Electronic Supplementary Material (ESI) for New Journal of Chemistry


# Supporting Information for

# Amorphous Array of Poly(*N*-isopropylacrylamide) Brush-Coated Silica Particles for Thermally Tunable Angle-Independent Photonic Band Gap Materials

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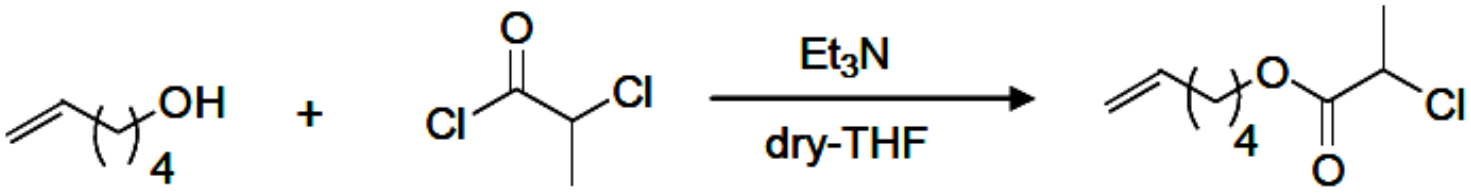
# Table 1S

| Sample No. | [M] : [I] : [$Cu_I$] : [L] (M / DMSO) (w/w) | Temperature (°C) | Reaction time (h) | Conversion (%) | $M_{n\text{-theol.}}$ / 10000 | $M_{n\text{-GPC}}$ / 10000 | $M_w / M_n$ |
|---|---|---|---|---|---|---|---|
| 1’ | | | | 81 | 4.58 | 3.77 | 1.26 |
| 2’ | | | | 63 | 3.56 | 3.34 | 1.20 |
| 3’ | | | | 80 | 4.52 | 3.80 | 1.24 |
| 4’ | | | | 70 | 3.96 | 3.58 | 1.21 |
| 5’ | | | | 85 | 4.80 | 3.52 | 1.27 |
| 6’ | | | | 71 | 4.00 | 3.49 | 1.26 |
| 7’ | 500 : 1 : 1 : 1 (1/2) | 20 | 5 | 80 | 4.52 | 2.85 | 1.20 |
| 8’ | | | | 77 | 4.35 | 3.62 | 1.20 |
| 9’ | | | | 70 | 3.96 | 4.42 | 1.24 |
| 10’ | | | | 65 | 3.69 | 4.26 | 1.32 |
| 11’ | | | | 84 | 4.75 | 4.26 | 1.32 |
| 12’ | | | | 72 | 4.07 | 3.74 | 1.24 |
| 13’ | | | | 92 | 5.20 | 4.09 | 1.27 |
| 14’ | | | | 70 | 3.96 | 2.56 | 1.29 |
| Ave. | | | | 76 | | 3.66 | 1.25 |




5-hexen-1-yl 2-chloro-2-methylpropionate


CPH-tES

Figure S1. Synthetic route of 6-(2-chloro)propionyloxyhexyltriethoxysilane (CPH-tES).

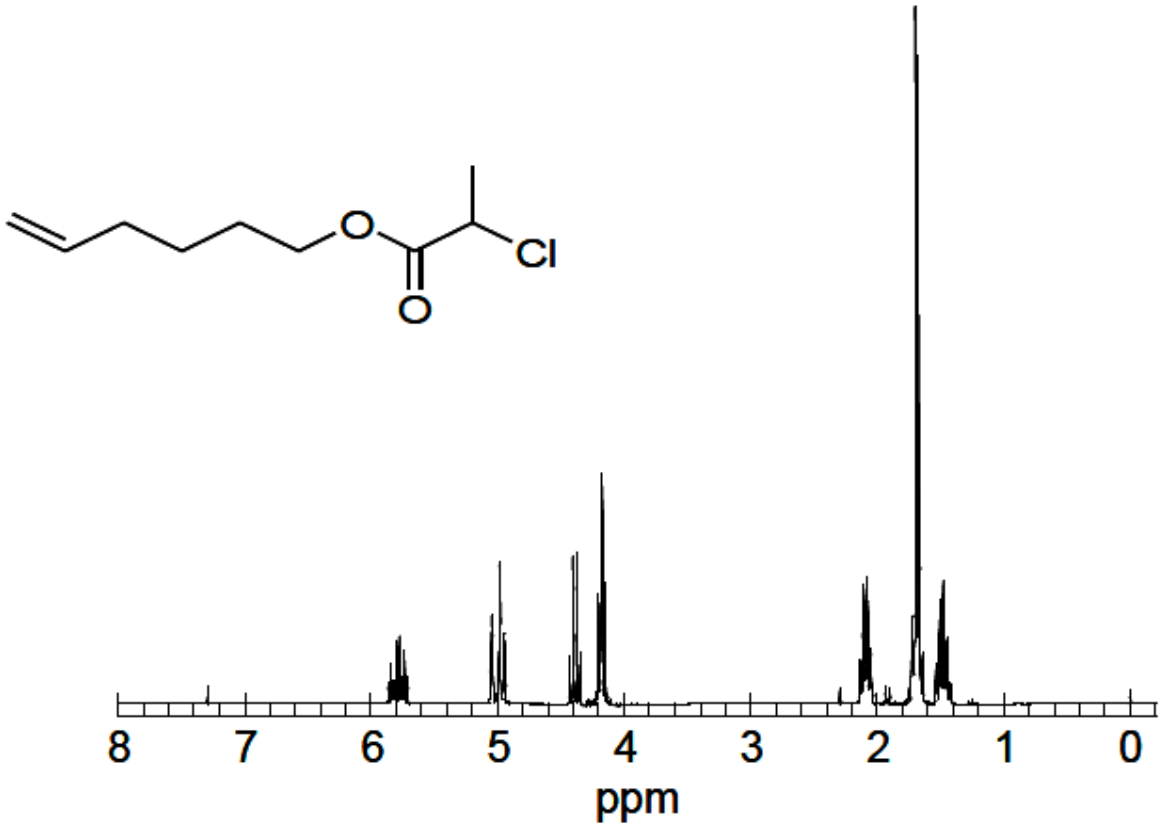



Figure S2. $^{1}H$ NMR spectrum of 5-hexen-1-yl 2-chloro-2-methylpropionate in $CDCl_3$.

