

Supporting Information

Exceptional photoconductivity in poly (3-hexyl thiophene) fibers through in-situ encapsulation of molybdenum disulfide quantum dots

Vishnu Nair^a, Anil Kumar^a, Chandramouli Subramaniam^{a,}*

^aDepartment of Chemistry, Indian Institute of Technology Bombay, Powai, Mumbai 400076,
India

*Corresponding author: csubbu@chem.iitb.ac.in

Figures:

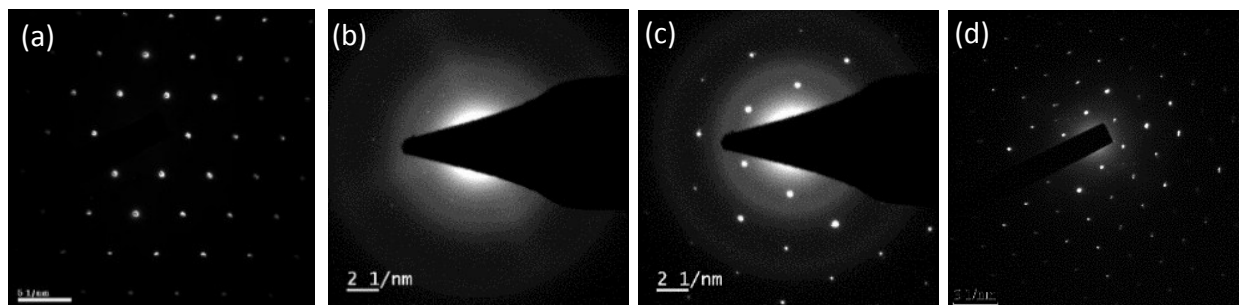


Figure S1. SAED pattern of: (a) Partially broken down MoS₂ sheet intermediate during synthesis of QDs showing (001) zone; b) As synthesized MoS₂ quantum dots showing weak diffraction spots; c) As synthesized MoS₂ sheets showing a strong diffraction pattern showing (001) zone; d) P3HT sheets hybrid showing predominant diffraction from (001) zone from MoS₂ sheets, indicating external coverage of P3HT fibers with sheet fragments.

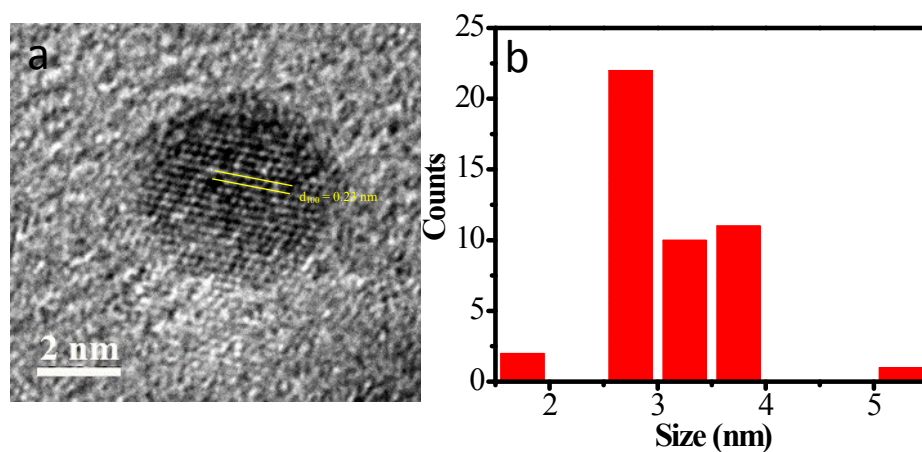


Figure S2. a) HRTEM image of as synthesized quantum dot showing characteristic (100) spacing; b) As synthesized quantum dot size distribution of Figure 1o giving an average distribution of $3.0 \text{ nm} \pm 0.5 \text{ nm}$.

