Electronic Supplementary Material (ESI) for Materials Horizons

Supporting Information

Highly Dispersible Polypyrrole Nanospheres for Advanced Nanocomposite Ultrafiltration Membranes

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1. Contrast Adjusted Surface SEM images of Membranes

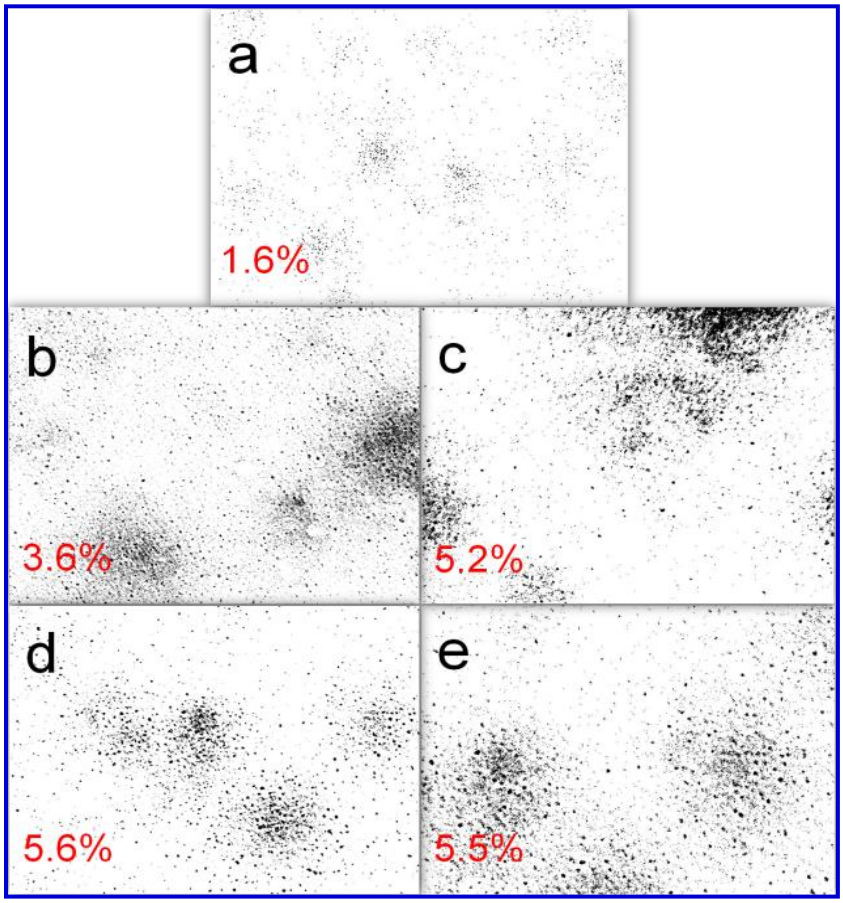

Figure S1 Surface SEM images of PPy/PSf nanocomposite membranes prepared with the addition of the following concentrations of PPy nanospheres: (a) 0, (b) 2, (c) 4, (d) 10, and (e) 20%, after contrast adjusted by NIH ImageJ software.

