Supporting information

Water dispersible electrically conductive poly (3, 4-ethylenedioxythiophene) nanospindles by liquid crystalline template assisted polymerization.

Sudha J. Devaki[a*], Neethu K. Sadanandhan[a], Renjith Sasi[a], Hans-Juergen P. Adler[c] , Andrij Pich[b*]

[a]*Chemical Sciences and Technology Division, National Institute for Interdisciplinary Science and Technology (NIIST), CSIR, Thiruvananthapuram 695 019, India.*

[b] *Leibniz Institute of Interactive Materials, Functional and Interactive Polymers, RWTH Aachen University, D-52056 Aachen, Germany.*

[c]*Department of Macromolecular Chemistry and Textile Chemistry, University of Technology, Dresden, Germany*.

Synthesis of 4 hydroxy-2-pentadecyl benzene sulphonic acid (PDPSA)

10 g of cardanol(0.025 mole) was mixed with 5 ml conc. H_2SO_4(0.092 mole) in a 100 ml round bottomed flask and magnetic stirred at 80 ^oC for 2 h and later 110 ^oC for 1 h. It was then dissolved in ice-cold water and washed with n- butanol and adjusted the pH to 7. Filtered, washed and then acidified to get the PDPSA. Further it was dried in a vacuum oven at 80 ^oC for 24 h. Color and appearance – colorless powder. Yield - 80%. Chemical structure of the PDPSA was characterized by elemental analysis, FT-IR and ^1H NMR. Mol. formula $C_{21}H_{39}SO_4$. Elem. anal (observed C- 64.9 %, H- 10%, S 8.3%) calculated (C- 65.1% H- 10.07 %, S 8.2%).

In FTIR spectra, it exhibited peaks with $\nu_{(max)}$ 2919, 2841, 1469 – $(CH_2\text{-})_n$, 1605, 694 (Ar), 1227 (CO), 1305, 1195 (SO) and 1032 cm^{-1} (SO_3).

In ^1H NMR ($CDCl_3$, ppm), δ -0.8-0.9 (3H, t, CH_2-$\underline{CH_3}$), 1.25 (26H, bs, -$\underline{CH_2}$-)$_n$, 2.8 (2H, t, Ph-$\underline{CH_2}$ -) n, 5.7 (1H, bs, $\underline{OH}$), 6.8-6.9 (3H, m, $\underline{Ar}$), 7.0 (1H, d, ArC-5).

Preparation and characterisation of liquid crystalline template of EDOT –PDPSA

0.5 gm (1.3×10^{-4} mole) of PDPSA was mixed with 0.02gm of EDOT (1.3×10-4 mole) by heating and stirring in presence of 10 mL of doubly distilled water for 1 h at 60-70 o C and cooled at room temperature. Concentration of EDOT-PDPSA was adjusted in water and ethanol-water mixture (30-70%) for finding out the critical micelle concentration of the EDOT-PDPSA using UV-Vis spectroscopy. Later concentration of EDOT-PDPSA in the solution was increased to observe liquid crystalline phase formation and was monitored using a combination of techniques such as PLM and rheology.

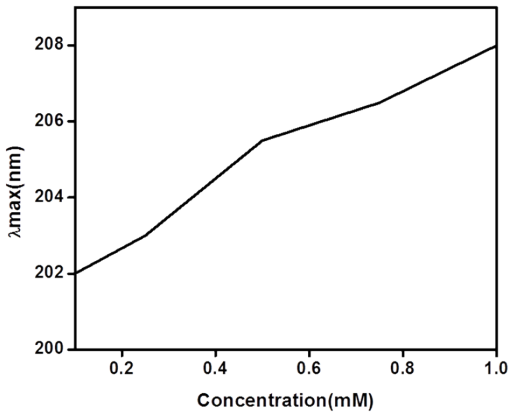

Fig. S1. UV-Vis absorbance vs. concentration of EDOT-PDPSA in water for evaluating CMC.

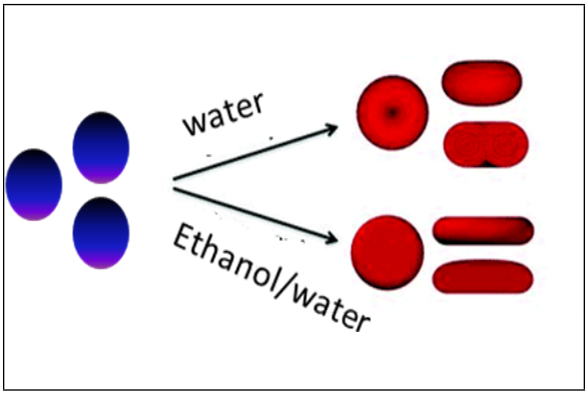

Fig. S2. Surface controlled conversion of microdiscs.

