

## Supporting Information for

### **Fabrication of triple responsive polymer brushes and their catalytic performance after loading palladium**

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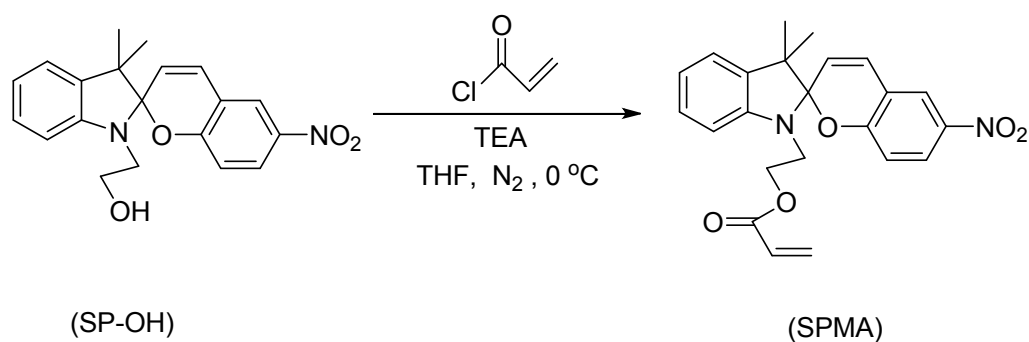
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## Experimental

### *Synthesis of photosensitive monomer SPMA*

The materials to synthesize the 1'-(2-acryloxyethyl)-3',3'-dimethyl-6-nitrospiro-(2H-1-benzopyran-2,2'-indoline) (SPMA) included photochromic spiropyran 1'-(2-hydroxyethyl)-3',3'-dimethyl-6-nitrospiro[2H-1-benzopyran-2,2'-indoline] (SP-OH, >93%, TCI), acryloyl chloride (99%, Aladdin), triethylamine (TEA, 99%, Aladdin), and tetrahydrofuran (THF, anhydrous, >99.9%, Aladdin). The methods were described in the literatures<sup>[1-4]</sup> and the SPMA was prepared as demonstrated in Scheme S1. The successful synthesis of the light-responsive monomer is confirmed by <sup>1</sup>H NMR spectroscopy (see Fig. S1) and the following peaks were identified of the as-synthesized monomer (500 MHz, CDCl<sub>3</sub>): δ 8.01 (m, 2H), 7.22 (m, 1H), 7.10 (d, J = 7.2 Hz, 1H), 6.90 (m, 2H), 6.75 (d, J = 8.8 Hz, 1H), 6.70 (d, J = 7.8 Hz, 1H), 6.38 (dd, J = 17.3, 1.1 Hz, 1H), 6.06 (dd, J = 17.3, 10.5 Hz, 1H), 5.87 (d, J = 10.4 Hz, 1H), 5.83 (dd, J = 10.5, 1.1 Hz, 1H), 4.31 (m, 2H), 3.59–3.40 (m, 2H), 1.28 (s, 3H), 1.16 (s, 3H).



