

# Supporting Information

## Covalent-Crosslinked Plasmene Nanosheets

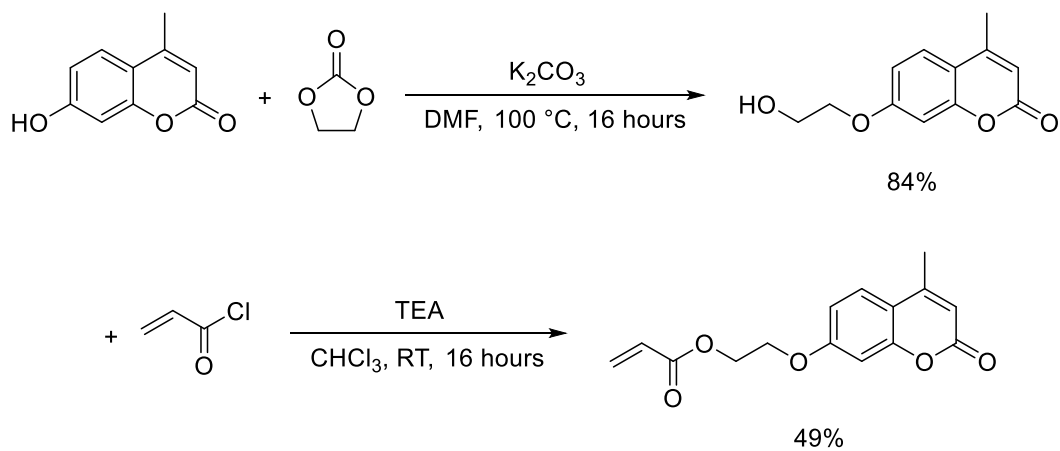
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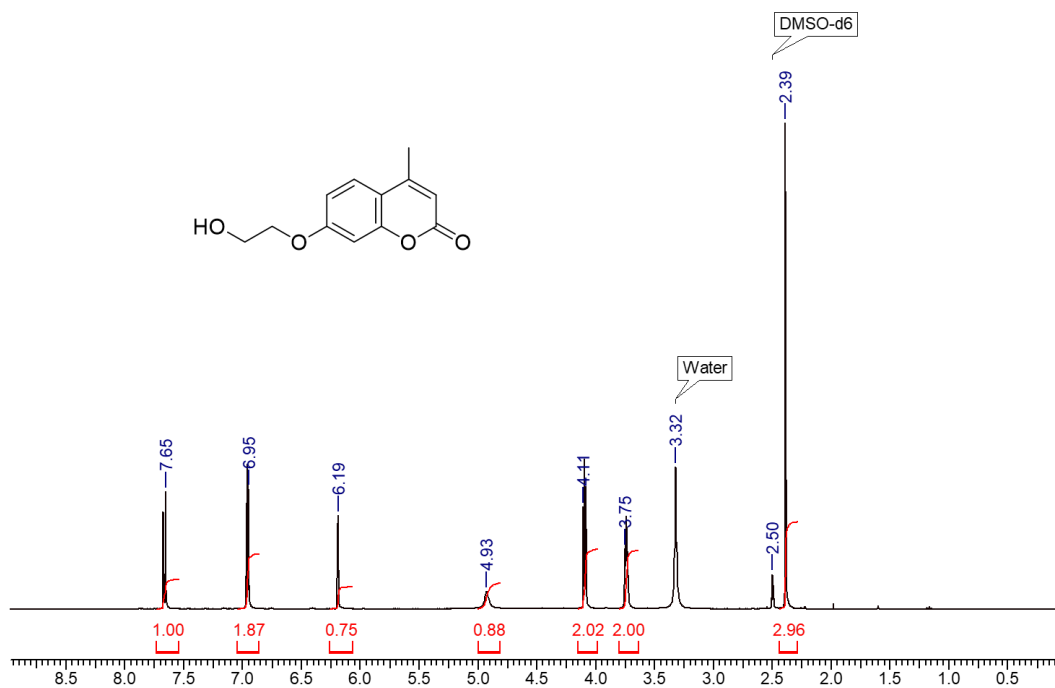
<sup>2</sup>School of Chemistry, Monash University, Clayton, Victoria 3800, Australia