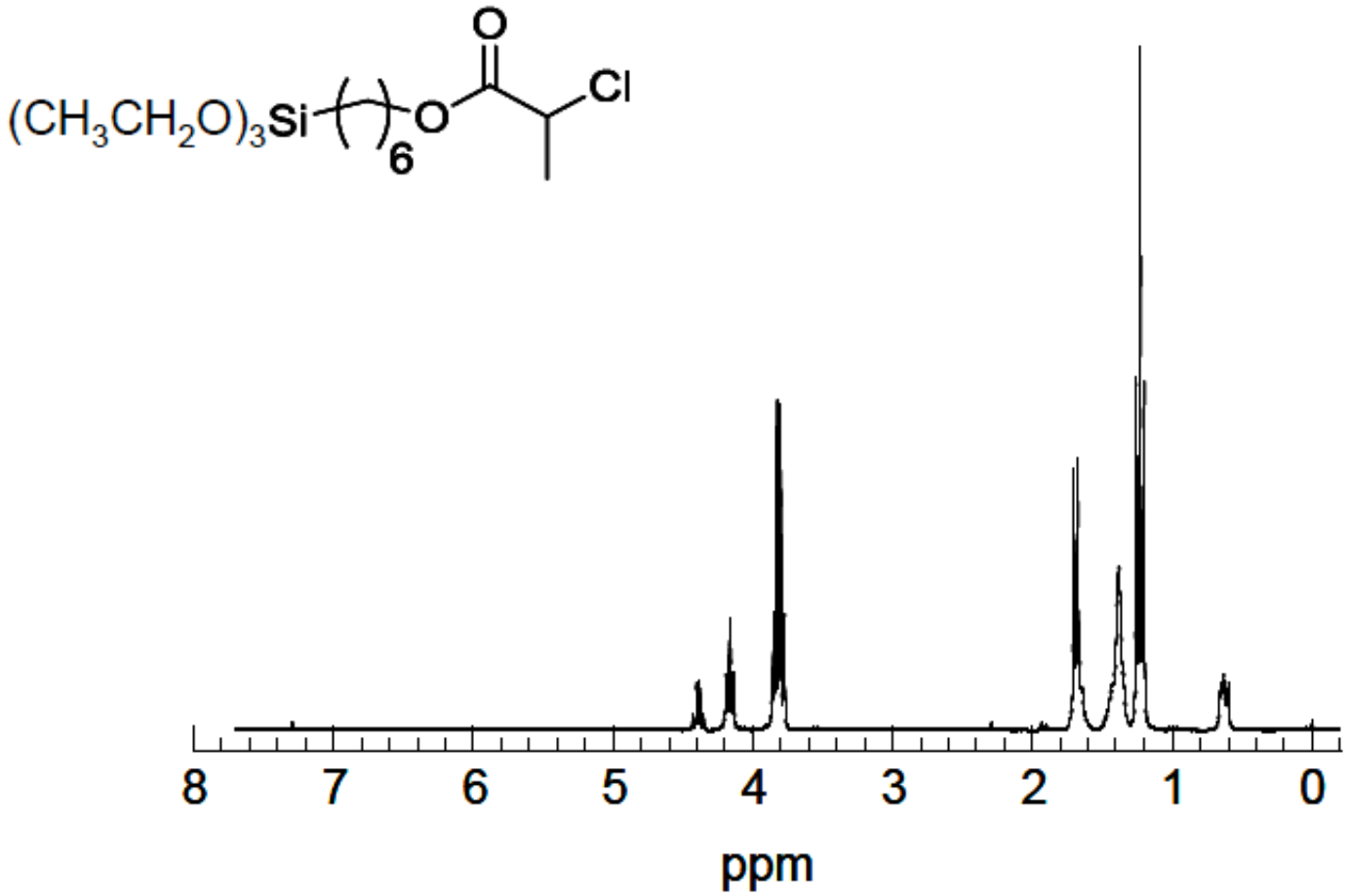



Figure S3. $^{1}H$ NMR spectrum of CPH-tES in $CDCl_3$.

