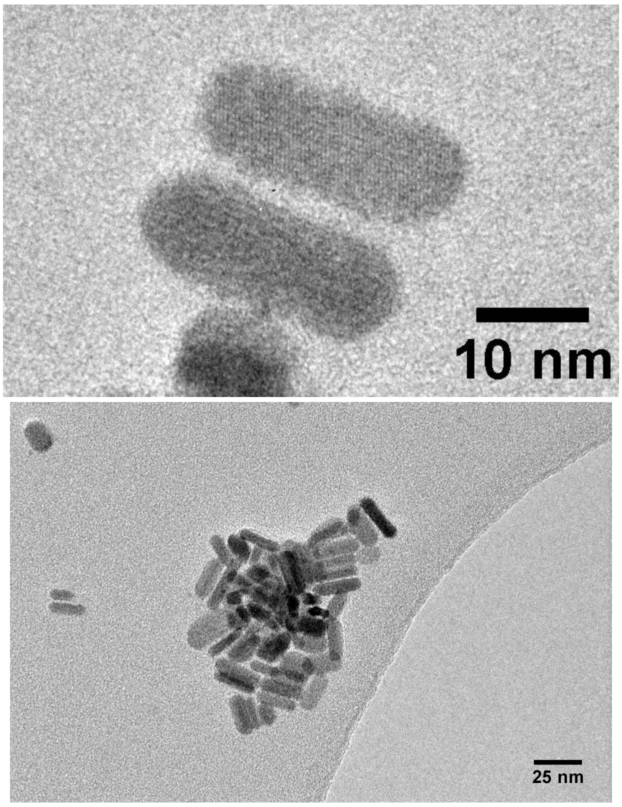
Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics

Supporting Information

Transmission electron microscopy

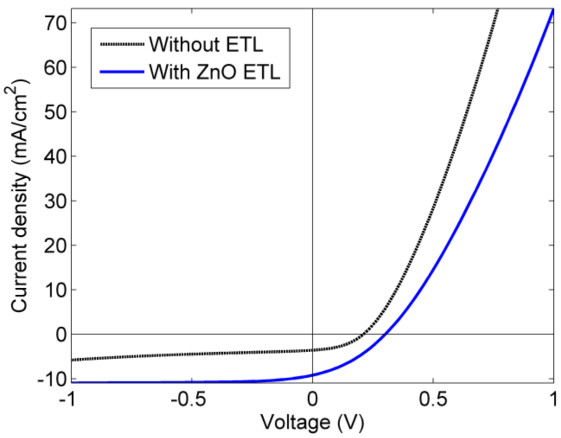


Supporting Information Figure 1 Transmission electron microscopy of Bi_2S_3 nanocrystals.

Transmission electron microscopy images reveal elongated crystalline Bi_2S_3 nanocrystals with a size distribution of 20±4.1 nm and 10±3.2 nm.

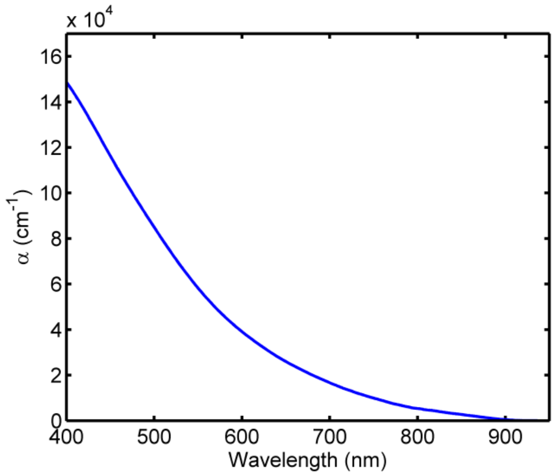
Electron transport layer (ETL)

To investigate the importance of having blocking layers in our devices we fabricated optimized devices with and without ETL. Devices without ETL showed reduced V_{oc} (0.22 V), J_{sc} (3.6 $mAcm^{-2}$) and PCE (0.32%) as a result of increased recombination. The role of the ETL is to prevent back injection of holes from the Bi_2S_3 or the P3HT into the ITO where they could recombine with electrons injected from the Bi_2S_3 nanocrystals in the bulk heterojunction (back recombination).



Supporting Information Figure 2 Current-Voltage characteristics of the hybrid devices with and without electron transport layer

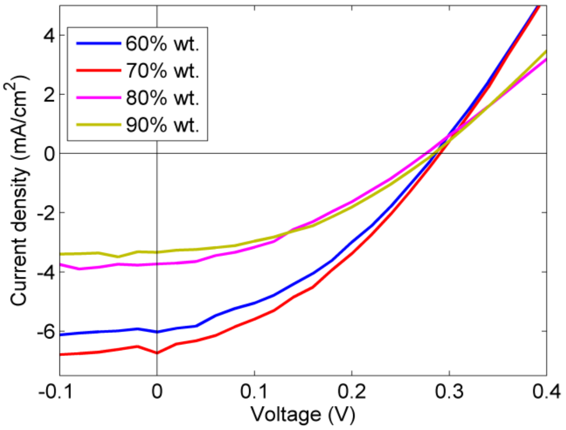
Absorption of bismuth sulfide



Supporting Information Figure 3 Extinction coefficient of bismuth sulfide nanocrystals.

Nanocrystal loading

The ratio between NCs and P3HT has been varied in order to investigate the optimum ratio for charge separation, transfer and transport. The device structure was: ITO/Bi_2S_3/BHJ/P3HT/MoO_3/Ag where only one layer of BHJ had been deposited and ligand exchanged as discussed in the manuscript.



Supporting Information Figure 2 Current-Voltage characteristics of the hybrid devices at different NCs loading.

sample	Voc (V)	Jsc (mA cm^{-2})	FF	PCE (%)
60% wt	-0.28	6.0	0.38	0.65
70% wt	-0.3	6.7	0.36	0.72
80% wt	-0.28	3.7	0.35	0.37
90% wt	-0.28	3.3	0.42	0.39

Supporting Information Table 1 Figures of the hybrid devices at different NCs-P3HT ratios.