

Supplementary Information

Zwitterionic Polymer Brush Coatings with Excellent Anti-fog and Anti-frost Properties

Metwally Ezzat and Chun-Jen Huang*

Department of Biomedical Sciences and Engineering, National Central University, Jhong-Li, Taoyuan 320 Taiwan.

*E-mail: cjhuang@ncu.edu.tw

Synthesis of 3-(2-bromoisobutyramido)propyl(triethoxysilane)

The initiator, 3-(2-bromoisobutyramido)propyl(triethoxysilane), was prepared following the procedure reported by Tugulu *et al.*¹ Briefly, 2-bromoisobutyryl bromide (12 mL) was added dropwise into a solution of (3-aminopropyl)triethoxysilane (14 mL) and triethylamine (13.4 mL) in 120 mL THF at 0 °C. The solution was stirred for additional 4 h under nitrogen atmosphere at room temperature. Finally, triethylammonium bromide was removed by filtration through a Celite pad under nitrogen atmosphere, and the resultant solution was evaporated to dryness using rotary evaporation under vacuum at 50 °C for 8 h and stored at 4 °C in a glove box under a stream of nitrogen. ¹H-NMR (600 MHz, CDCl₃, δ, ppm): 0.62 (t, 2H), 1.2 (m, 9H), 1.63 (m, 2H), 1.92 (s, 6H), 3.25 (m, 2H), 3.8 (m, 6H).

Synthesis of SBVI monomer

Sulfobetaine vinylimidazole (SBVI) monomer was synthesized according to previous report.² 1-vinylimidazole (6.42 g, 68.2 mmol) was added slowly into a solution of 1,3-propanesultone (10 g, 81.86 mmol) dissolved in 60 mL anhydrous THF in a round bottom flask at room temperature and stirred for 30 min. The mixture was subsequently heated at 50 °C and stirred for 2 days under nitrogen. The white precipitate was separated, washed with ether and dried in vacuo. ¹H-NMR (600 MHz, D₂O, δ, ppm): 2.39 (m, 2H), 2.99 (t, 2H), 4.46 (t, 2H), 5.48 (d, 1H), 5.86 (d, 1H), 7.2 (m, 1H), 7.66 (s, 1H), 7.83 (s, 1H), 9.1 (s, 1H, reduced intensity).

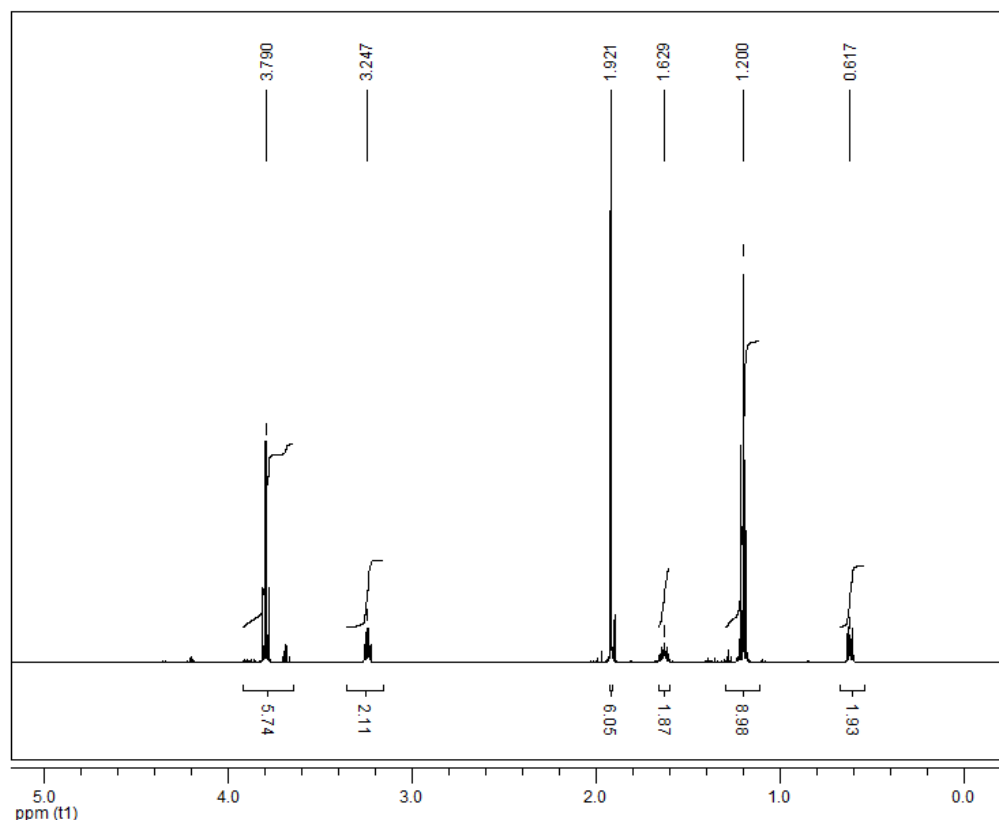


Fig. S1 ¹H-NMR Spectra for the initiator in CDCl₃.