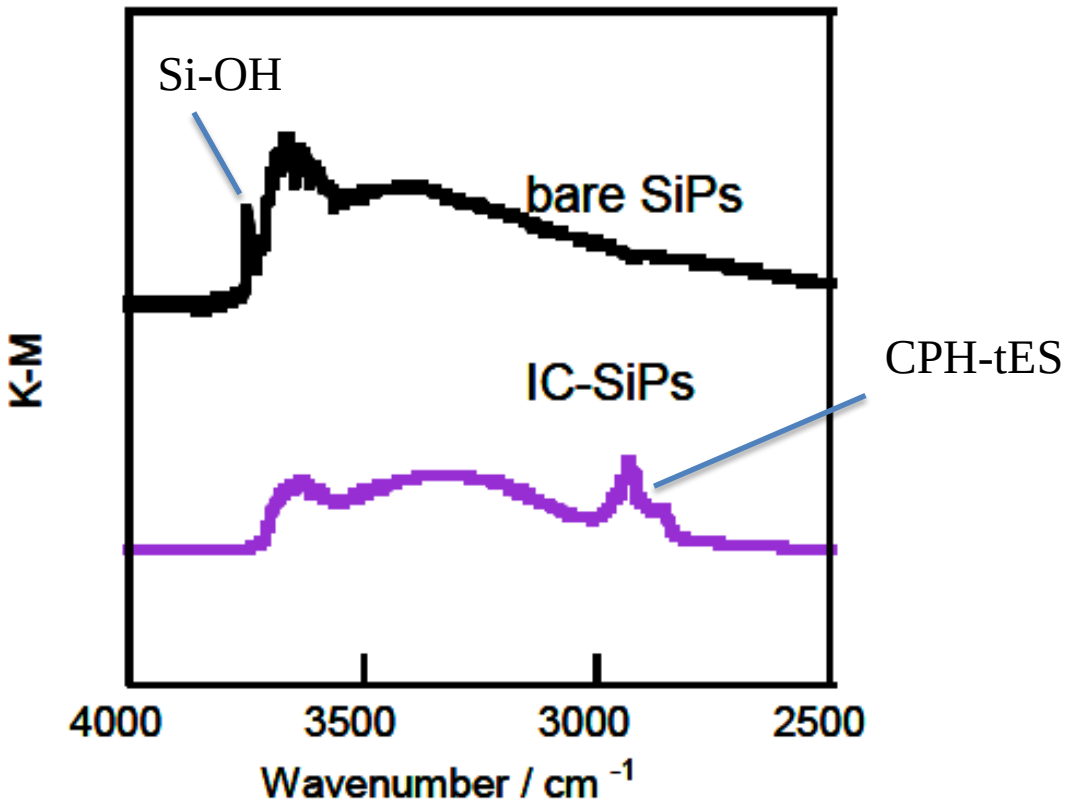



Figure S4. Diffuse reflectance FT-IR spectra of bare $SiO_2$ particle (bare SiPs) and Initiator Coated $SiO_2$ particle (IC-SiPs).

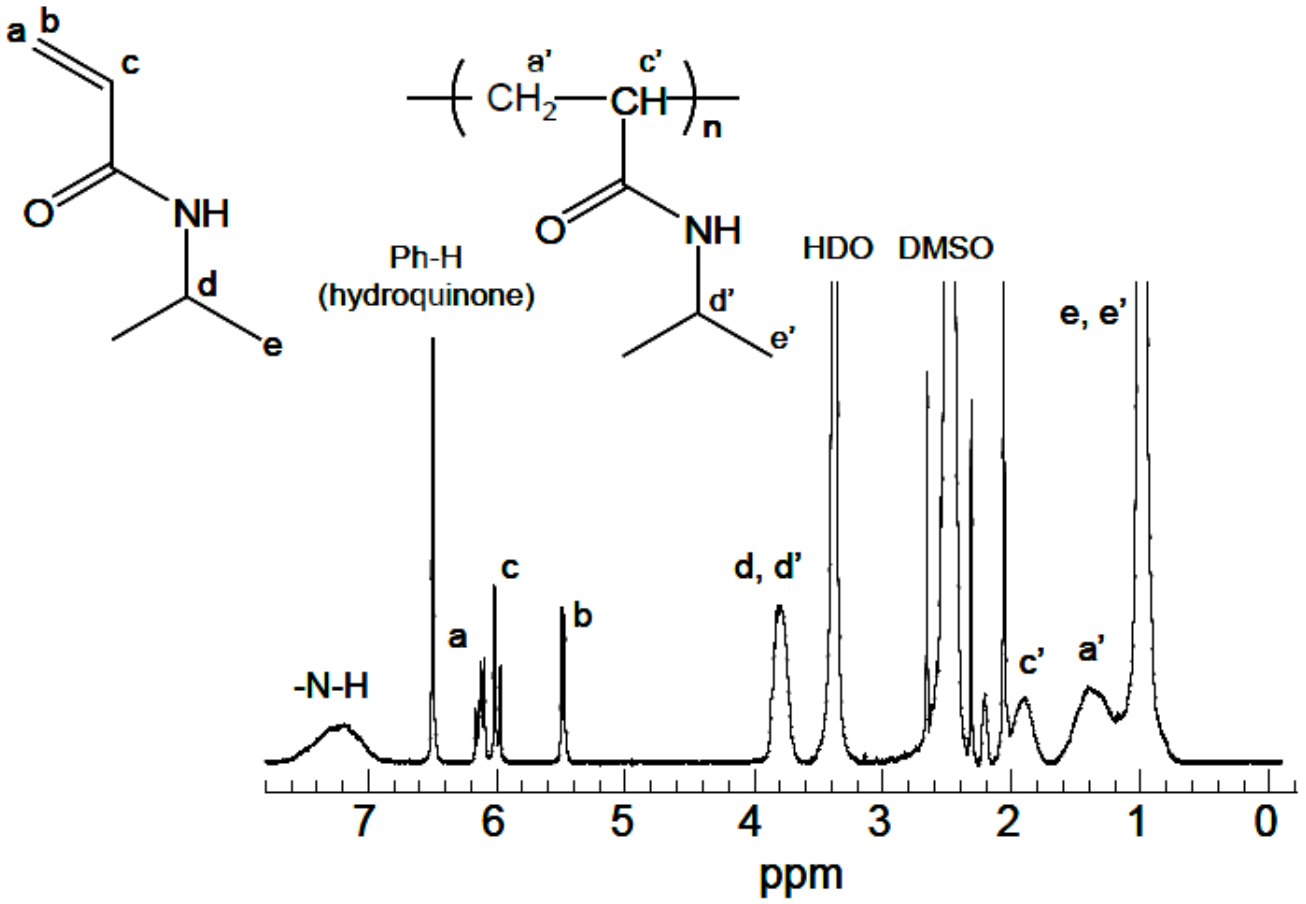



Figure S5. $^{1}$H-NMR spectra of ATRP reaction solution for NIPA before purification in *d*-DMSO. This data was used to determine the monomer conversion.