2. AFM Morphologies and Histogram Analyses of the Membranes

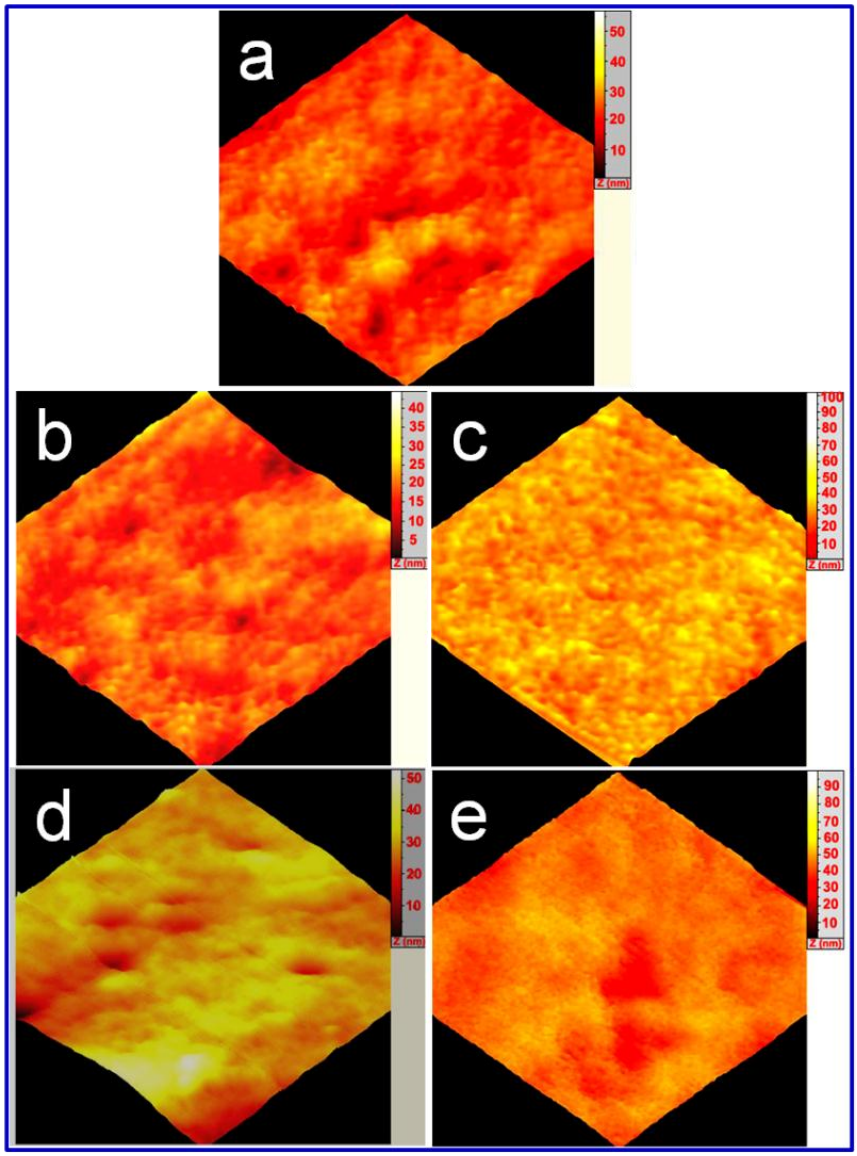

Figure S2 AFM 3D images of (a) PSf and (b−e) PPy/PSf nanocomposite membranes with addition of the following concentrations of PPy nanospheres: (b) 2, (c) 4, (d) 10, and (e) 20%.