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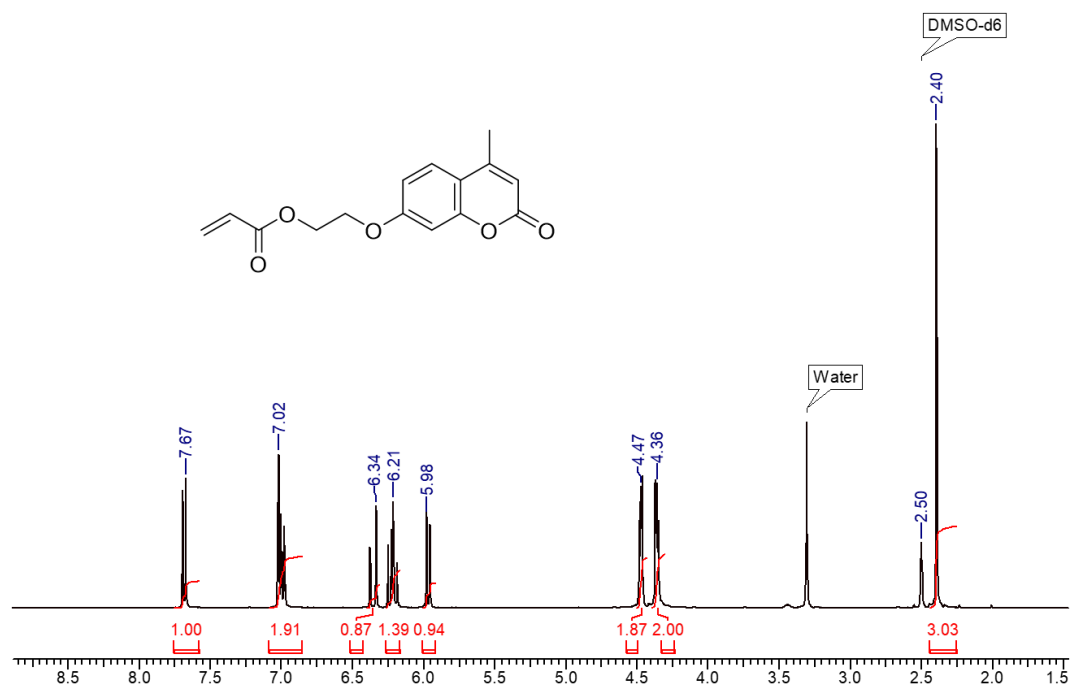
\*Address correspondence to [wenlong.cheng@monash.edu](mailto:wenlong.cheng@monash.edu)



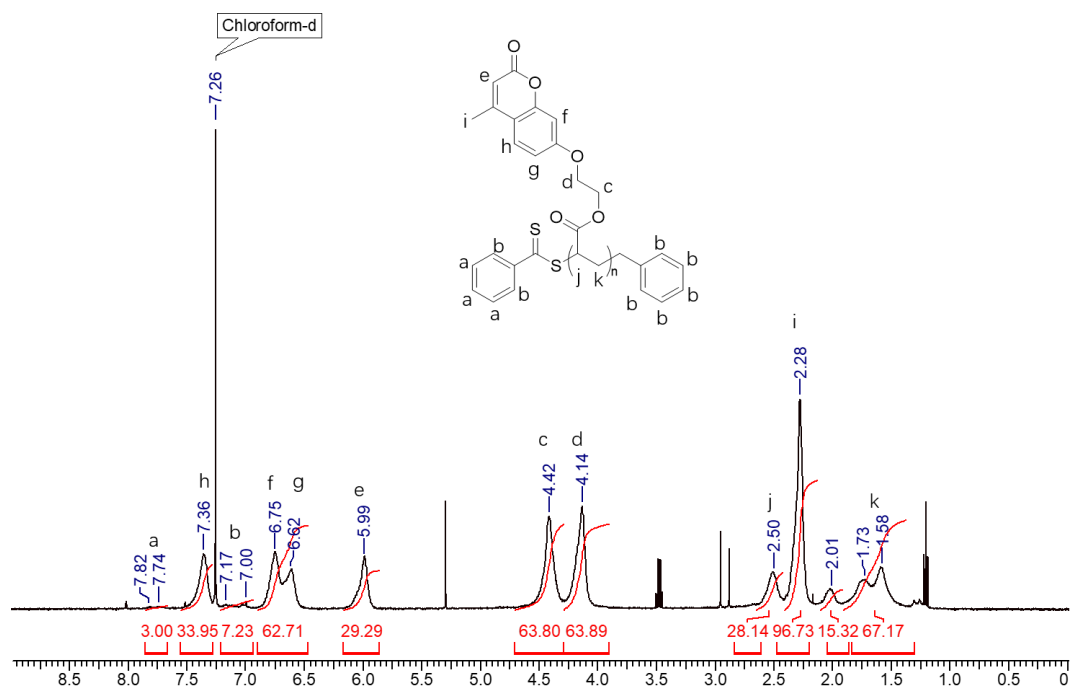
**Figure S1.** Scheme of the synthesis of photo-crosslinkable monomer 7-(2-acryloyloxyethoxy)-4-methylcoumarin (AEMC)