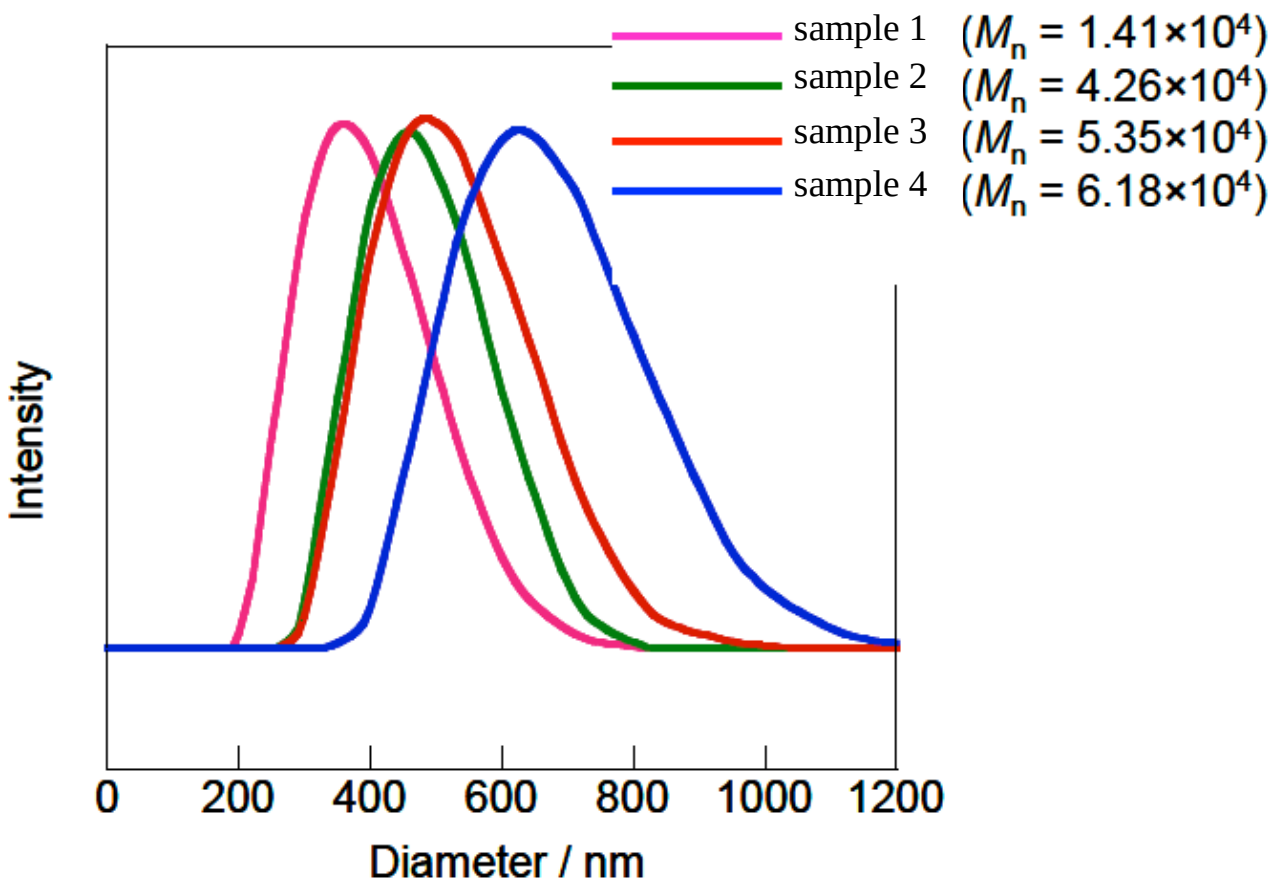



Figure S6. GPC traces for free PNIPA of sample 1-4.

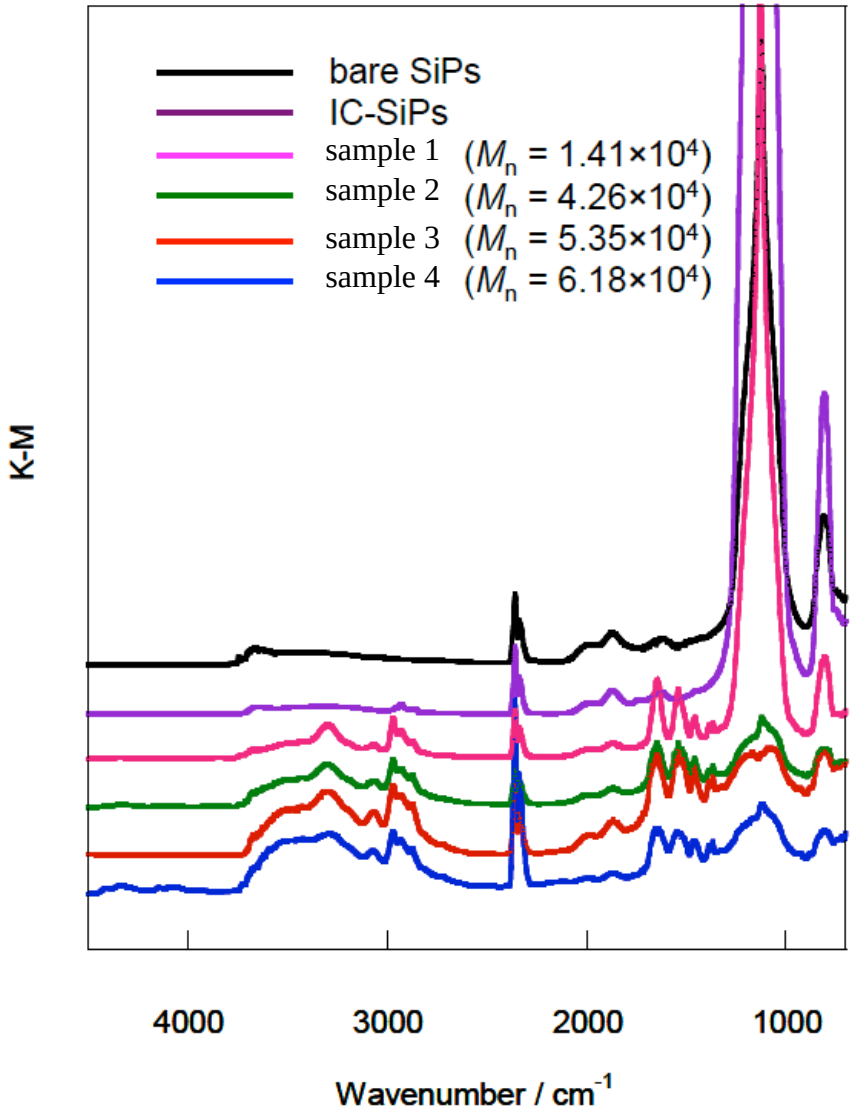



Figure S7. FT-IR spectra of bare $SiO_2$ particle and PNIPA-SiPs with different polymer chain length. The presence of PNIPA in the resulting particles was confirmed by these diffuse reflectance FT-IR spectra.

