Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Electronic Supporting Information

SWCNT photocathodes sensitised with InP/ZnS core-shell nanocrystals

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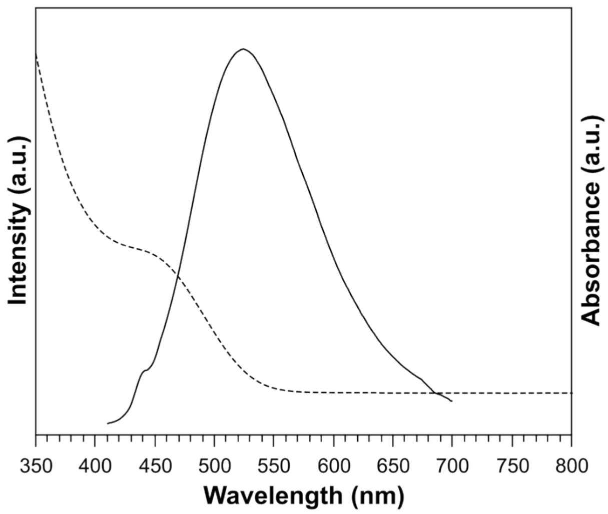

Figure S1. UV-visible and photoluminescence spectroscopy of InP core NCs.

Table S1. Spectroscopy of InP core and InP/ZnS NCs

NC	Wavelength (nm)	Absorbance (nm)	Quantum Yield (%)	Lifetime (ns)	β (beta)
InP Core	525	445	13	140 ± 0.83 ± 0.18	0.66
InP/ZnS	575	470	21	58 ± 0.38 ± 0.06	0.88

Figure S1 and Table S1 show the UV-Visible and photoluminescence spectroscopy of InP Core NCs. The optical properties of the NCs are outlined in Table S1. The increase in lifetime for the InP core NCs has been attributed to the surface properties of the cores. InP/ZnS core-shell particles reduce the number of surface defects and remove the longer-lived contributions to the lifetime. As a result, the average lifetime decreases and the character of the lifetime becomes more single-exponential.

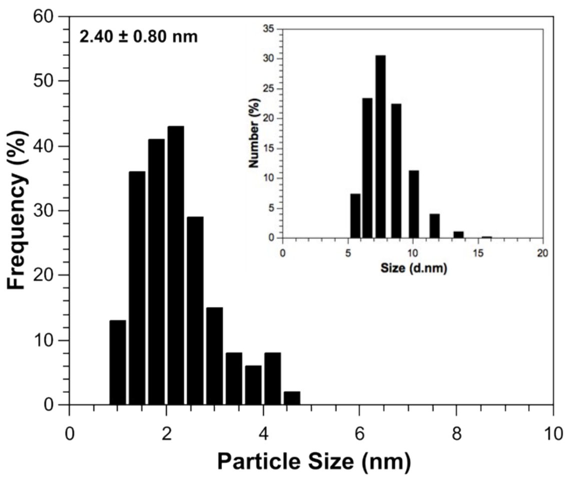

Figure S2. Histogram for particle sizes of InP/ZnS NCs. The inset represents the DLS showing the hydrodynamic diameter of the NCs.

Figure S2 shows a histogram for the InP/ZnS NCs calculated using *ImageJ* software. Particle counting was performed over areas consisting of over 200 NCs. The inset of Figure S2 shows the hydrodynamic diameter of the NCs from DLS measurements and the results are consistent with our previous report. [1]

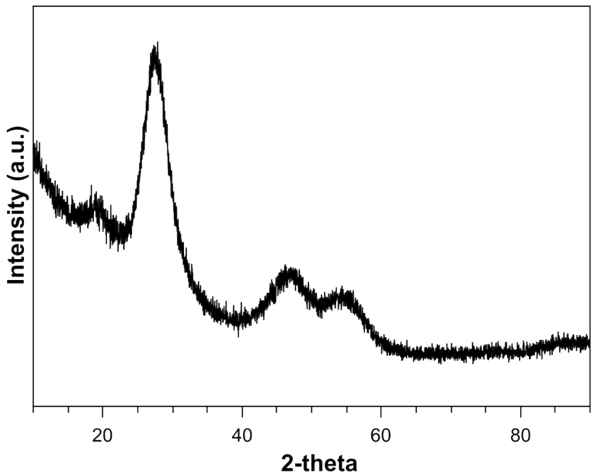

Figure S3. InP/ZnS XRD

The crystal structure of the InP/ZnS was measured using powered-XRD (Figure S3). The results are consistent with the crystalline structure of ZnS, supporting adequate shelling of the NCs.