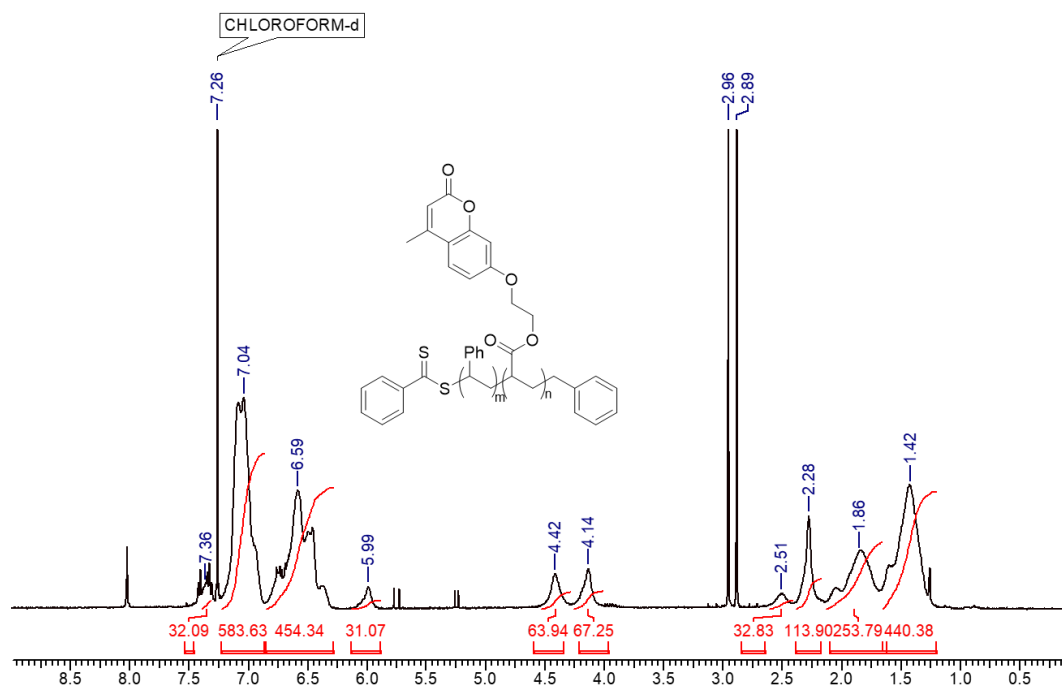
**Figure S2.**  $^1\text{H}$  NMR spectrum of 7-(2-hydroxyethoxy)-4-methylcoumarin ( $\text{DMSO-}d_6$ , 400 MHz).



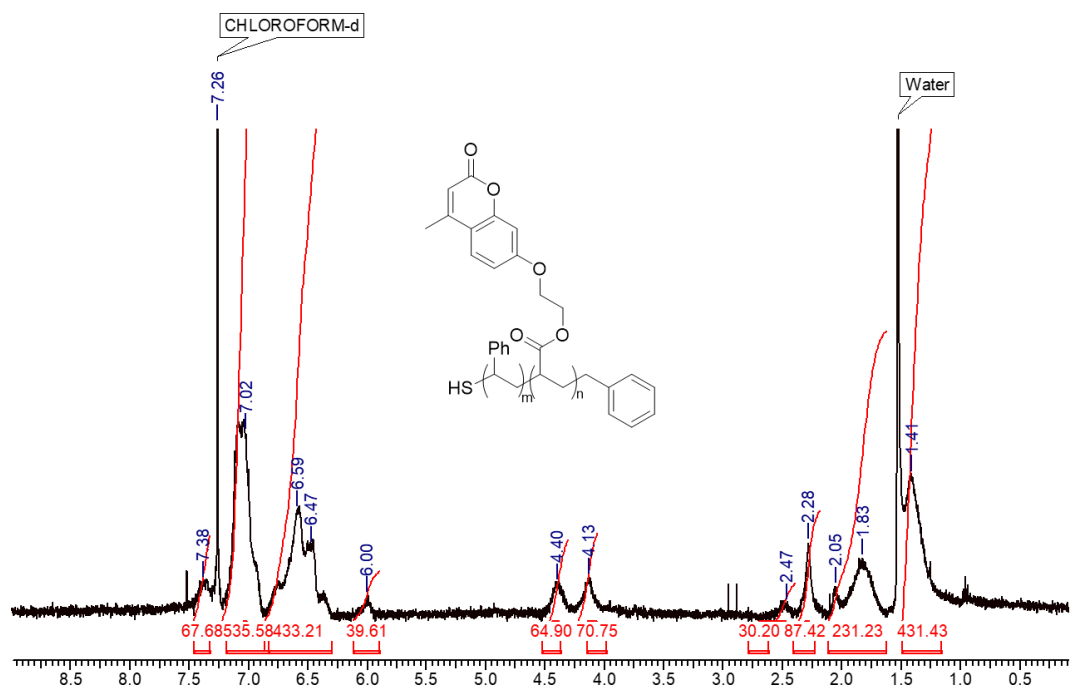
**Figure S3.** <sup>1</sup>H NMR spectrum of 7-(2-acryloyloxyethoxy)-4-methylcoumarin (AEMC) (DMSO-*d*<sub>6</sub>, 400 MHz).