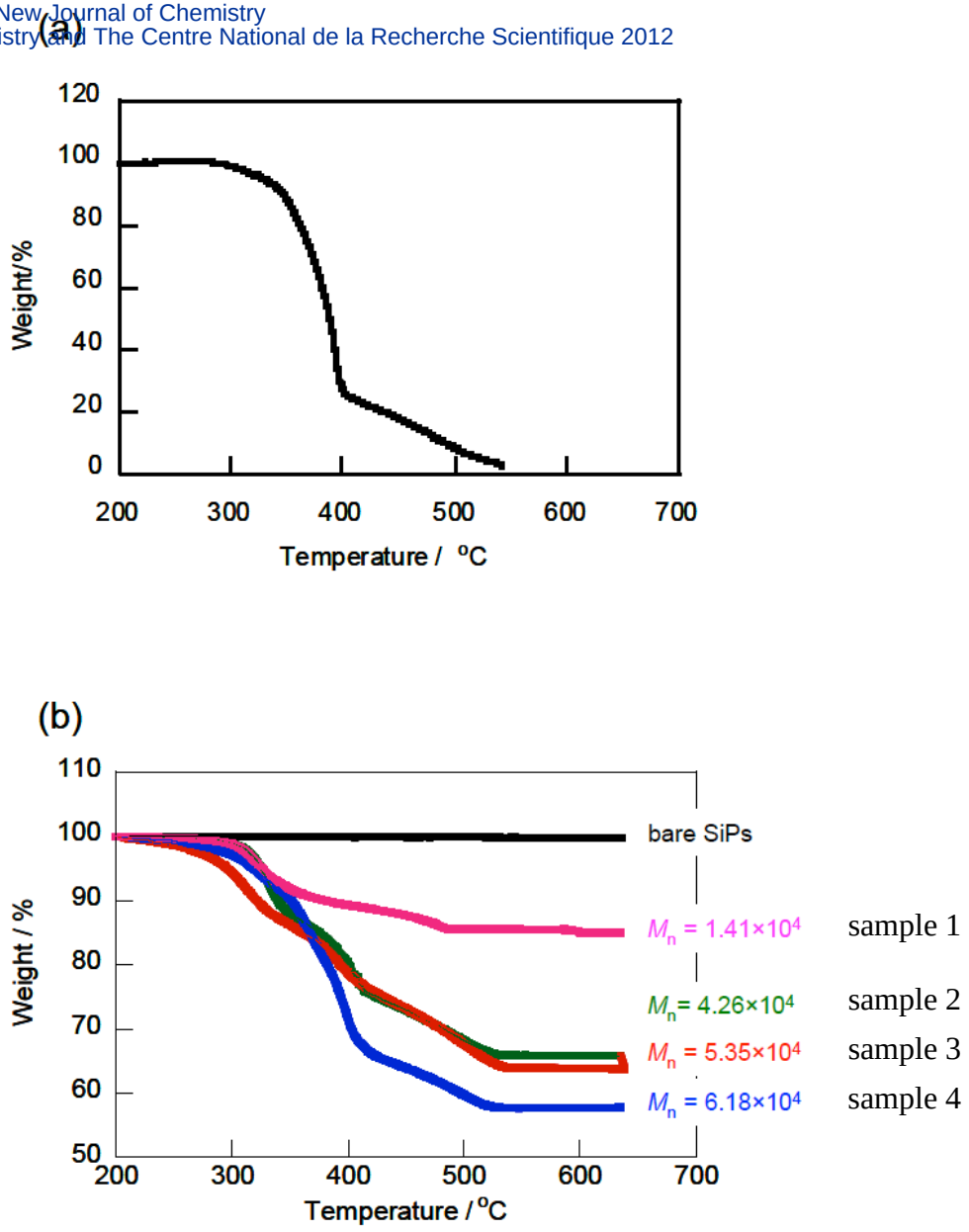
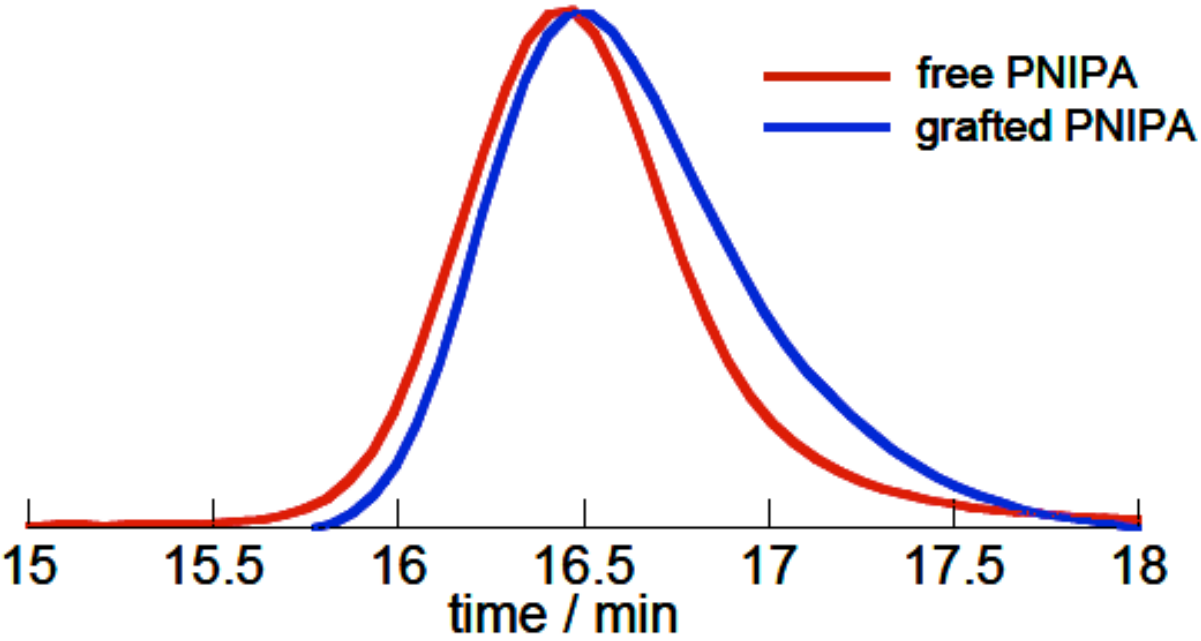



