Electronic Supplementary Material (ESI) for Polymer Chemistry.


# Electronic Supplementary Information

## Influence of interfacial molecular structures of quaternary ammonium-type poly(ionic liquid) brushes on their antibacterial properties

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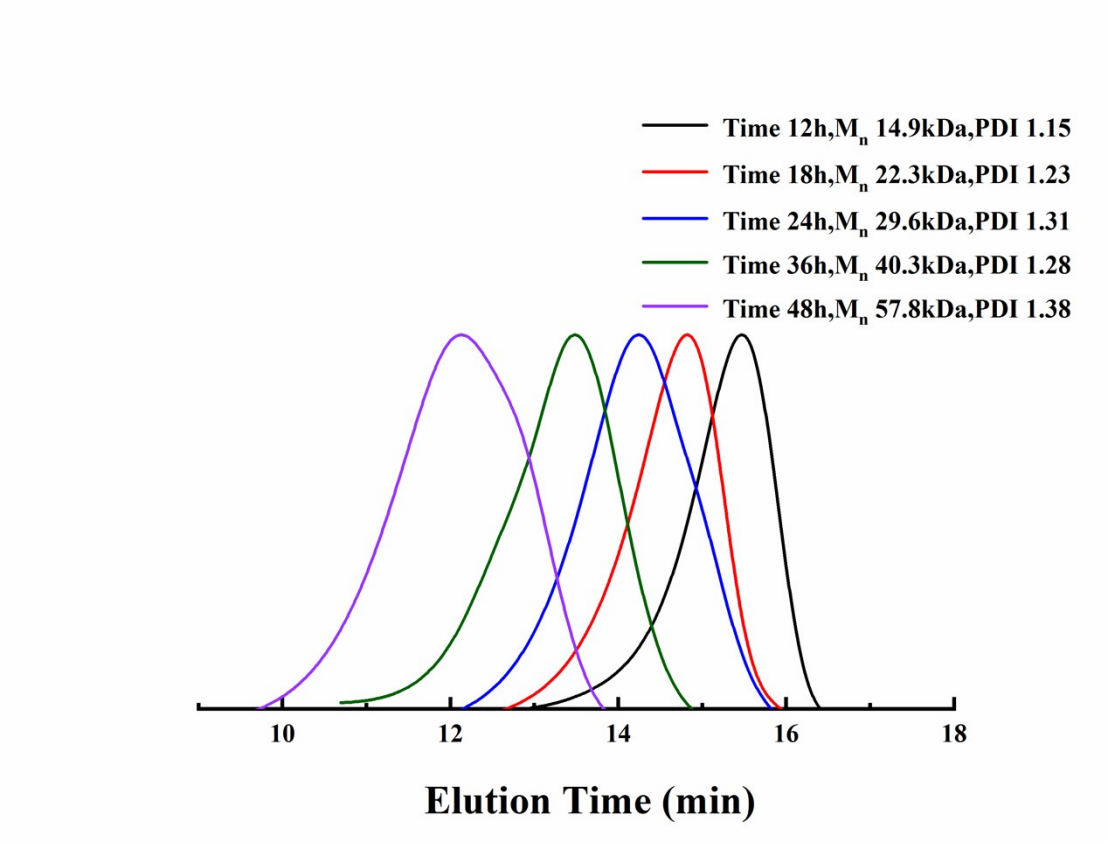