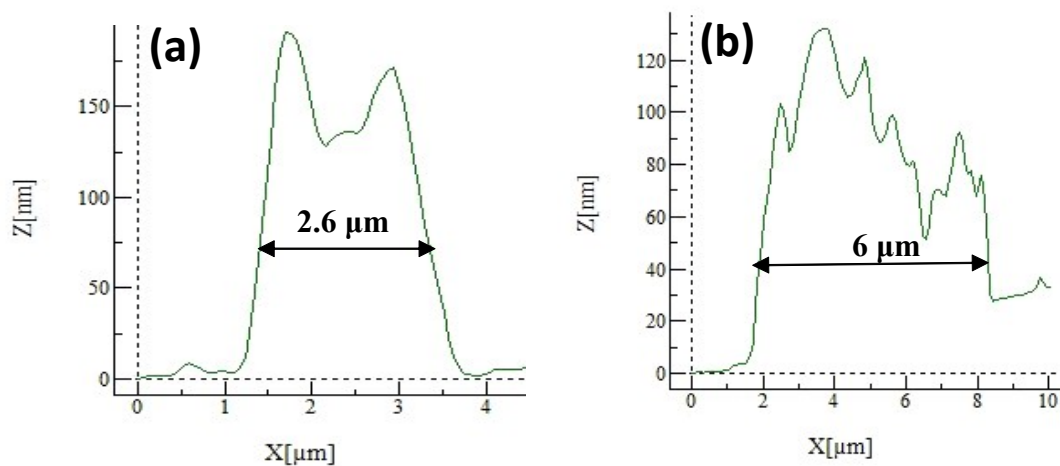
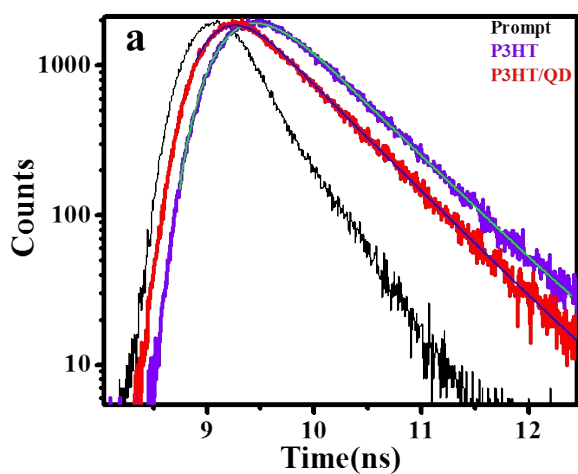


Figure S3. AFM profile taken on the indicated white line of: a) pure P3HT from Figure 3h; b) QD-P3HT hybrid from Figure 3i



b: Table of fitting parameters for $I(t) = e^{-\frac{t}{T1}}$

Sample	T1
QD	628 ps
P3HT/QD	611 ps

Figure S4. a) TCSPC decay and mono-exponential fitting for pure P3HT and the P3HT/QD hybrid; b) Mono-exponential fitting parameters for both decays.