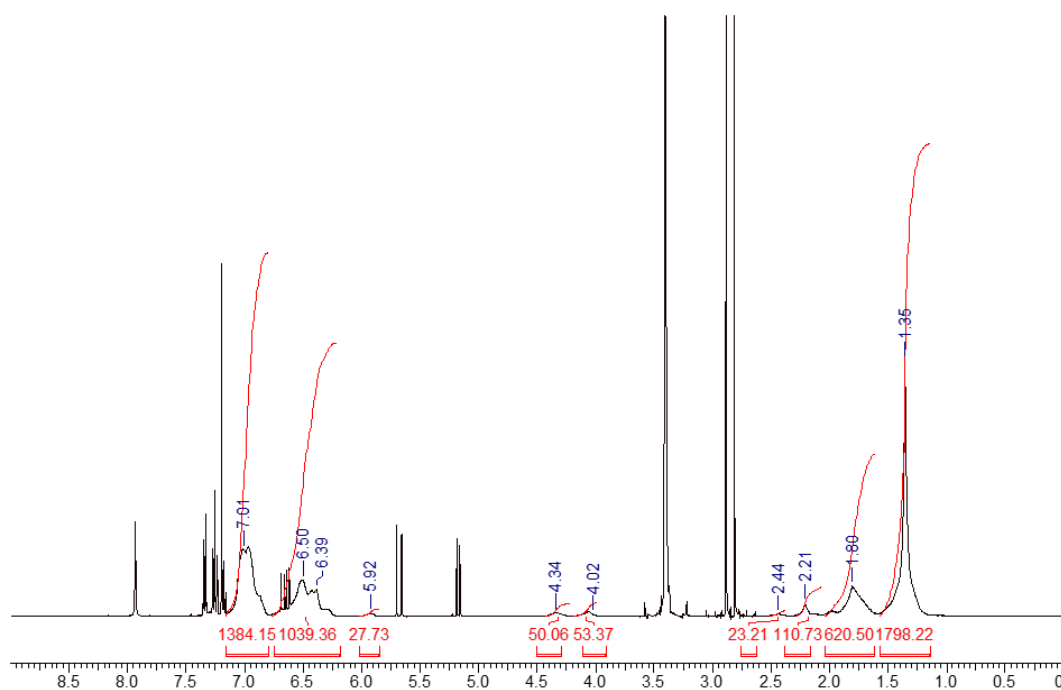
**Figure S4.** <sup>1</sup>H NMR spectrum of dithioester-terminated PAEMC (CDCl<sub>3</sub>, 400 MHz), with presence of trace diethyl ether, dichloromethane and DMF.



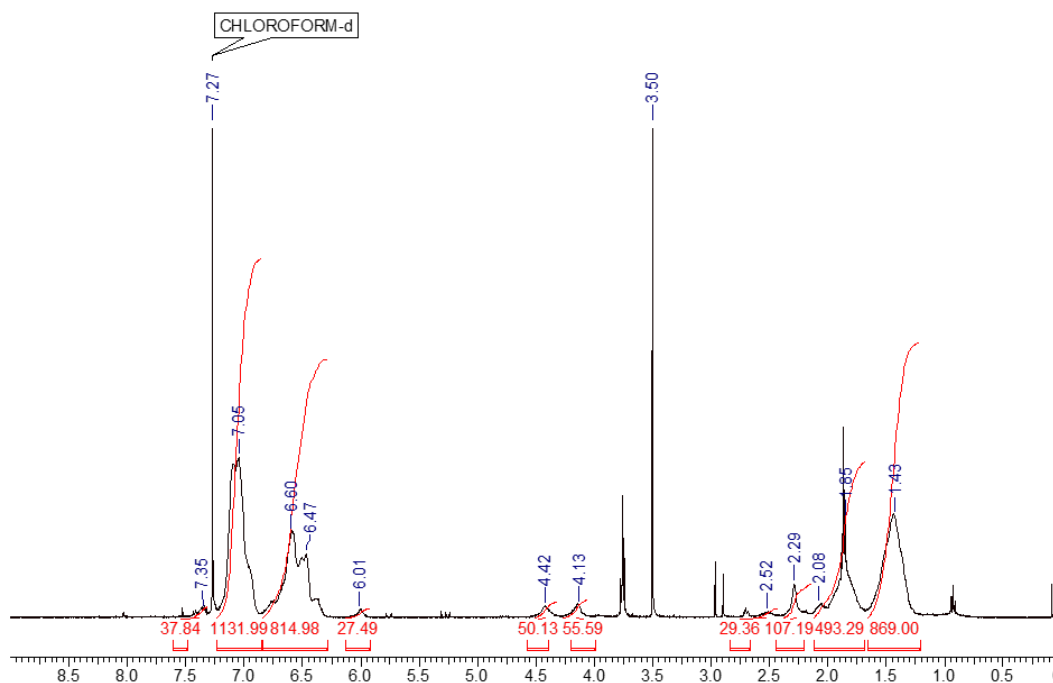
**Figure S5.** <sup>1</sup>H NMR spectrum of dithioester-terminated PS(20k)-*b*-PAEMC(9k) (CDCl<sub>3</sub>, 400 MHz), with presence of trace DMF.



