Supporting Information

Amino N-Oxide Functionalized Graphene Quantum Dots as Cathode Interlayer for the Inverted Polymer Solar Cells

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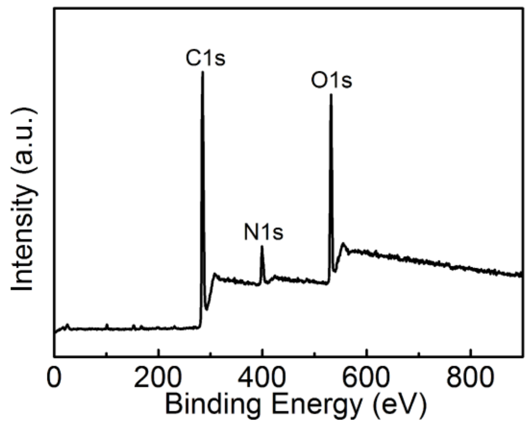

Figure S1 XPS survey spectrum of GQD-NO.

Table S1. The component analysis of GQD-N and GQD-NO by XPS.

Materials	C (at%)	O (at%)	N (at%)
GQD-N	66.98	25.34	7.68
GQD-NO	65.26	26.58	8.16

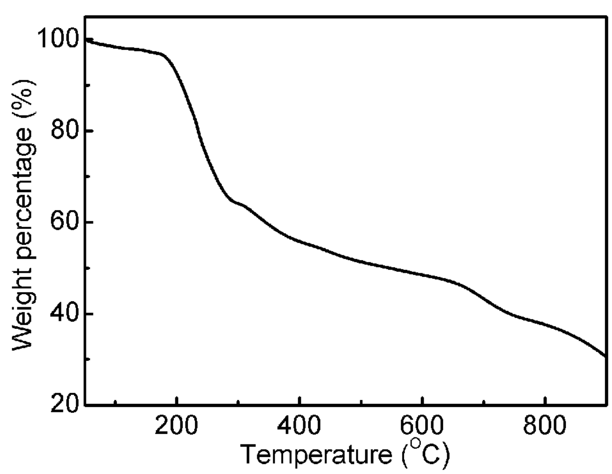

Figure S2 TGA curve of GQD-NO under nitrogen. TGA analysis shows that the decomposition temperature (Td) of GQD-NO at 5% weight loss is 188^{o}C.

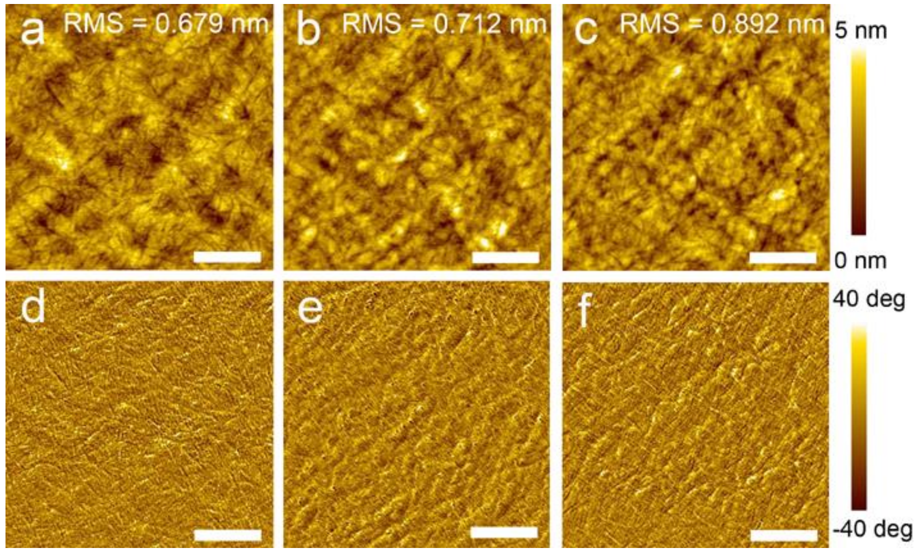

Figure S3 AFM height images of the PCDTBT:PC_{71}BM active layer on ITO (a), ITO/ZnO (b) and ITO/GQD-NO (c) substrates. AFM phase images of the PCDTBT:PC_{71}BM active layer on ITO (d), ITO/ZnO (e) and ITO/GQD-NO (f) substrates. The scale bar is 500 nm.