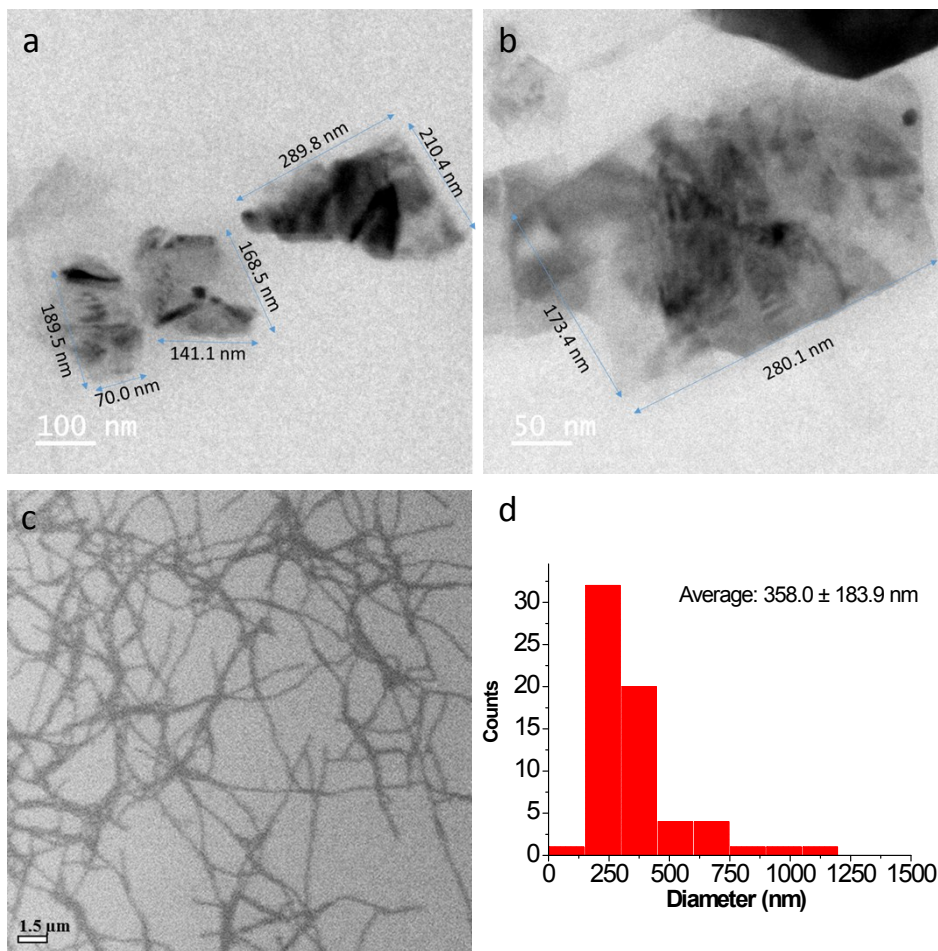


Figure S5. a) TEM micrograph showing three NS fragment with their lateral dimension; b) Higher magnification TEM micrograph showing a NS fragment with lateral magnification; c) Large area TEM micrograph of P3HT fibers showing how fibers exist as distinct nano sized fibres and how they bundle to form micro fibers; d) Diameter distribution of P3HT fibers from Fig. S5c, showing an average diameter of 358.0 ± 183.9 nm.

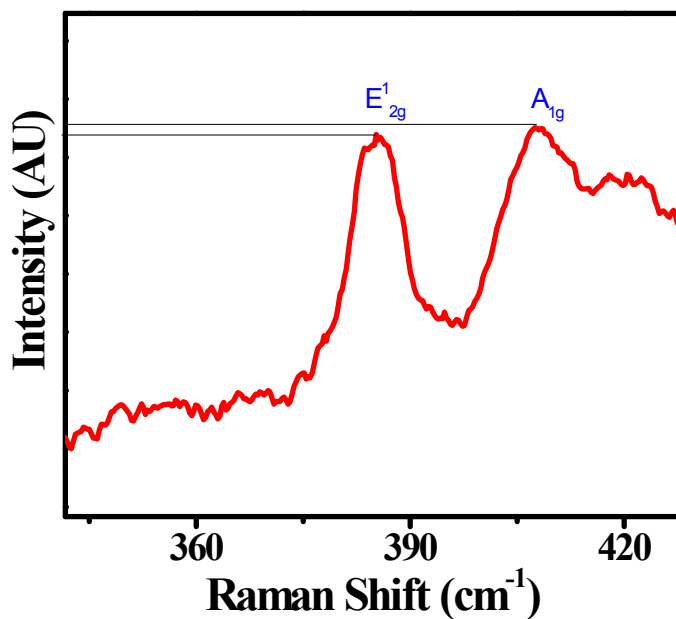


Figure S6: Magnified view of QD Raman spectra showing the intensity of A_{1g} to be greater than E'_{2g} peak.

Tables:

Table S1. Comparison of Raman peaks in bulk MoS₂ with respect to QDs and NS

Peak	Bulk (cm ⁻¹)	QD (cm ⁻¹)	Sheets (cm ⁻¹)
E _{2g} ¹	377	385	383
A _{1g}	404	407	408
T _{1u} ¹	-	-	420
2X LA	449	454, 466	455, 466

Table S2. Tri-exponential fitting parameters of $I(t) = B1 e^{\frac{-t}{T1}} + B2 e^{\frac{-t}{T2}} + B3 e^{\frac{-t}{T3}}$ for QD

and P3HT/QD decays

Sample	B1	B2	B3	T1	T2	T3
QD	0.06	0.034	0.9	1.46 ns	6.41 ns	74 ps
QD-P3HT	0.08	0.028	0.93	1.19 ns	4.25 ns	96 ps