Figure S8. Thermogravimetric Analysis in air: TG of (a) free PNIPA, (b) bare $SiO_2$ particle and PNIPA-SiPs of sample 1-4.




| | $M_n$ / $10^4$ | $M_w$ / $M_n$ |
|---|---|---|
| free PNIPA | 4.61 | 1.21 |
| grafted PNIPA | 4.10 | 1.31 |

Figure S9. GPC chart of free PNIPA and grafted PNIPA.

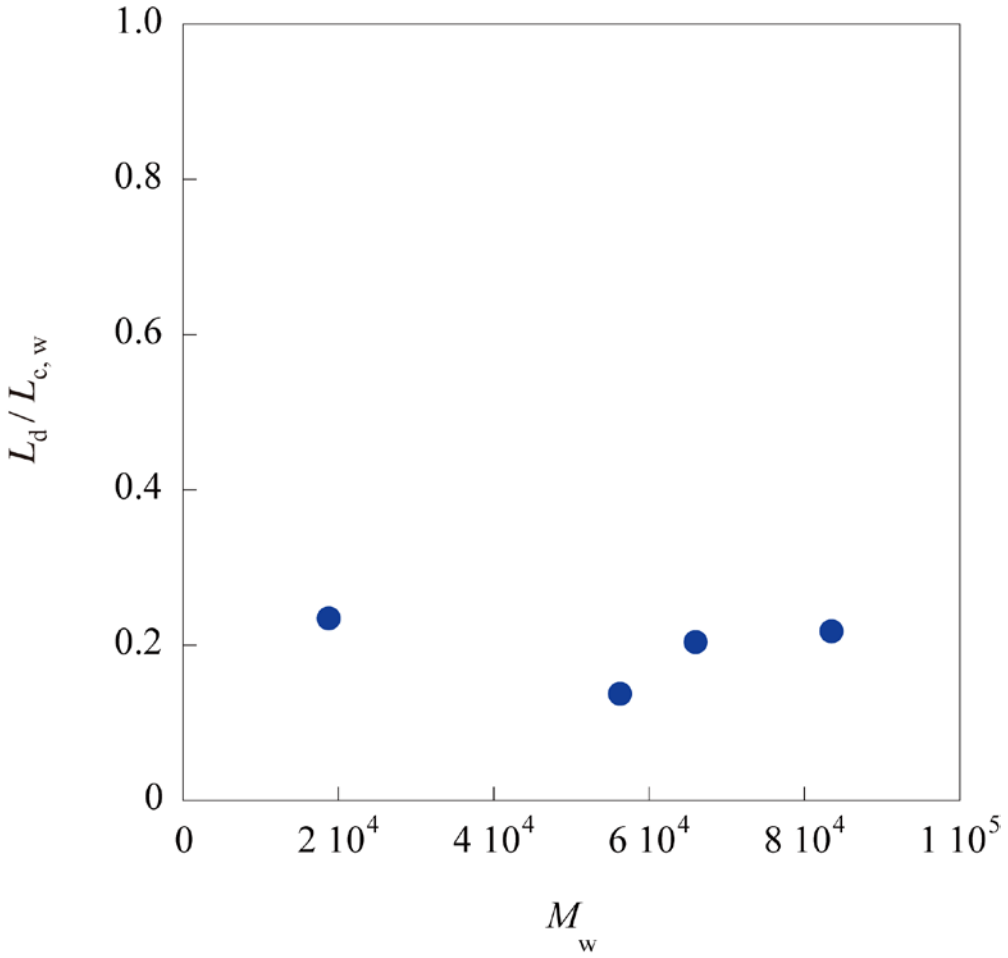



Figure S10. Plots of $L_d/L_{c,w}$ versus weight average molecular weight, $M_w$.

