Electronic Supplementary Information for *Soft Matter* Manuscript: Wormlike Core-Shell Nanoparticles Formed by Co-Assembly of Double Hydrophilic Block Polyelectrolyte with Oppositely Charged Fluorosurfactant

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(i) Zoomed views of objects on Cryo-TEM micrographs of the PSCI-PEO/HFDPCl system at the stoichiometric ratio, β = 0.71:

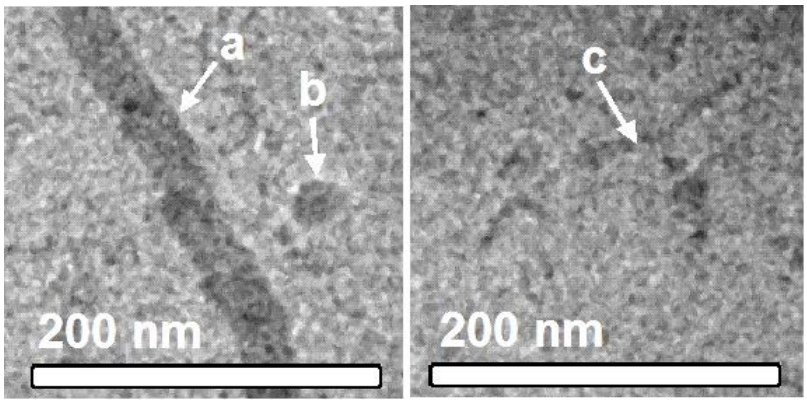

Fig. S1. Zoomed views of objects on Cryo-TEM micrographs of the PSCI-PEO/HFDPCl system at the stoichiometric ratio, β = 0.71: (a) PSCI-PEO/HFDPCl wormlike micelle, (b) PSCI-PEO/HFDPCl spherical micelle and (c) HFDPCl threadlike micelle.

(ii) The model for the SAXS of PSCI-PEO/HFDPCl system at the stoichiometric ratio, β = 0.71: The scattering function, $I_{\text{PE-S}}(q)$, consists of contributions from (i) wormlike particles, described by the form factor $P_{\text{worm}}(q,L,b,R_{\text{c}})$ for homogeneous semiflexible chain of the contour length L, the Kuhn length b and the cylindrical cross-section with the radius R_{c}, (ii) from spherical particles, treated by the simple form factor $P_{\text{sphere}}(q,R_{\text{s}})$ for homogeneous spheres of the radius R_{s}, and (iii) from densely packed surfactant micelles in the PE-S complex, described by the structure factor $S_{\text{cor}}(q,l,\xi)$ for disordered cell-cell correlations with the characteristic distance between cells l, and the correlation length ξ. The overall scattering function is given by the expression,

$$I_{\text{PE-S}}(q) = I_1 P_{\text{worm}}(q,L,b,R_{\text{c}}) + I_2 P_{\text{sphere}}(q,R_{\text{s}}) + I_3 S_{\text{cor}}(q,l,\xi) \ , \qquad \text{(S1)}$$

where I_1, I_2, respectively, are the forward scattering intensities for wormlike and spherical particles and I_3 is the amplitude of the correlation peak.

1. Wormlike particles. The scattering from wormlike particles is given by the relationship[1]

$$P_{\text{worm}}(L,b,R_{\text{c}},q) = P_{\text{cyl}}(R_{\text{c}},q)P_{\text{chain}}(L,b,q)\,, \tag{S2}$$

where

$$P_{\text{cyl}}(R_{\text{c}},q) = \left[\frac{2J_1(qR_{\text{c}})}{qR_{\text{c}}}\right]^2, \tag{S3}$$

in which $J_1(x)$ is the 1st order Bessel function, and

$$\begin{aligned} P_{\text{chain}}(q,L,b) = &\left\{\frac{2(\mathrm{e}^{-u}+u-1)}{u^2}+\left[\frac{4}{15}+\frac{7}{15u}-\left(\frac{11}{15}+\frac{7}{15u}\right)\mathrm{e}^{-u}\right]\frac{b}{L}\right\}\times \\ &\times\exp\left[-\left(\frac{qb}{q_1}\right)^{p_1}\right]+\left(\frac{1}{Lbq^2}+\frac{\pi}{Lq}\right)\left\{1-\exp\left[-\left(\frac{qb}{q_1}\right)^{p_1}\right]\right\}. \end{aligned} \tag{S4}$$

Here $p_1 = 4.12$, $q_1 = 5.53$ and

$$u = \frac{Lbq^2}{6}\left[1-\frac{3b}{2L}+\frac{3b^2}{2L^2}-\frac{3b^3}{4L^3}\left(1-\mathrm{e}^{-2L/b}\right)\right]\left[1+\left(\frac{L}{3.12b}\right)^2+\left(\frac{L}{8.67b}\right)^3\right]^{0.059}. \tag{S5}$$

2. Spherical particles. Scattering from spherical particles is given by the relationship,

$$P_{\text{sphere}}(q,R_{\text{s}}) = \frac{9}{q^6R_{\text{s}}^6}\left[\sin(qR_{\text{s}})-qR_{\text{s}}\cos(qR_{\text{s}})\right]^2. \tag{S6}$$

3. Correlation peak. The structure factor for correlations between surfactant micelles in the PE-S complex is given by the formula,[2]

$$S_{\text{cor}}(q,l,\xi) = \frac{\xi^{-2}}{\xi^{-2}+(q-2\pi/l)^2}. \tag{S7}$$

1 J.S. Pedersen and P. Schurtenberger, *Macromolecules*, 1996, **29**, 7602.

2 N. Lei, C.R. Safinya, D. Roux and K.S. Liang, *Phys. Rev. E*, 1997, **56**, 608.