**Fig.S1** GPC traces of SI-ATRP of DMAEMA with polymerization time varying from 12 h to 48 h.

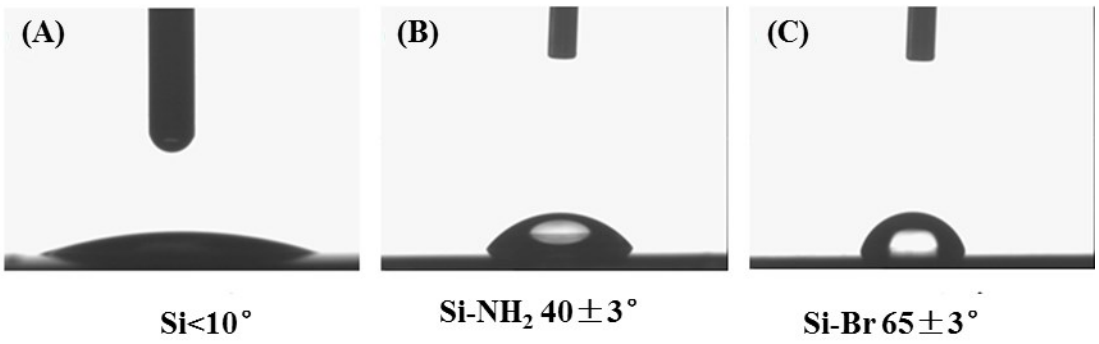


**Fig.S2** Water contact angles of (a) silicon wafer, and silicon treated with (b) APTES and (c) BIBB.

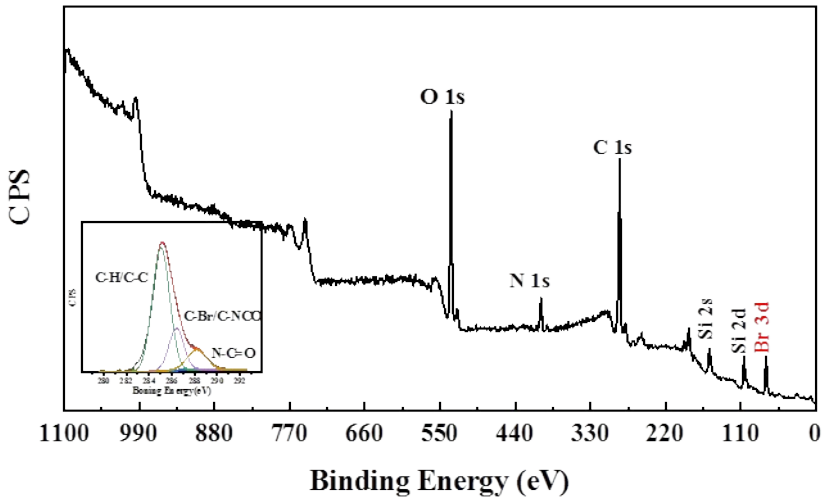


**Fig.S3** XPS survey scan spectra of initiator-functionalized silicon wafer. Insets: high-resolution scan of $C_{1s}$ spectra. The appearance of the Br 3d peak and C-Br peak in XPS spectra indicates the introduction of BIBB initiator onto silicon wafers.

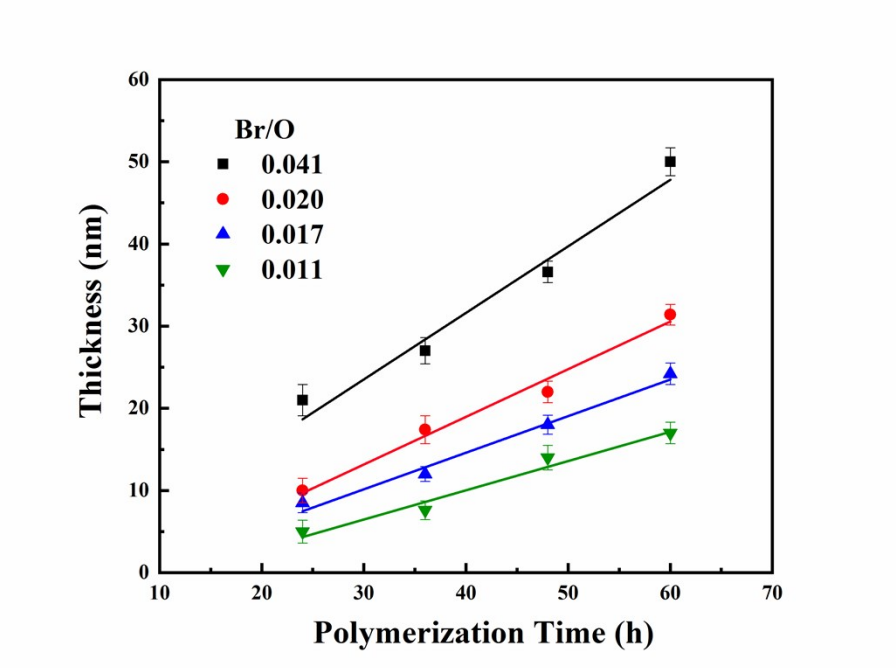


**Fig.S4** Dry thickness of PDMAEMA brushes as a function of polymerization time at different Br/O ratios.

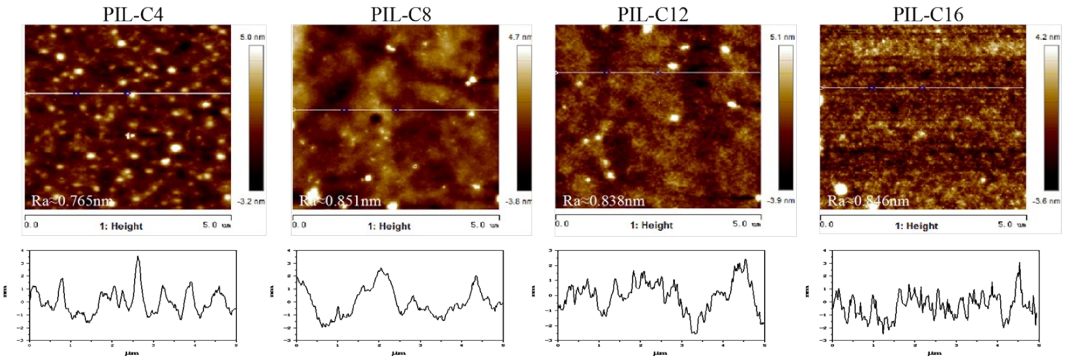


Fig.S5 AFM images of PIL brush films with different alkyl chain lengths.

