Supporting Information

Polypeptide-Guided Assembly of Conducting Polymer Nanocomposites

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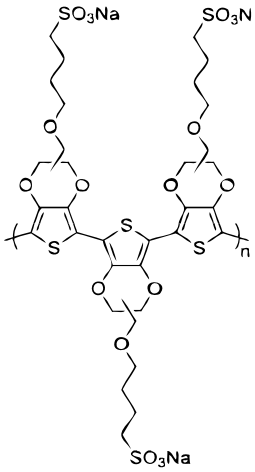

Fig. S1 Alkoxysulfonate poly(3,4-ethylenedioxythiophene) (PEDOT-S)

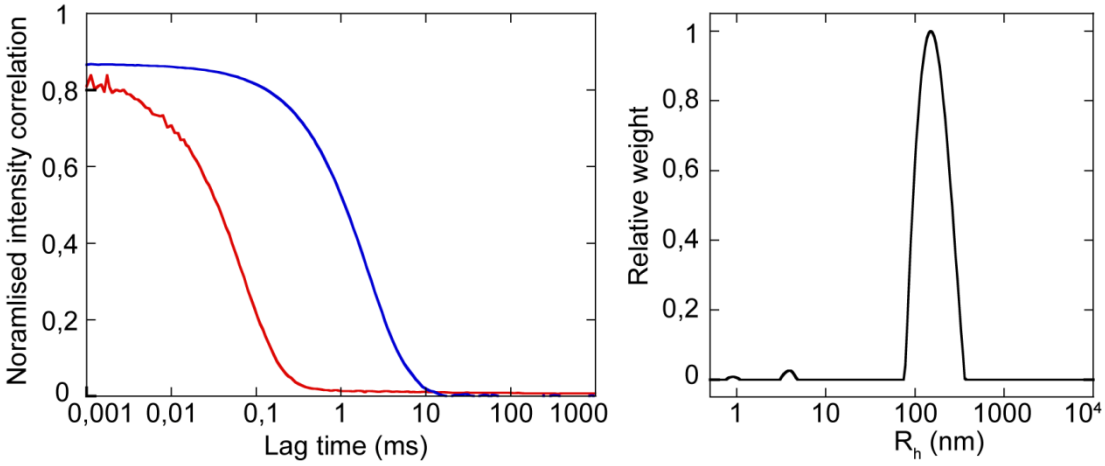

Fig. S2 Normalized intensity correlation for AuNP-JR2EC and PEDOT-S before (red) and after (blue) addition of the bridging polypeptide $JR2KC_2$. Hydrodynamic radius (R_h) of $JR2KC_2$ and PEDOT-S after 15 minutes incubation.

Experimental Details

Polypeptide and polymer synthesis: The polypeptides JR2E, JR2EC, (NAADLEKAIEALEKHLEAKGPCDAAQLEKQLEQAFEAFERAG), JR2K, and JR2KC (NAADLKKAIKALKKHLKAKGPCDAAQLKKQLKQAFKAFKRAG), were synthesized on a Pioneer automated peptide synthesizer (Applied Biosystems) using standard fluorenylmethoxycarbonyl (Fmoc) chemistry. The crude products were purified by reversed-phase HPLC on a semi-preparative HICHROM C-8 column and identified by MALDI-TOF mass spectrometry. In order to obtain $JR2KC_2$, lyophilized peptide monomers (1 mM) were dissolved in 0.1 M ammonium bicarbonate buffer pH 8, aerated for 90 minutes and incubated at 4^{o} C for at least 24 hours before use. Complete oxidation was confirmed using a standard Ellman´s test for determination of free thiols.[1] The synthesis of PEDOT-S is described in detail elsewhere.[2] The molar concentration of PEDOT-S was calculated based on an average molecular mass of 4000 g/mol, corresponding to approximately 12 monomer units.[2]

Nanoparticle synthesis and functionalization: Gold nanoparticles with an approximate average diameter of ~13 nm were prepared by citrate reduction of $HAuCl_4$. Details on synthesis are described elsewhere.[3] JR2EC (100 μM) in 10 mM sodium citrate pH 6 was incubated with the nanoparticles (~10 nM) for about 12 hours. Unbound peptides were removed by repeated centrifugations at 18000 g, and the supernatant was removed and replaced with 30 mM Bis-Tris buffer pH 7.0 until the resulting concentration of peptides in solution was less than 0.5 nM.

Structural analysis: Circular dichroism spectra were recorded with a CD6 Spectrodichrograph (JobinYvon-Spex) using a 0.1 mm cuvette at room temperature. Each spectrum was collected as an average of three scans in the range 190-260 nm. UV-vis spectroscopy was performed on a Schimadzu UV-1601PC spectrophotometer with 0.5 nm resolution at room temperature. TEM was conducted on a Philips CM20 Ultra-Twin lens high-resolution microscope operating at 200 kV. 20 µl of the samples was incubated on carbon coated TEM-grids for 2 minutes before the suspension was removed using a filter paper. The grids were dried before analysis. Dynamic light scattering experiments were carried out using an ALV/DLS/SLS-5022F system from ALV-GmbH, Langen Germany, using a HeNe laser at 632.8 nm with 22 mW output power at 90^{o}. Data analysis was carried out using the CONTIN 2DP routine implemented in the ALV data analysis package. Raman spectra were obtained using a FRA 106 Raman Fourier transform spectrometer (Bruker, Billerica, MA) equipped with a 1064 nm Nd:YAG laser and using a laser power of 400 mW and a 4 cm^{-1} resolution.

Current voltage measurements: The self-assembled structures were transferred to water and placed on an inter-digitized gold electrode with a spacing of 10 µm and a total length of 1 cm. The water was evaporated using a nitrogen flow flowed by washing with ethanol and water in order to removed ions and any unbound PEDOT-S from the surface.

References

1. G. L. Ellman, *Arch. Biochem. Biophys.,* 1959, **82**, 70-77.
2. R. H. Karlsson, A. Herland, M. Hamedi, J. A. Wigenius, A. Åslund, X. Liu, M. Fahlman, O. Inganäs, P. Konradsson, *Chem. Mater.,* 2009, **21**, 1815-1821.
3. D. Aili, K. Enander, J. Rydberg, I. Nesterenko, F. Bjorefors, L. Baltzer, B. Liedberg, *J. Am. Chem. Soc.,* 2008, **130**, 5780-5788.