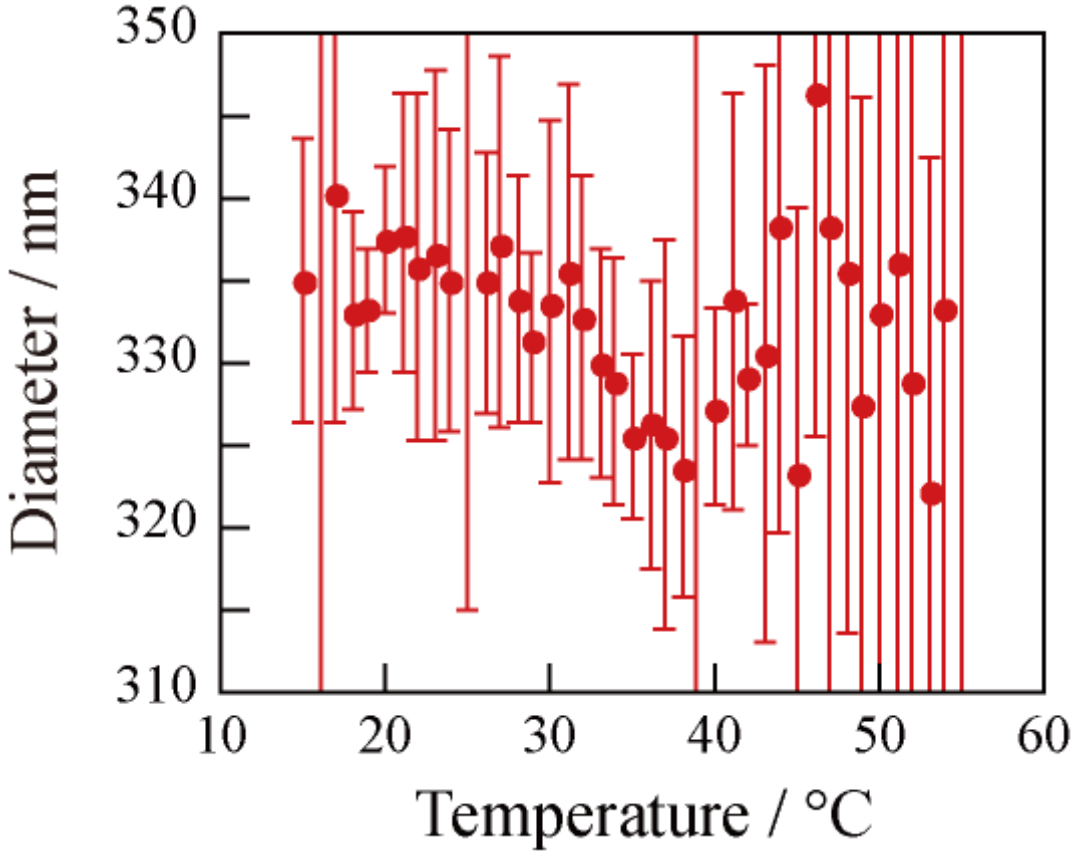



Figure S11. Temperature dependence of the hydrodynamic diameter for PNIPA-SiPs with PNIPA of $M_n = 1.41\times10^4$.

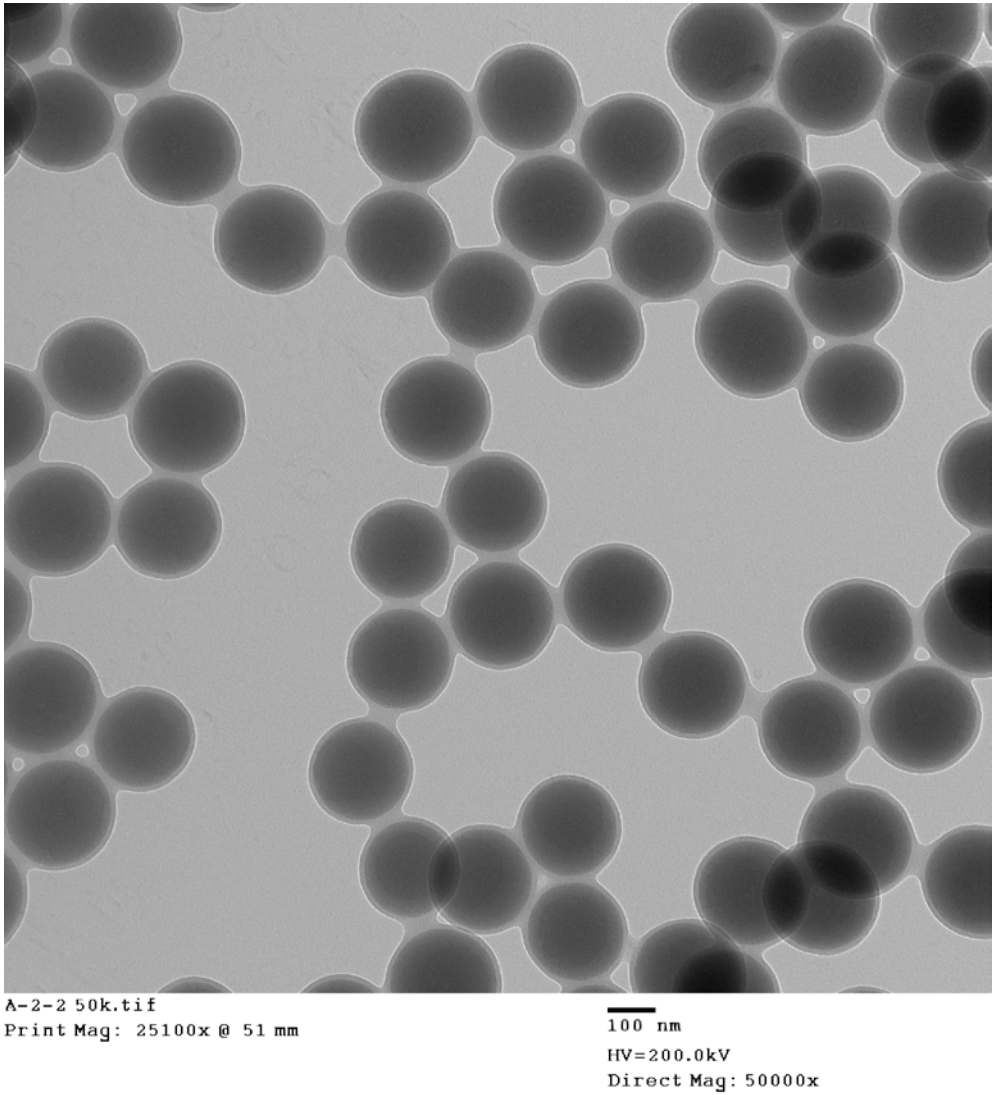



Figure S12. TEM image of PNIPA-SiP using 207 nm silica particles modified with PNIPA of $M_n$ = 25,500, and $M_w/M_n$ = 1.29.