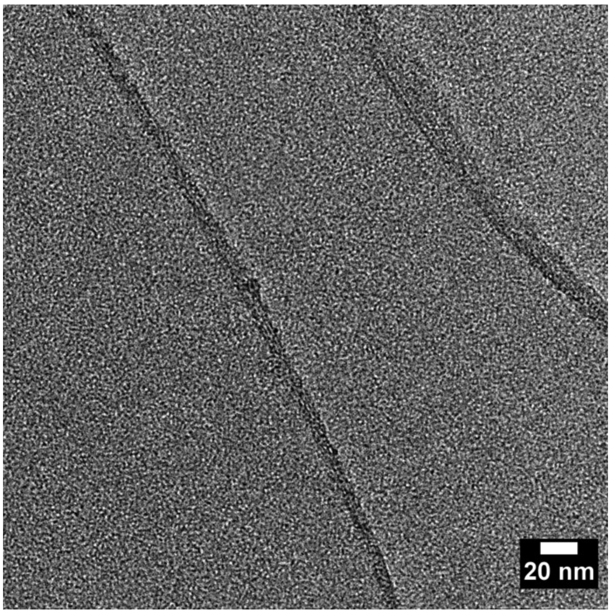

Figure S4. Full scale TEM of SWCNT bundles from which graphene lattice fringes were measured

Figure S4 shows the full scale TEM image of SWCNT bundles. The lattice fringes were measured using *ImageJ* software and consistent with previous reports.[2]

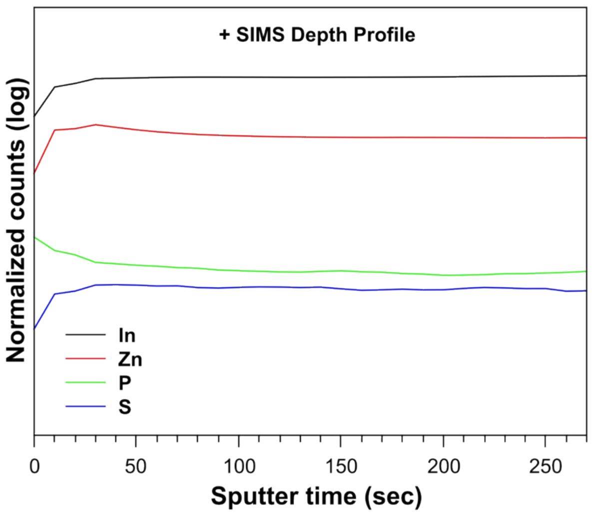

Figure S5. ToF-SIMS depth profile for InP/ZnS NCs

Positive SIMS depth profile measurements of InP/ZnS sensitized SWCNT films is shown in Figure S5. The results suggest the NCs are rich in Zn and P ions close to the surface.

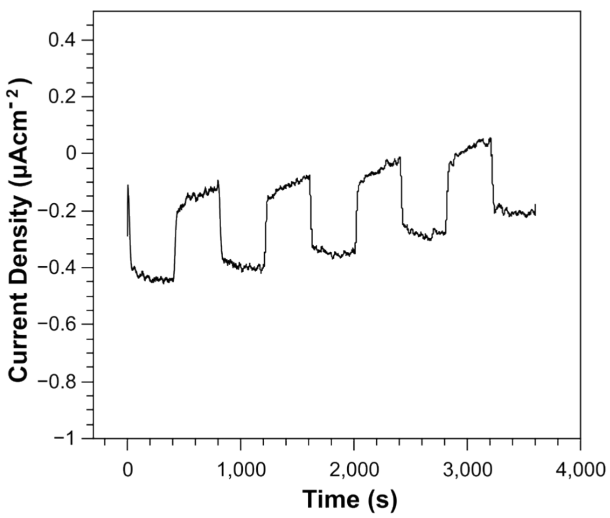

Figure S6. Current density as a function of time for 1 hour (stability test of photocathodes)

Figure S6 shows a 1-hour stability test for the InP/ZnS SWCNT photocathodes. The results indicate that the photocathodes maintain a consistent photocurrent response over a 1-hour time period. The slight drift of the photocurrent response has been attributed to diffusion in the photo-electrochemical cell.

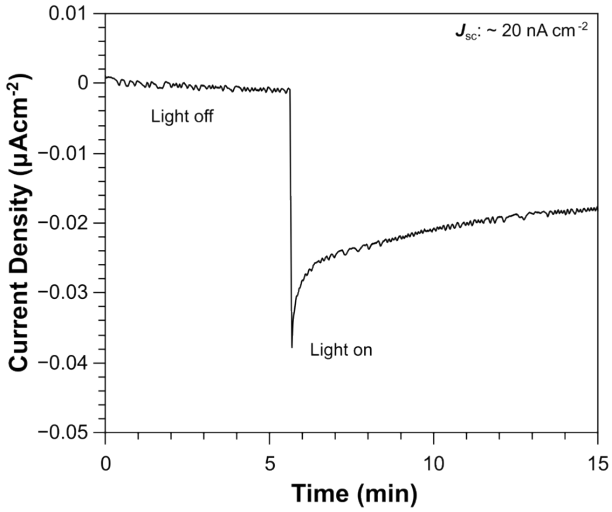

Figure S7. Current density as a function of time for gold electrode coated with InP NCs

Figure S7 shows the control measurement for a gold electrode coated in InP NCs (without SWCNTs). The photocurrent density was ~ 20 nA cm^{-2} over a 15 minute time period. This measurement shows that the combination of SWCNT + InP NCs on gold is superior to a bare gold electrode system. Furthermore, the current density measured was consistent with our previous study on gold + InP photocathodes.[3]

References

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