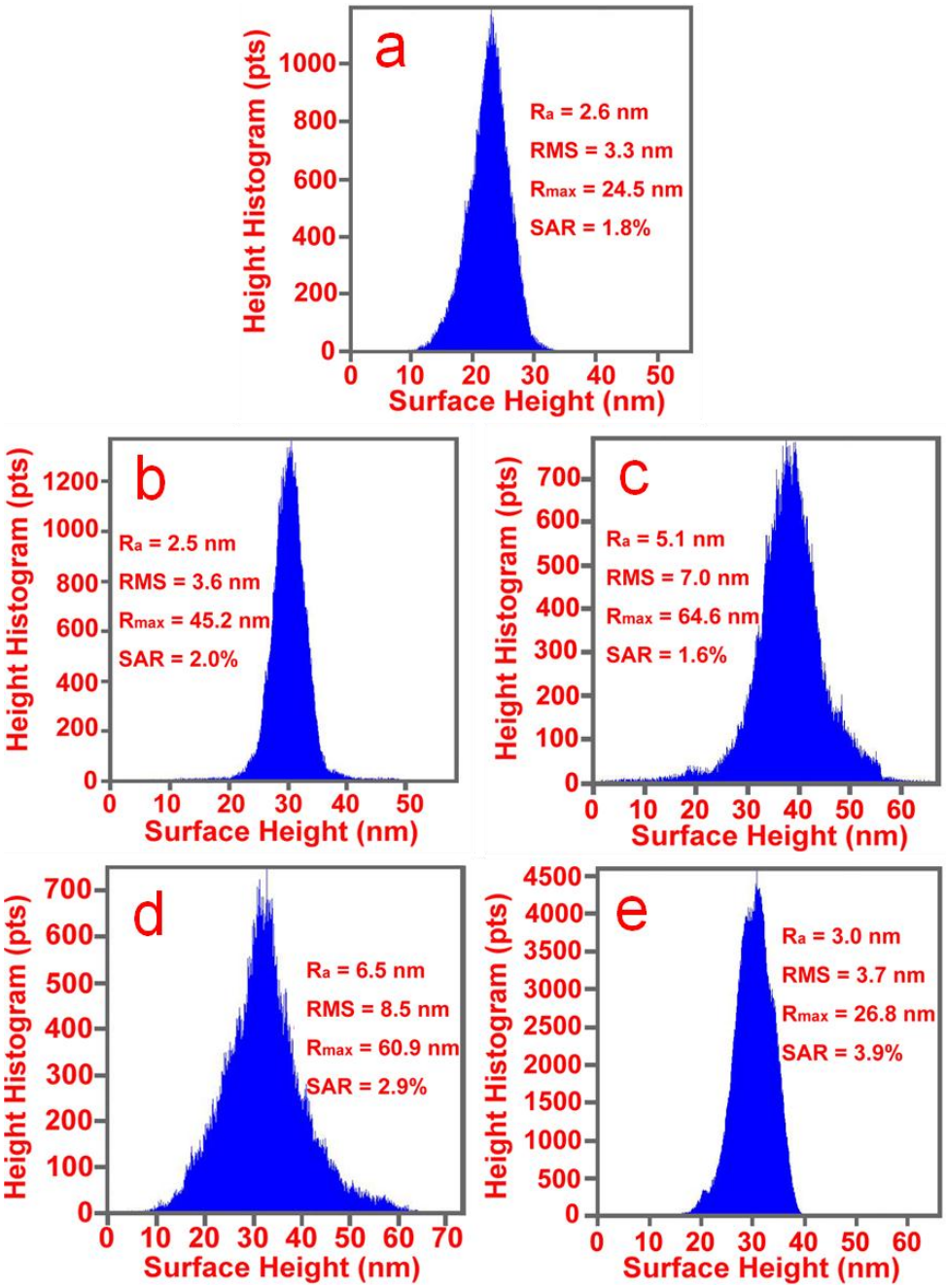

Figure S3 Surface AFM histogram analyses of (a) PSf and (b−e) PPy/PSf nanocomposite membranes with the addition of the following concentrations of PPy nanospheres: (b) 2, (c) 4, (d) 10, and (e) 20%.

