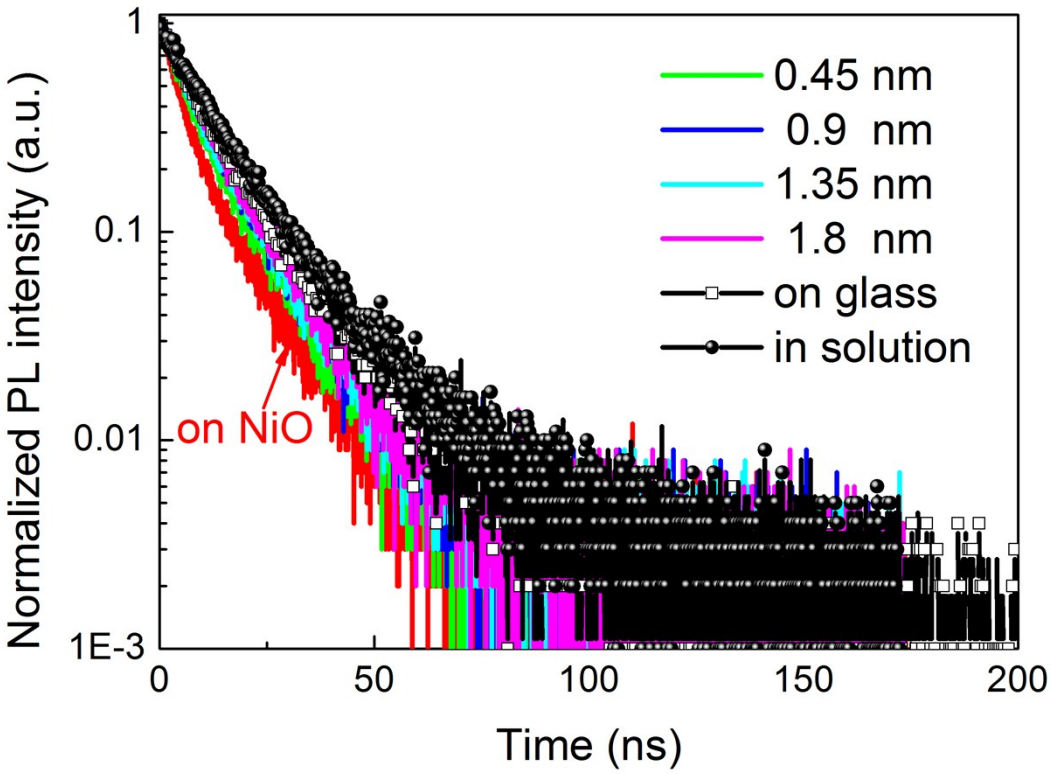

Figure S7 (a) Time-resolved PL spectra of QD layers on s-NiO substrates differentiated by inserted different cycle Al_2O_3 layers, from 0 to 1.35 nm for different samples. The TRPL spectra of QDs in toluene and on glass substrate are also shown as the reference.