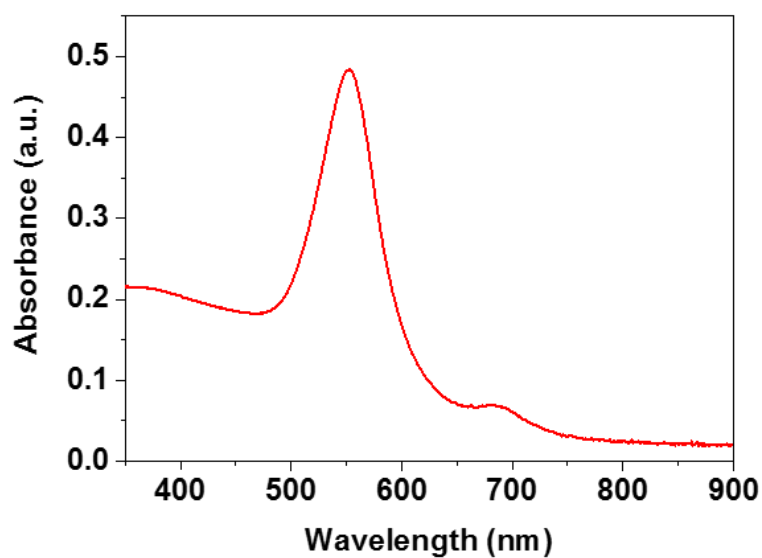
**Figure S6.** <sup>1</sup>H NMR spectrum of SH-PS(20k)-*b*-PAEMC(9k) (CDCl<sub>3</sub>, 400 MHz).



**Figure S7.**  $^1\text{H}$  NMR spectrum of dithioester-terminated PS(38k)-*b*-PAEMC(7k) ( $\text{CDCl}_3$ , 400 MHz), with presence of DMF, methanol and some monomers.

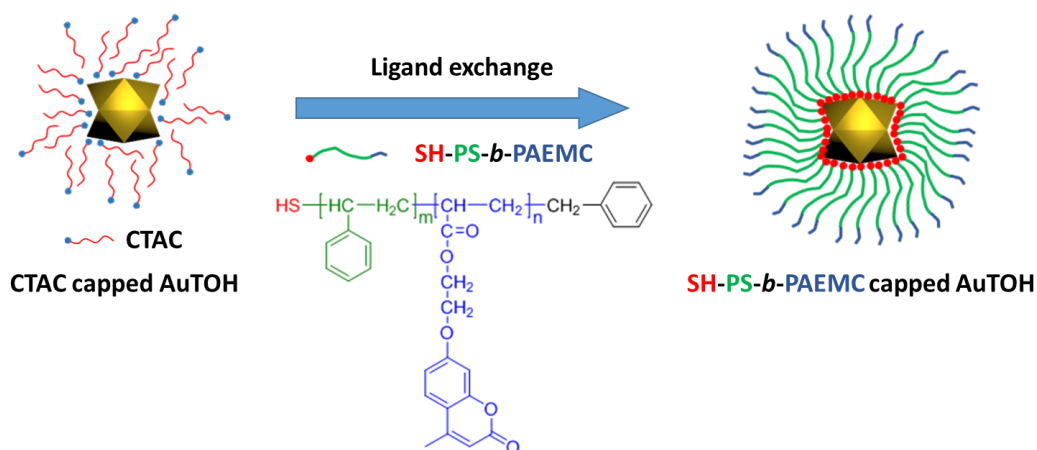


**Figure S8.**  $^1\text{H}$  NMR spectrum of SH-PS(38k)-*b*-PAEMC(7k) ( $\text{CDCl}_3$ , 400 MHz), with presence of THF and methanol.