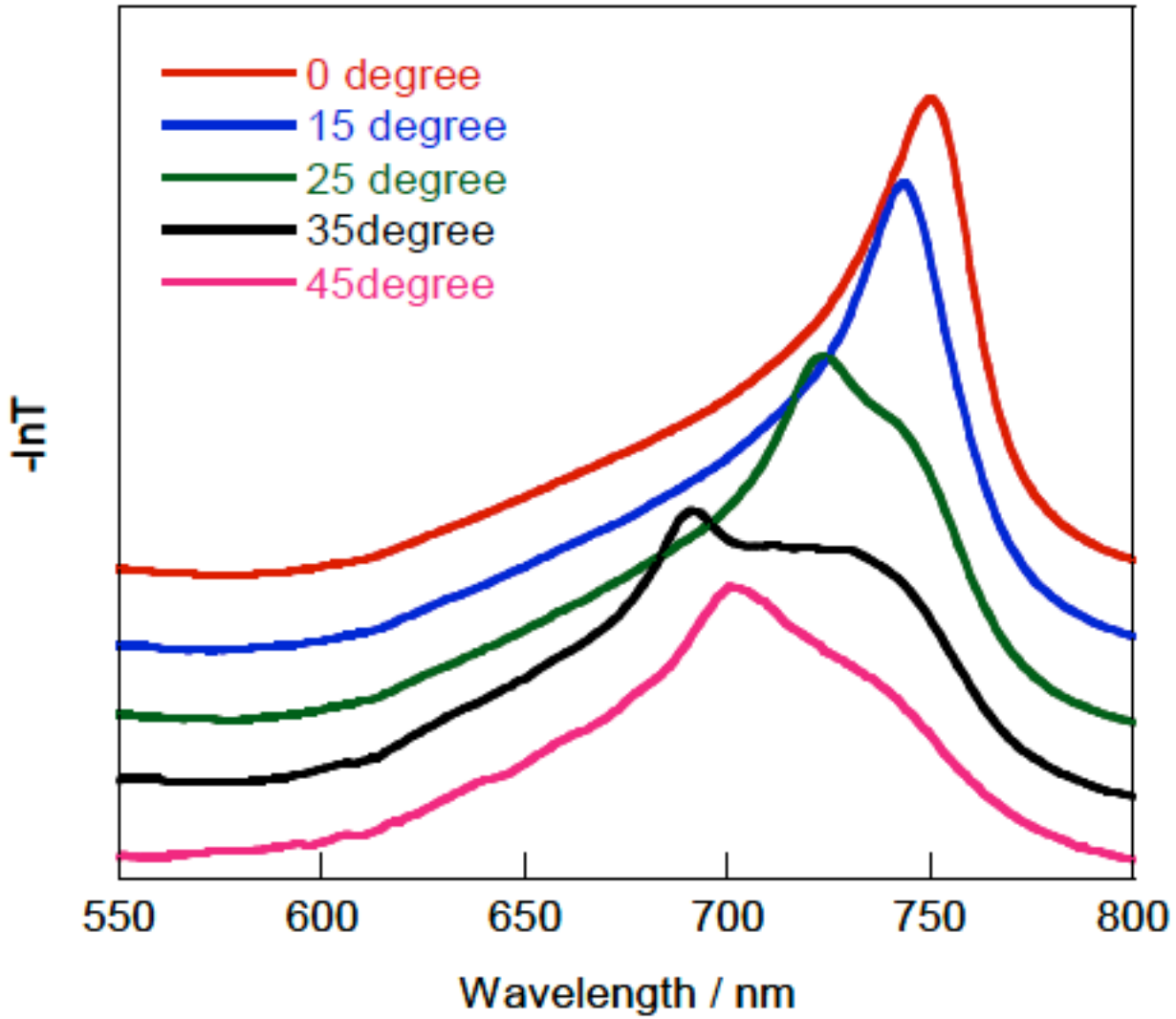



Figure S13. Transmission spectra of the thin membrane of colloidal crystal composed of PNIPA-SiP with 207 nm silica core particle and PNIPA of $M_n$ = 2.55×10$^4$ measured at various angles at 25° C. This thin membrane was prepared from the ethanol suspension of the PNIPA-SiPs.

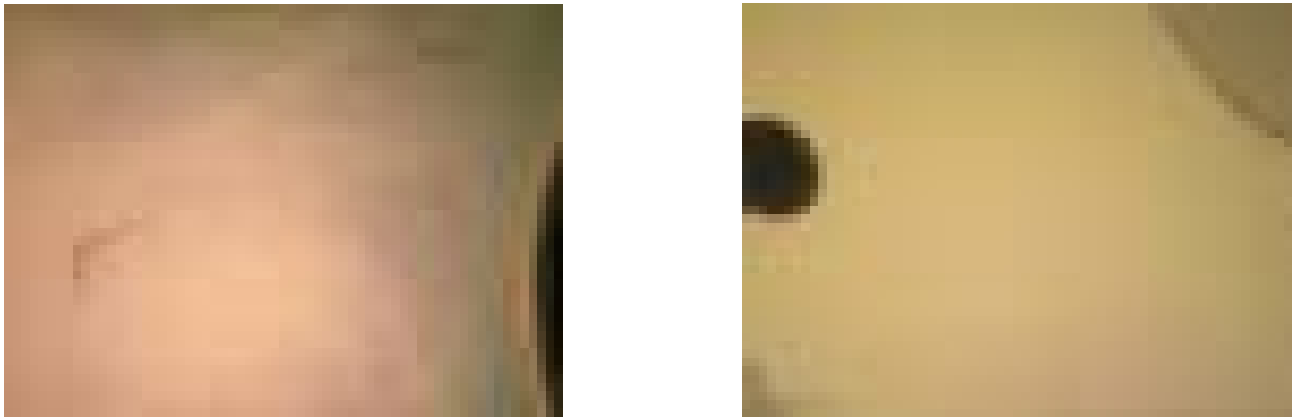


Figure S14. Photographs of the thin membrane of colloidal crystal (left) and the amorphous array (right) composed of PNIPA-SiP with 207 nm silica core particle and PNIPA of $M_n = 2.55 \times 10^4$ measured at various angles at 25° C. Both of them are opaque due to the multiple scattering of light from the presence of disordered portions.