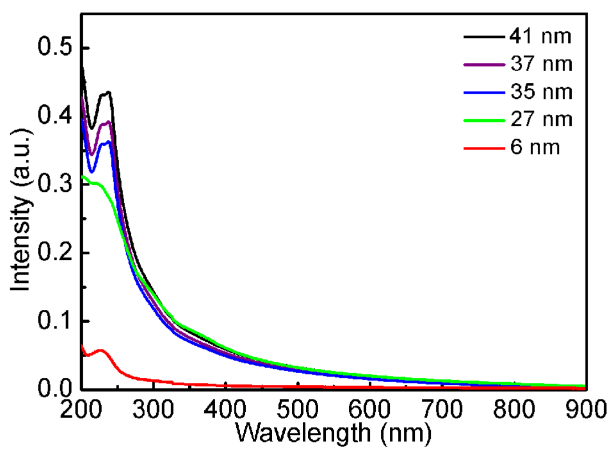

Figure S4 UV/Vis absorption spectra of GQD-NO interlayers with different thicknesses on quartz plates. The thicknesses of four thick GQD-NO films on quartz substrates are measured by profilometer. We fit linear to get a function relation between the thickness and the corresponding absorbance at 230 nm according to the Lambert-Beer law. The thickness of GQD-NO interlayer in the same condition as device fabrication is then calculated to be 6 nm using the function relation.

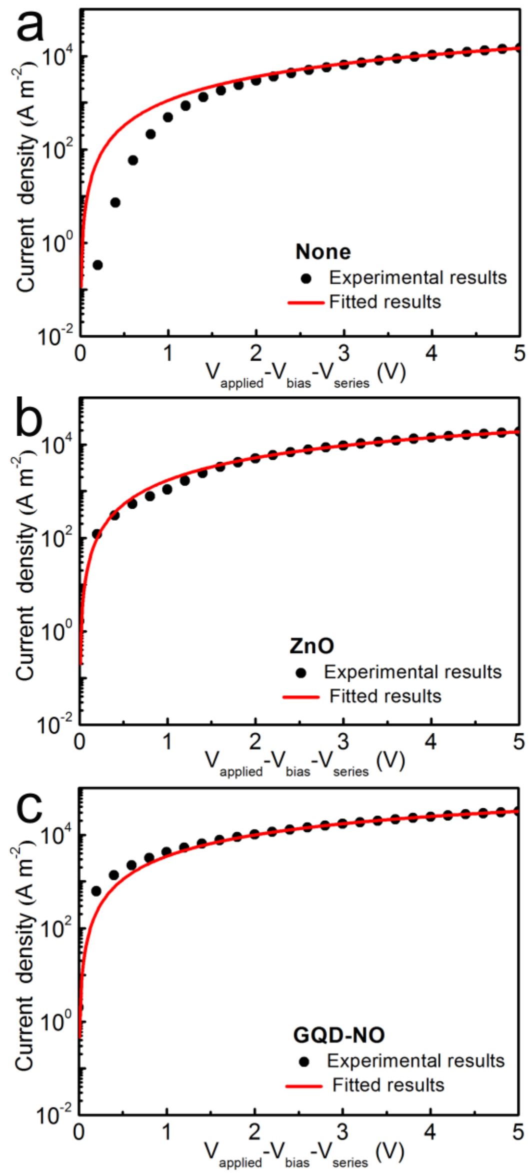

Figure S5 SCLC fittings of the electron-only devices based on PCDTBT:$PC_{71}BM$ active layer with none (a), ZnO (b) and GQD-NO (c) as CILs.

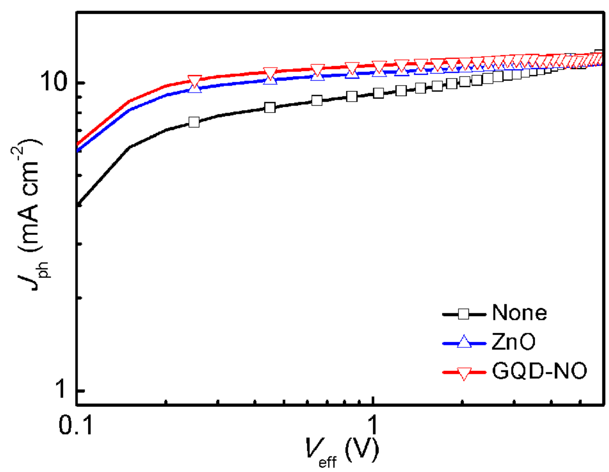

Figure S6 Photocurrent versus effective voltage plots of the PCDTBT:$PC_{71}BM$ based PSC devices with different CILs. The charge-transfer state (CTS) dissociation efficiency of the PSC device without cathode interlayer is 72.8%, which indicates the inefficient exciton dissociation or charge transfer process at the cathode interface. The CTS dissociation efficiency of the device with GQD-NO as CILs (93.8%) is very comparable to that with the state-of-the-art CILs, ZnO (91.6%), illustrating that the GQD-NO CILs may effectively prevents charge recombination at the cathode interface.