Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Ternary hybrid systems of P3HT/CdSe/WS_2 nanutubes for photovoltaic applications

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1. Ultrafast spectroscopy

A detailed optical scheme of the up-conversion fluorescence system is reported in Fig. ESI 1.

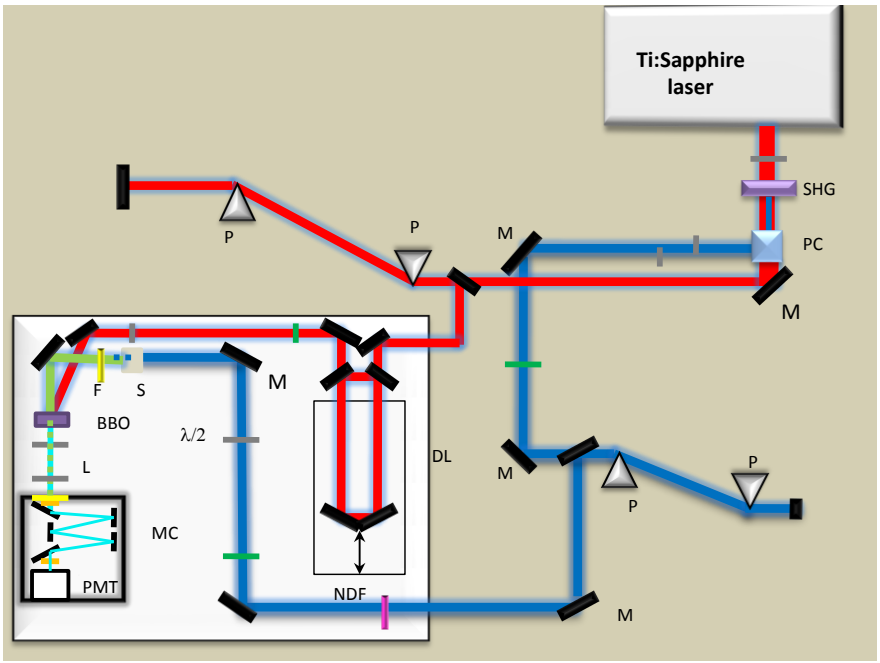

Fig. ESI 1 Schematic view of the experimental apparatus for the time-gated fluorescence upconversion apparatus. The major components have been highlighted: SHG: second harmonic generation crystal (BBO); polarizing beam splitter; M : mirror; P: prisms; L: lenses; F: band pass filter; NDF: neutral density filter; DL: delay Line; λ/2: waveplates; S: sample; MC; monocromathor; PMT: photomultiplier tube; BBO : beta barium borate crystal

2. Binary P3HT/WS_2 Blends

2. 1 Fluorescence decays

The fluorescence decays for all the P3HT/WS_2 blends are reported in Fig. ESI 2. The excitation is provided at 400 nm and the detection wavelength was 650 nm.

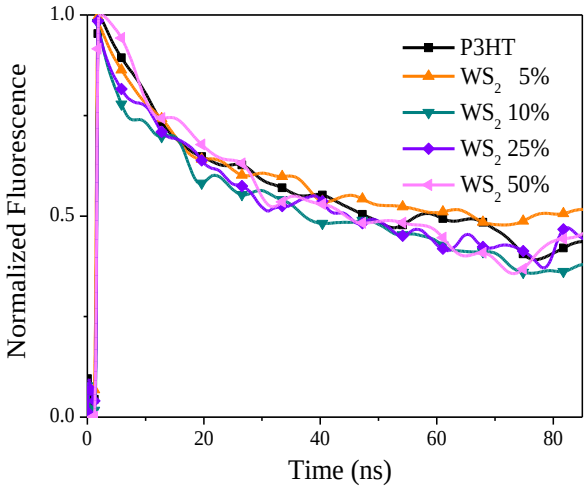

Fig. ESI 2: Fluorescence decays of all P3HT/WS_2 blends at 650 nm.

3. Binary P3HT/CdSe Blends

The emission spectra of the pure P3HT and P3HT:CdSe QDs blends corrected for the absorption at the excitation wavelength is reported in Fig. ESI 3. The QDs signal peak around 650 nm increases with the QDs concentration even when the total emission is quenched.