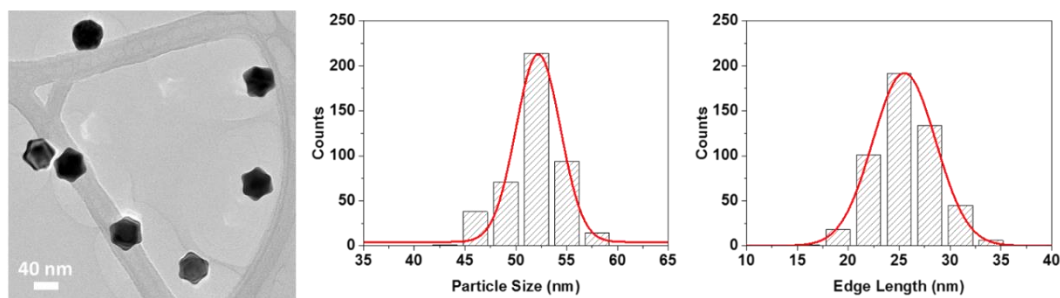


**Figure S9.** UV-Vis spectrum of freshly prepared CTAC protected AuTOH nanoparticles.

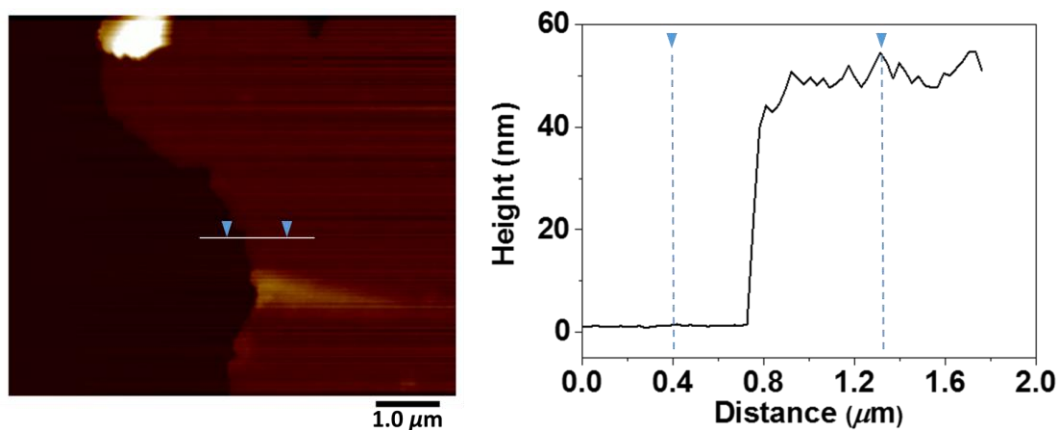




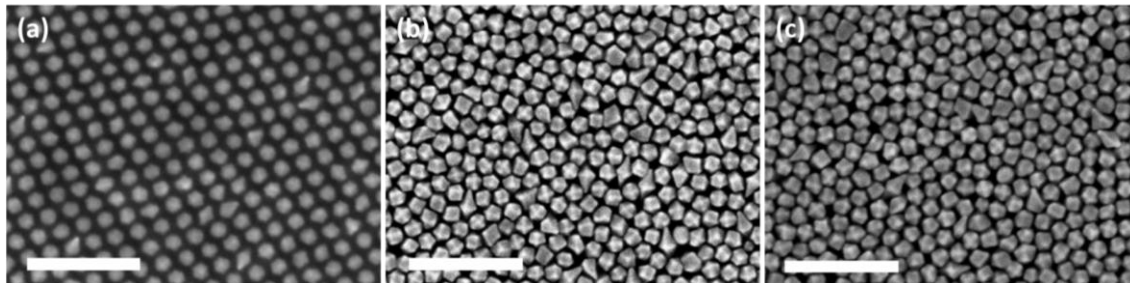
**Figure S10.** Ligand exchange process of AuTOH nanoparticles.



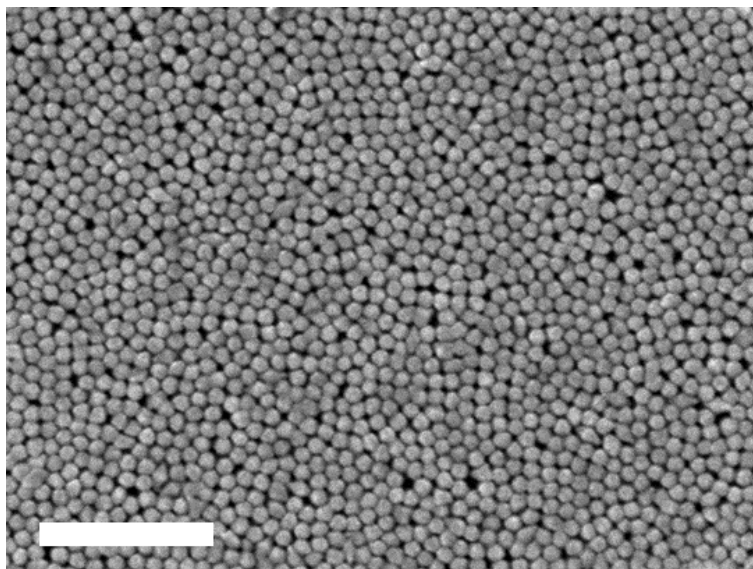
**Figure S11.** TEM image of monodispersed AuTOH@SH-PS(20k)-*b*-PAEMC(9k) nanoparticles and corresponding histogram of average particle size and apparent edge length. Red lines are the Gaussian fits of the size distributions.



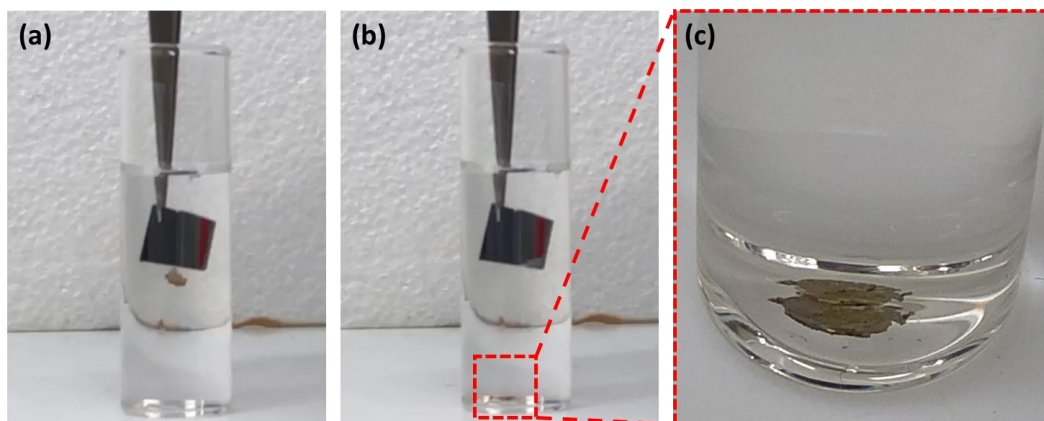
**Figure S12.** Representative AFM height image of a Si wafer supported crosslinked plasmene nanosheets and the corresponding height profile of crosslinked plasmene nanosheets with bare Si wafers as the substrate.