3. Cross-sectional and Surface SEM Morphologies of the Membranes

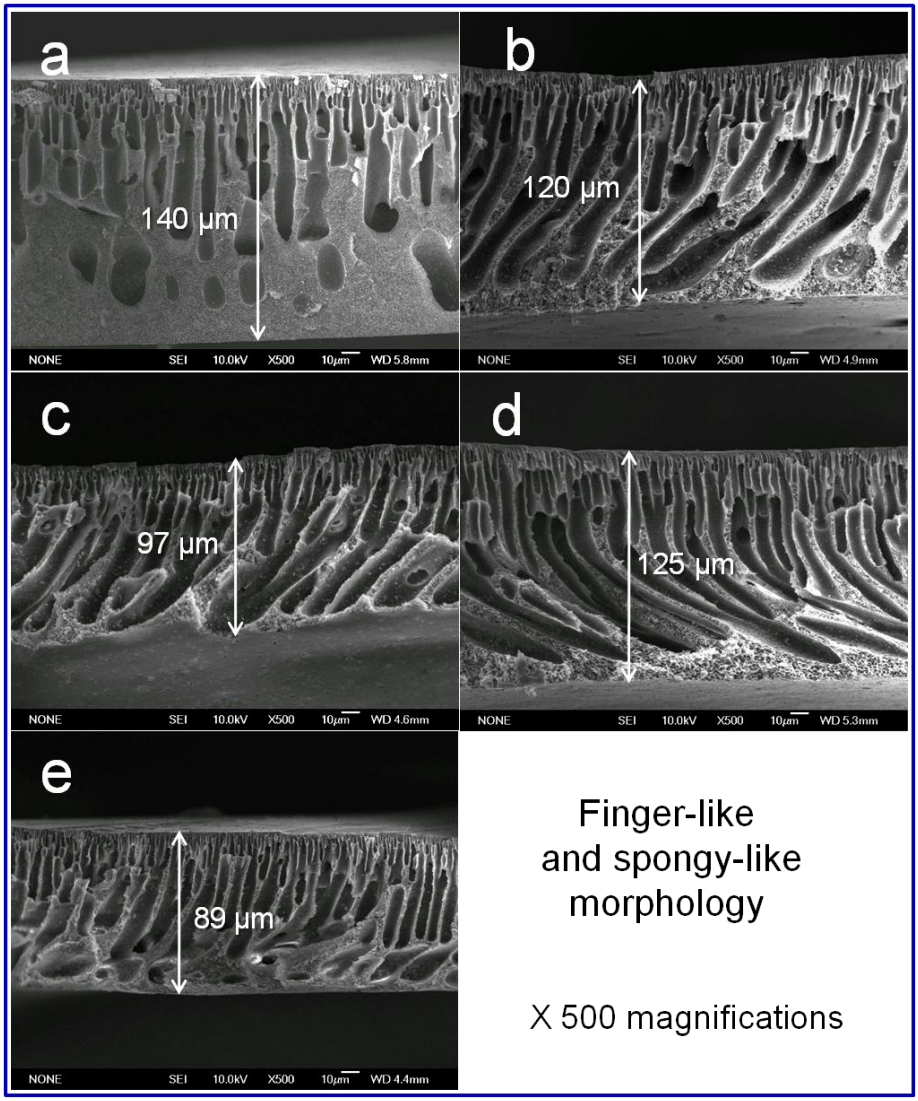

Figure S4 Cross-sectional SEM images of (a) a pure PSf and (b−e) PPy/PSf nanocomposite membranes prepared with the following sizes of PPy nanospheres (4%): (b) 85, (c) 110, (d) 200, and (e) 220 nm synthesized with (b) HCl, (c) HNO_3, (d) $HClO_4$, and (e) CSA, respectively.