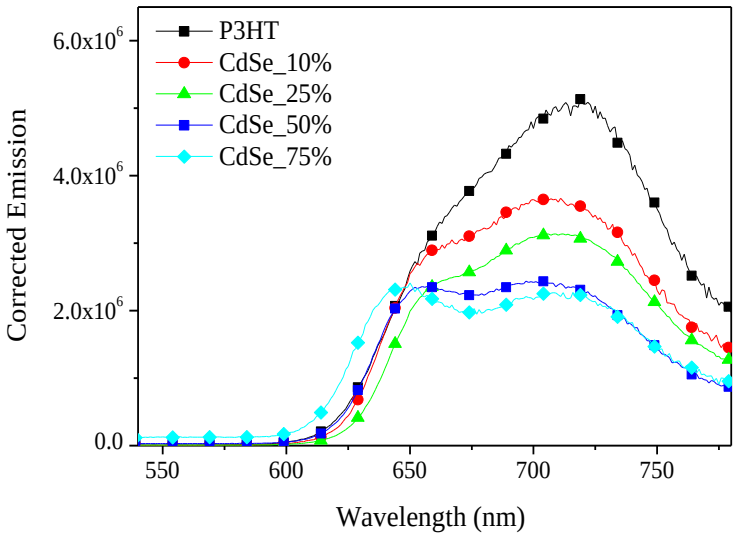

Fig. ESI 3: Emission spectra of P3HT and P3HT/QDs blends

Fig ESI 4 shows the first peak position of pure P3HT, pure CdSe and P3HT:CdSe blends as function of QDs concentration. The shift of the signal is linear vs QDs loading confirming that the emission peak obtained in the blend is due to a combination of the polymer and QDs emissions.

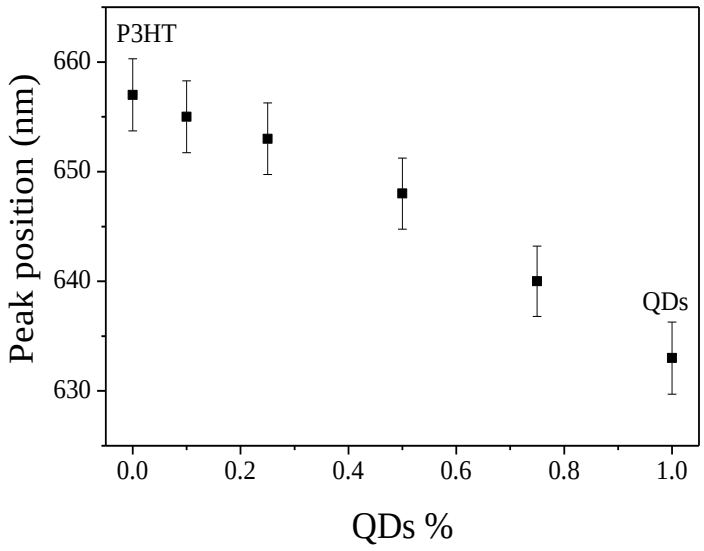

Fig. ESI 4: Peak position vs.QDs concentration in the blends

The fluorescence decays for all the P3HT/CdSe blends are reported in Fig. ESI 5. The excitation is provided at 400 nm and the detection wavelength was 650 nm.

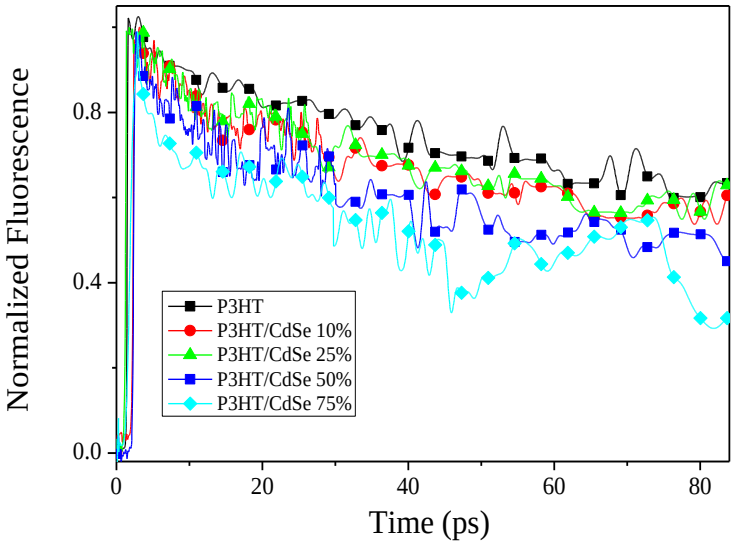

Fig. ESI 5: Fluorescence decays of all P3HT/CdSe blends at 650 nm.