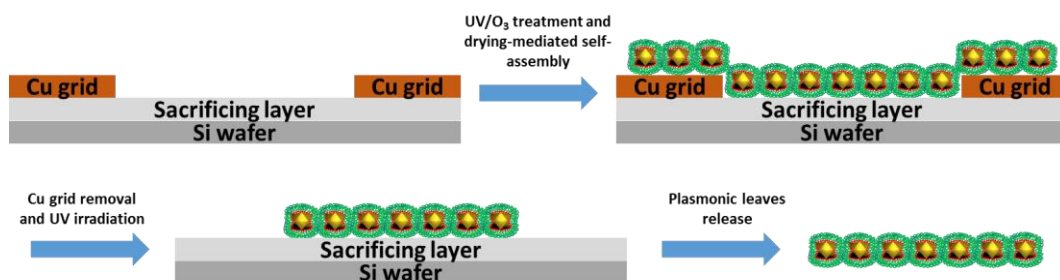
**Figure S13.** SEM images of plasmene nanosheets fabricated on ITO glass from (a) AuTOH@SH-PS(50k), (b) AuTOH@SH-PS(20k)-*b*-PAEMC(9k) and (c) AuTOH@SH-PS(38k)-*b*-PAEMC(7k), respectively. Scale bars: 300 nm.



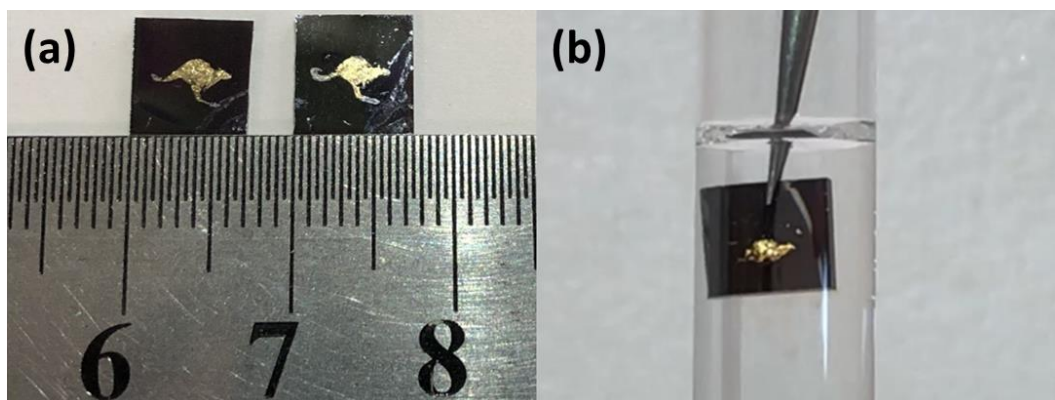
**Figure S14.** SEM image of AuTOH crosslinked plasmene nanosheets released in acetone. Scale bar: 500 nm.



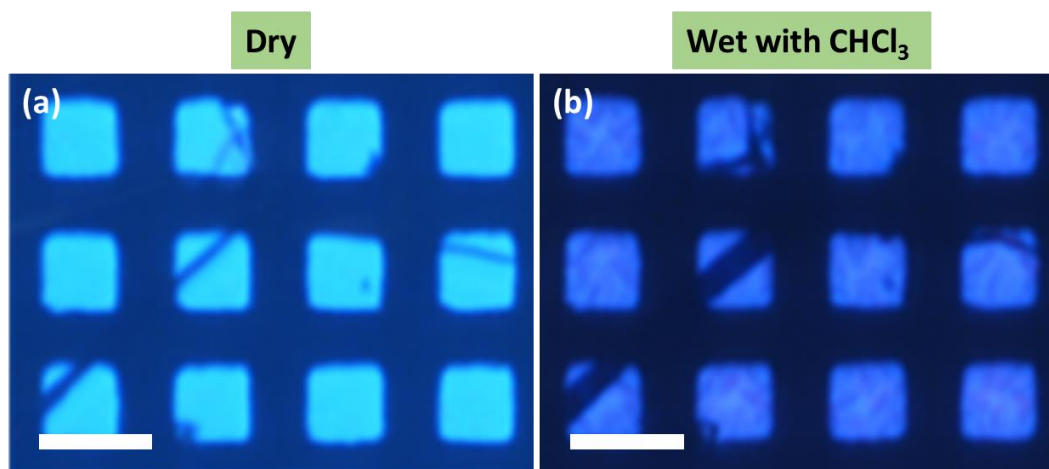
**Figure S15.** Optical images of crosslinked plasmene nanosheets (a) released into  $\text{CHCl}_3$  and (b) sink to the bottom of a glass vial. (c) High magnification image of the released plasmene nanosheet in (b).