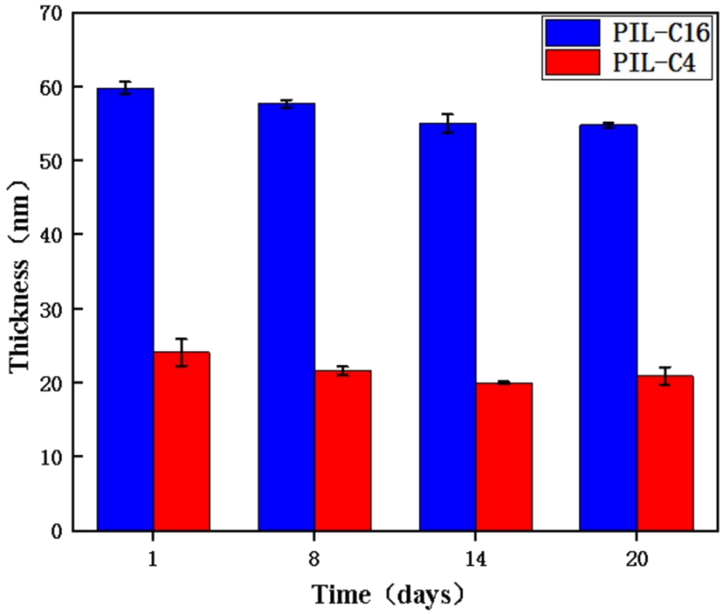


Fig.S6 Thicknesses of PIL brushes as they were immersed into PBS solution for different times. There were almost no changes in brush thicknesses when these PIL brushes were immersed into PBS solution for even 20 days, implying their good stabilities.

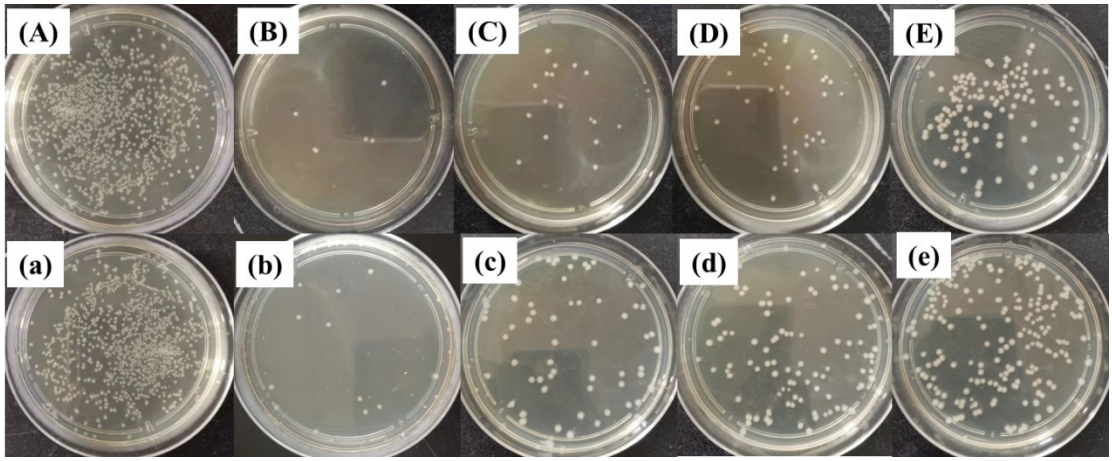


**Fig.S7** Number of colony forming units (CFU) of *E. coli* (A-E) and *S. aureus* (a-e) treated with PIL brushes possessing different alkyl chain lengths for 3 h. (A, a) the control sample; (B, b) PIL-C4; (C, c) PIL-C8; (D, d) PIL-C12; (E, e) PIL-C16.