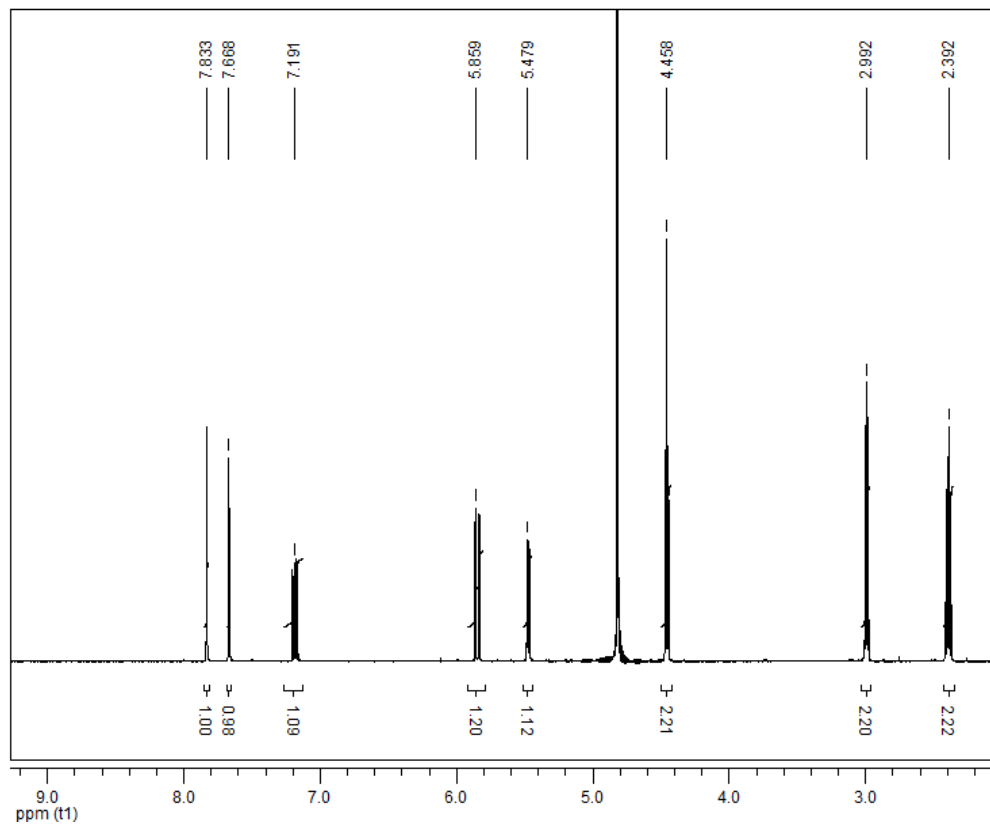


Fig. S2 $^1\text{H-NMR}$ Spectra for the SBVI monomer in D_2O .



Fig. S3 Contact angle measurements for: (a) bare glass, (b) pSBMA-H and (c) pSBVI-H.

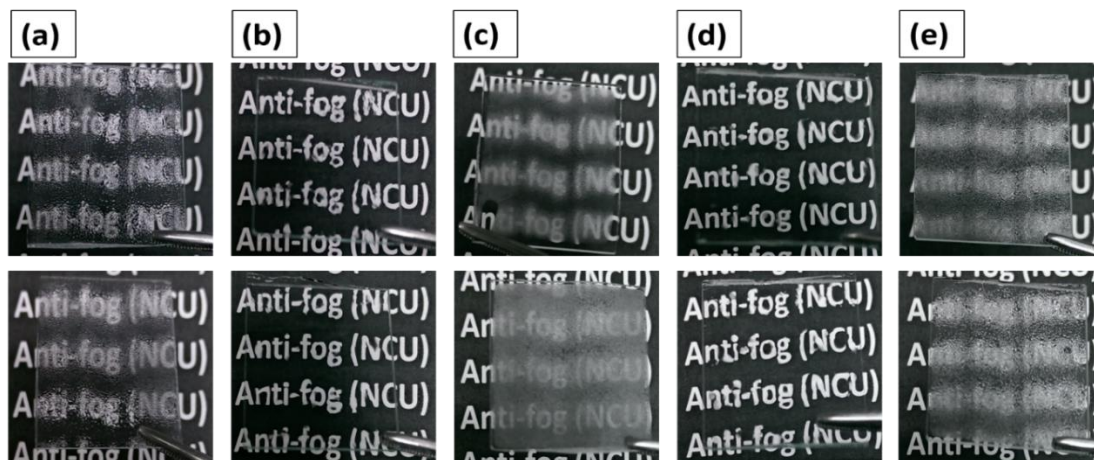


Fig. S4 Digital photos of different samples: (a) bare glass, (b) pSBMA-SH, (c) pSBMA-H, (d) pSBVI-SH, and (e) pSBVI-H, after exposure to hot water vapour for 30 s (upper) and 60 s (bottom) under ambient lab conditions (temperature ~ 21 °C, 88 % relative humidity).

References

1. S. Tugulu, A. Arnold, I. Sielaff, K. Johnsson and H.-A. Klok, *Biomacromolecules*, 2005, **6**, 1602-1607.
2. L. Carr, G. Cheng, H. Xue and S. Jiang, *Langmuir*, 2010, **26**, 14793-14798.