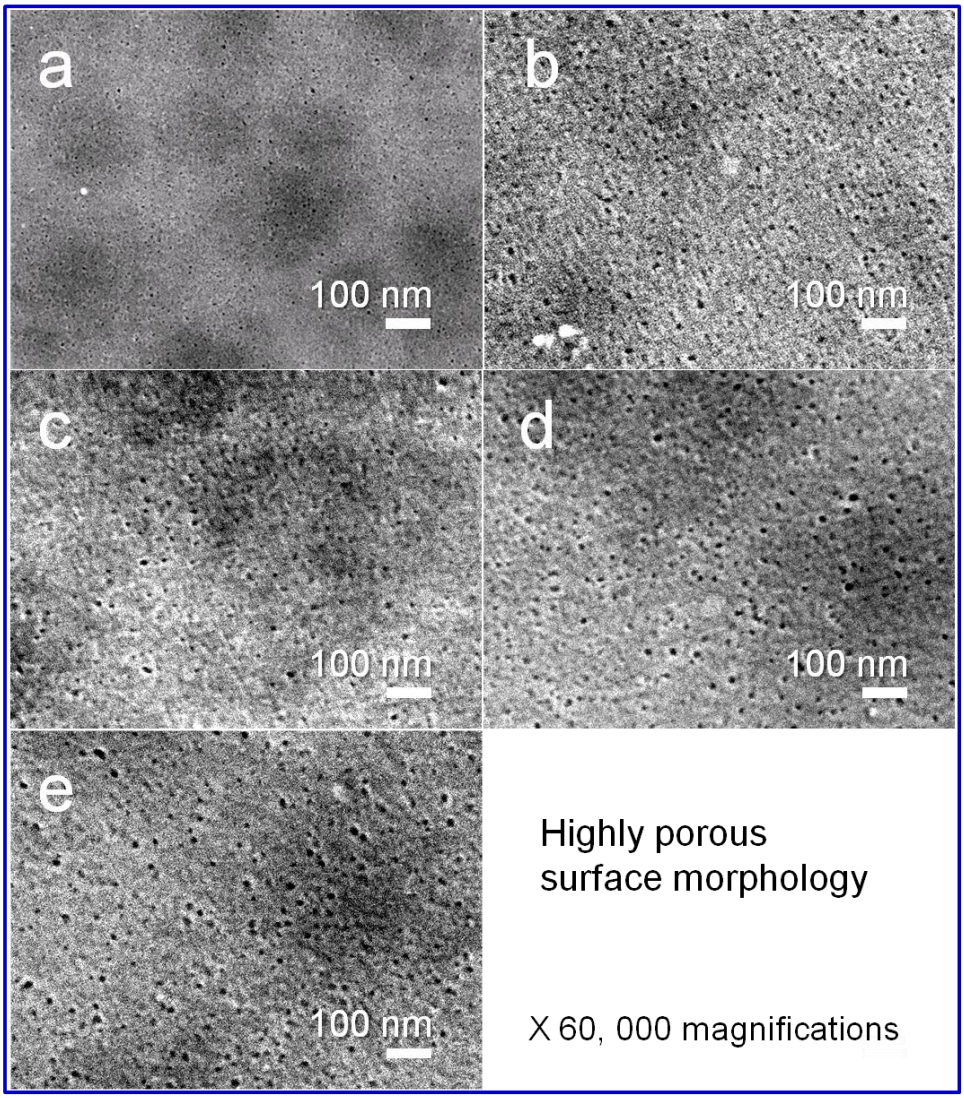

Figure S5 Surface SEM images of (a) a pure PSf and (b−e) PPy/PSf nanocomposite membranes prepared with the following sizes of PPy nanospheres (4%): (b) 85, (c) 110, (d) 200, and (e) 220 nm synthesized with (b) HCl, (c) HNO_3, (d) $HClO_4$, and (e) CSA, respectively.

4. Calculations of Surface Average Pore Diameters of the Membranes

The surface average pore diameters (d_p) of the membranes can be approximately calculated from BSA rejection (r) values on the basis of the equation, $\lambda = 1-\sqrt{1-\sqrt{r}}$, where $\lambda = d_s/d_p$, d_s is BSA diameter of ~6 nm, $0<r<1$. The d_p values of the membranes are calculated by 7.0−8.2 nm, consistent with the values determined by SEM observations.

5. Proposed Geometric Structure of the PPy/PSf Nanocomposite Membrane

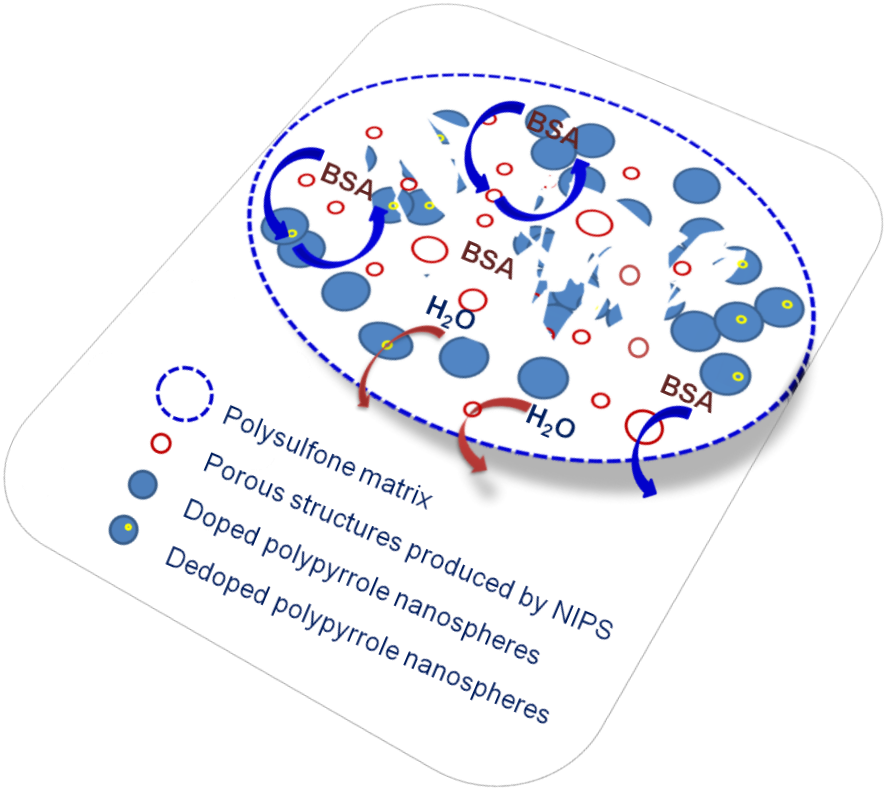

Figure S6 A schematic diagram illustrating the geometric structure for a typical size selective PPy/PSf nanocomposite membrane. Small molecules such as water readily pass through the membrane, while big particles such as BSA are mostly rejected.