**Scheme S1** The synthetic route of photo-responsive monomer (SPMA).

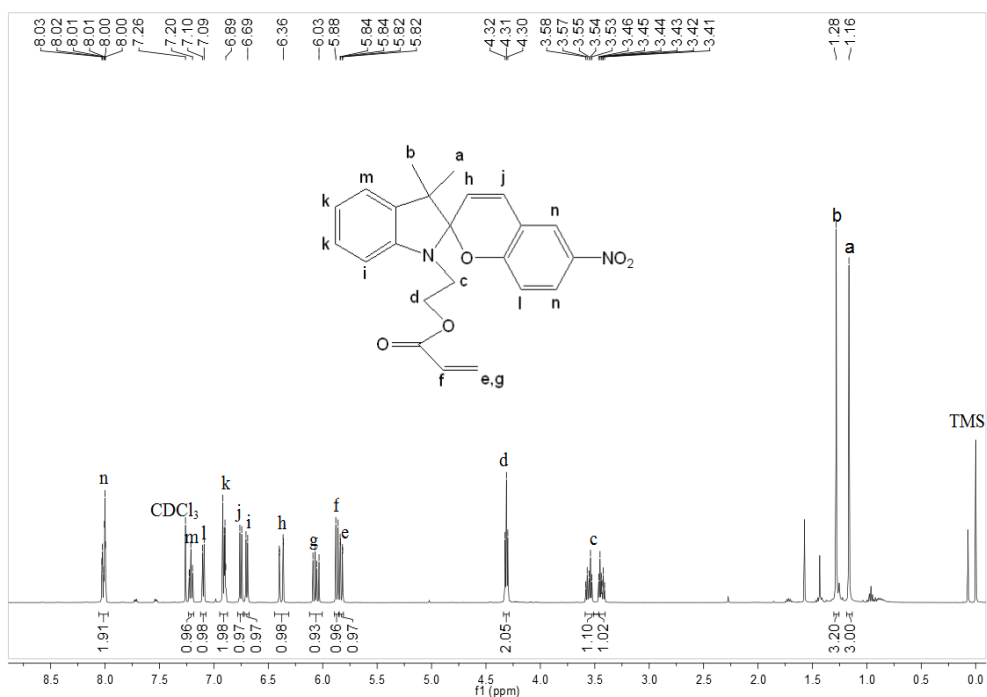
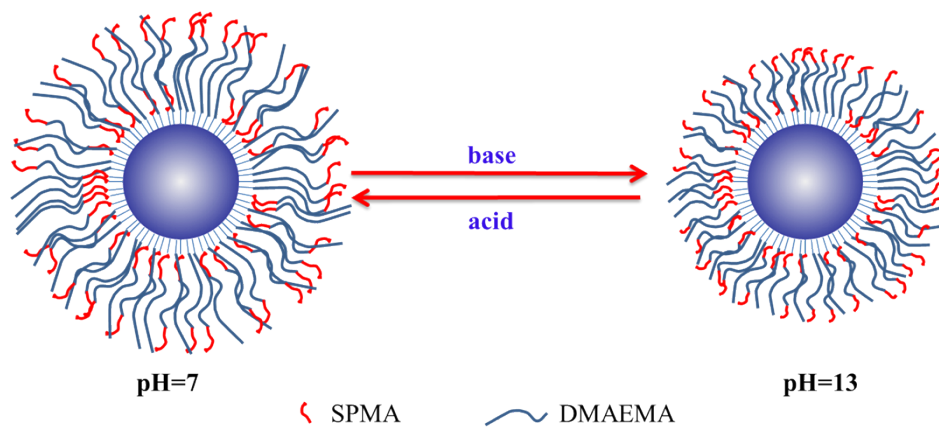


Fig. S1 <sup>1</sup>H NMR spectrum (in CDCl<sub>3</sub>) of photo-responsive monomer (SPMA).

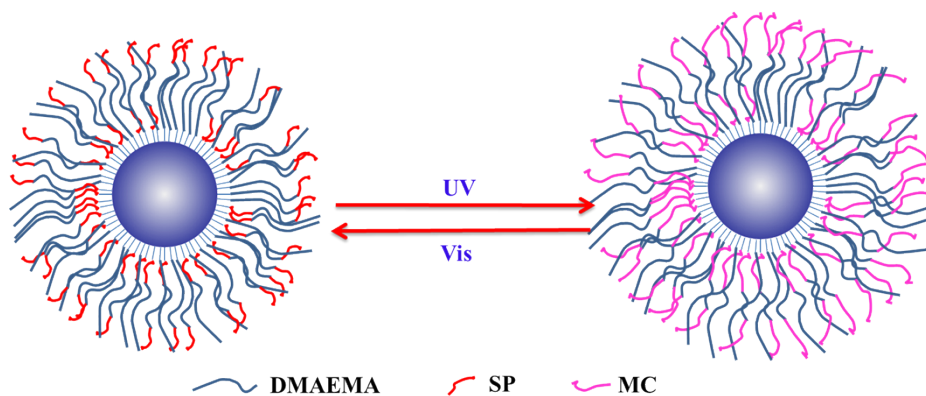
## Results and Discussion

### *pH-induced shrinking/swelling of SiO<sub>2</sub>-g-P(SPMA-co-DMAEMA)*



Scheme S2 Schematic illustration of the reversible pH-tunable swelling/shrinking transition.

### *Photo-responsive behaviors of SiO<sub>2</sub>-g-P(SPMA-co-DMAEMA)*



**Scheme S3** Schematic illustration of the photo-responsive transition. SP is the colorless, nonpolar, and hydrophobic spiropyran molecule, and MC is the colored, polar, hydrophilic, and zwitterionic merocyanine molecule.

## References

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