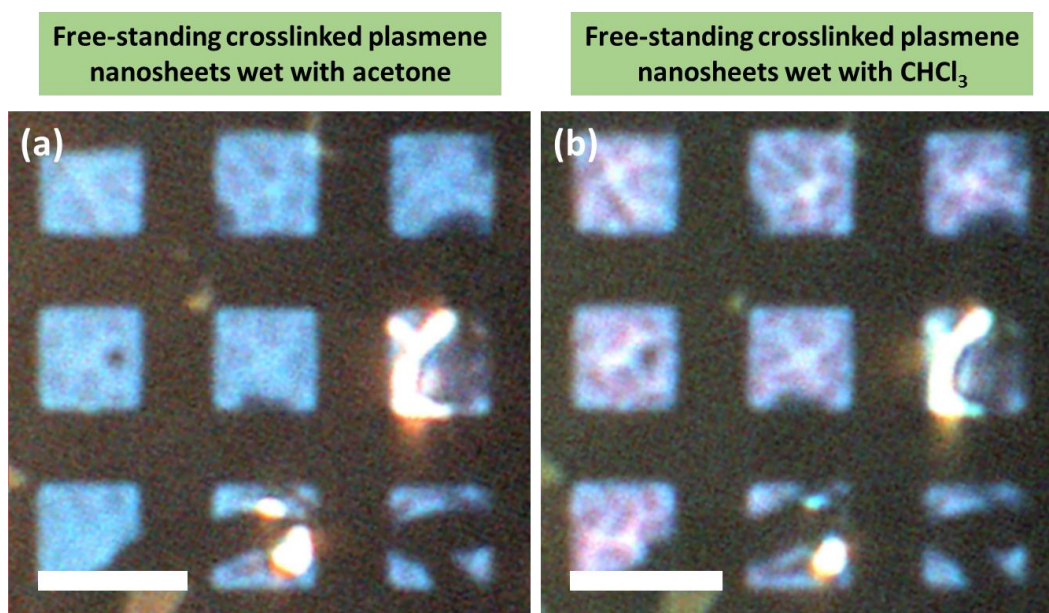
**Figure S16.** Schematic showing for the preparation of shapeable free-standing plasmonic leaves.



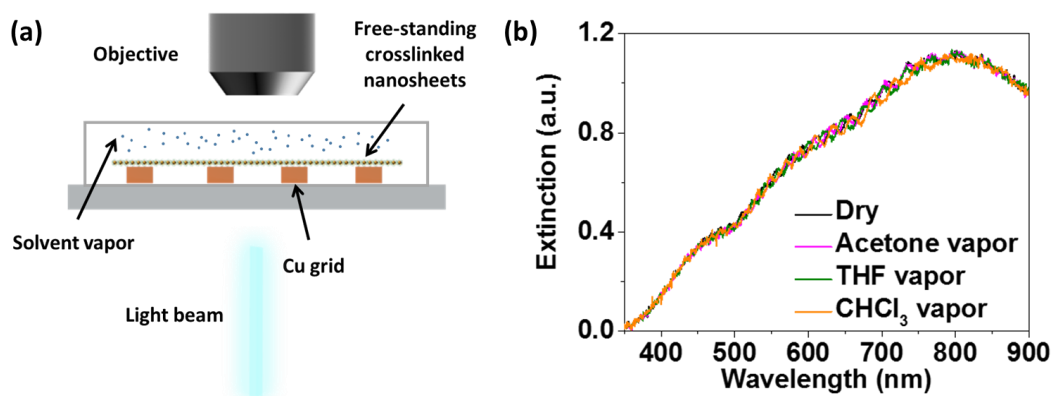
**Figure S17.** Millimeter scale kangaroo shaped plasmonic leaves on (a) Si wafers and released in (b) acetone.



**Figure S18.** Transmission mode optical microscope images of free-standing crosslinked plasmene nanosheets in the (a) dry and (b)  $\text{CHCl}_3$ -wet conditions. Scale bars: 10  $\mu\text{m}$ .



**Figure S19.** Transmission mode optical microscope images of free-standing crosslinked plasmene nanosheets wet with (a) acetone and (b) chloroform, respectively. Scale bars: 10  $\mu\text{m}$ .



**Figure S20.** (a) Schematic showing of home-built microscope spectrophotometry set up for the different solvent vapors responses measurements. (b) Extinction spectra of free-standing crosslinked plasmene nanosheets in the dry state, under acetone vapor atmosphere, THF vapor atmosphere and CHCl<sub>3</sub> vapor atmosphere, respectively.