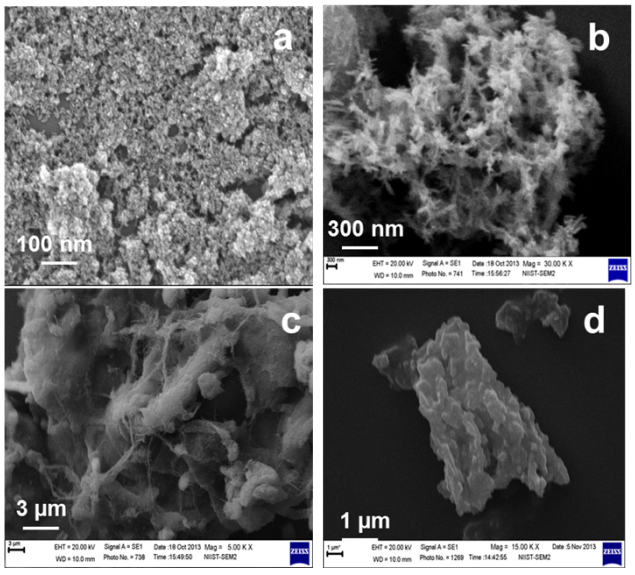

Fig. S3. SEM images of a) PEDOTS1, b) PEDOTS3, c) PEDOTS4 and d) PEDOT.

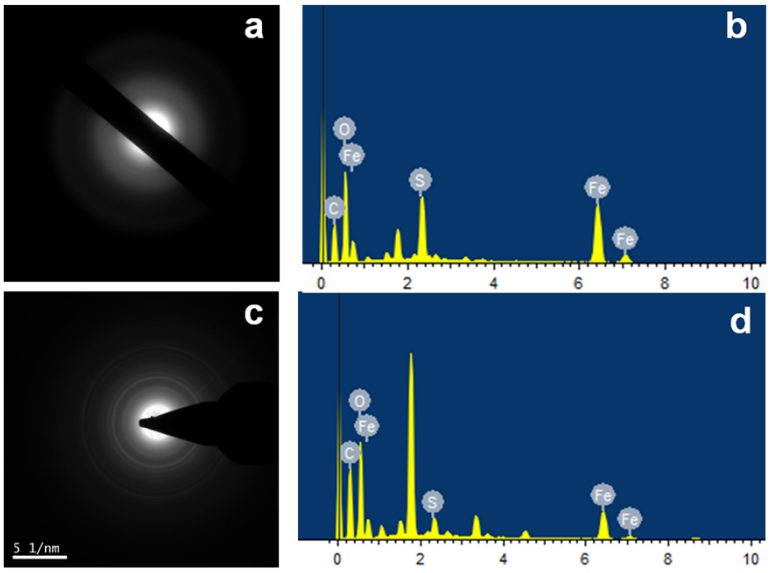

Fig. S4. a) SAED pattern of PEDOTS1, b) EDAX of PEDOTS1, c) SAED pattern of PEDOTS3 and d) EDAX of PEDOTS1.

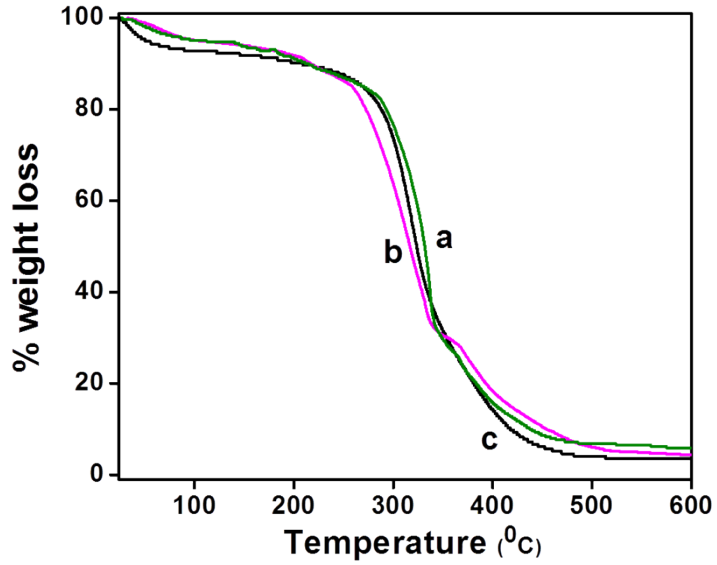

Fig. S5. Thermograms of a) PEDOTS1, b) PEDOT3 and c) PEDOT

Table S1. Effect of shape of PEDOT particles on the electrical conductivity.

Sl. No:	Morphology	Conductivity (S/cm)	Reference
1	Films	5.4×10^{-4}	Macromolecules 2012, 45, 599−601
2	Nanorods	2×10^{-1}	Chemical Physics Letters 394 (2004) 339–343
3	Nanowires	7×10^{-2}	*New J. Chem.,* 2014, 38, 1106--1115
4	Nanospheres	1.1×10^{-2}	Macromol. Res., Vol. 21, No. 6, 2013, 693-698
5	Nanorings	1.1×10^{-1}	J Polym Res (2010) 17:713–718
6	Nanospindles	2.79×10^{o}	Present work