Electronic Supporting Information

**SWCNT photocathodes sensitised with InP/ZnS core-shell nanocrystals**


---

[a] Dr. TJ Macdonald, Dr. JC Bear, Prof. IP Parkin
Department of Chemistry
University College London
London, United Kingdom

[b] Dr. DD Tune
Institute of Nanotechnology
Karlsruhe Institute of Technology
Karlsruhe, Germany

[c] Dr. TJ Macdonald, Dr. MR Dewi, Prof. T Nann
Ian Wark Research Institute
University of South Australia
South Australia, Australia

[d] Dr. PD McNaughter, Prof. AG Mayes
School of Chemistry
University of East Anglia
Norwich, United Kingdom

[e] Dr. DD Tune, Prof. JG Shapter
Centre for Nanoscale Science and Technology
Flinders University
South Australia, Australia

[f] Prof. Thomas Nann
MacDiarmid Institute for Advanced Materials and Nanotechnology
School of Chemical and Physical Sciences
Victoria University of Wellington
Wellington, New Zealand
Email: thomas.nann@vuw.ac.nz
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 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.

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.
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 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 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.  

References