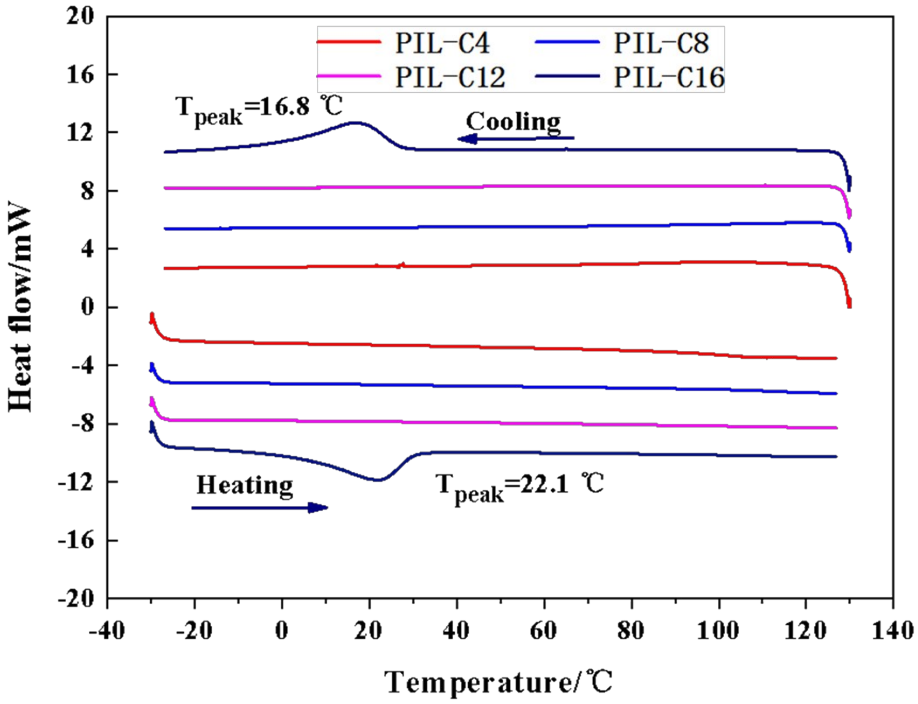


**Fig.S8** Differential scanning calorimetry (DSC) curves of free polymers of PIL-C4, PIL-C8, PIL-C12 and PIL-C16.

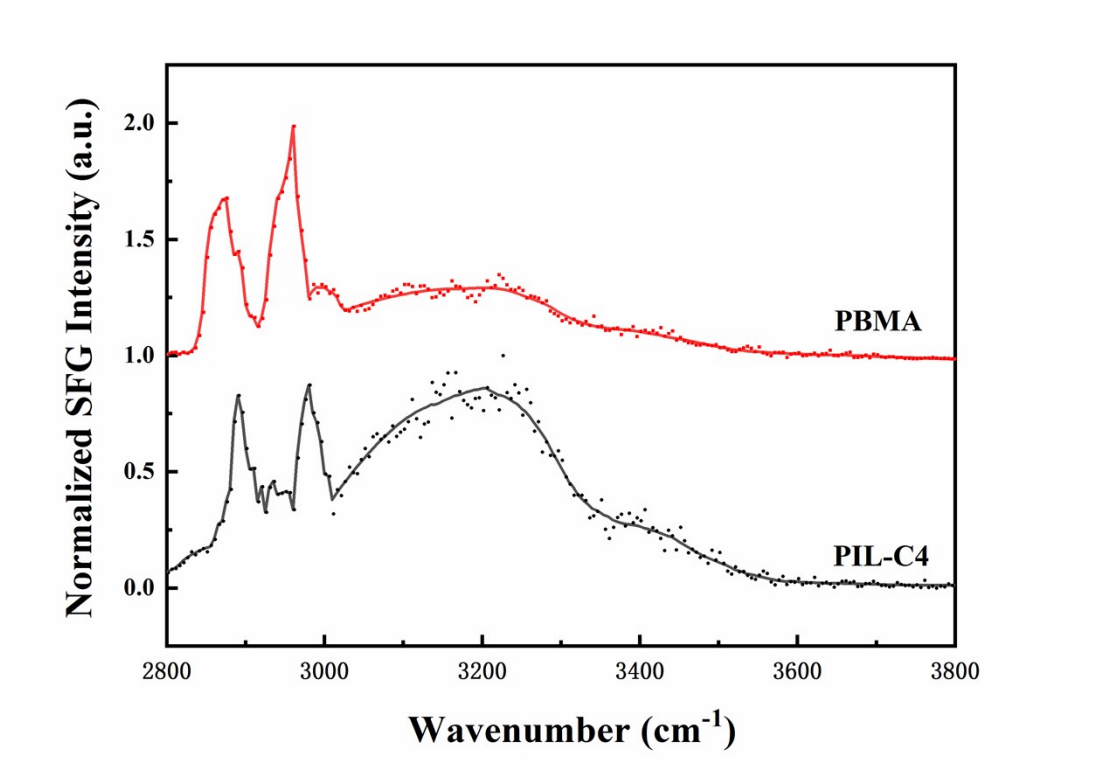


**Fig.S9** SFG ssp spectra collected from PIL-C4 brushes and PBMA brushes in PBS solution. The PBMA brushes on silicon wafer were prepared according to the same procedure as PIL-C4 did. PIL brushes exhibit remarkably stronger water resonant signals than PBMA brushes, implying that it is the charged nitrogen atoms that induce the ordering of water molecules at polymer/PBS interfaces because PBMA have similar backbone and side chains with PIL-C4 except quaternized nitrogen atoms.

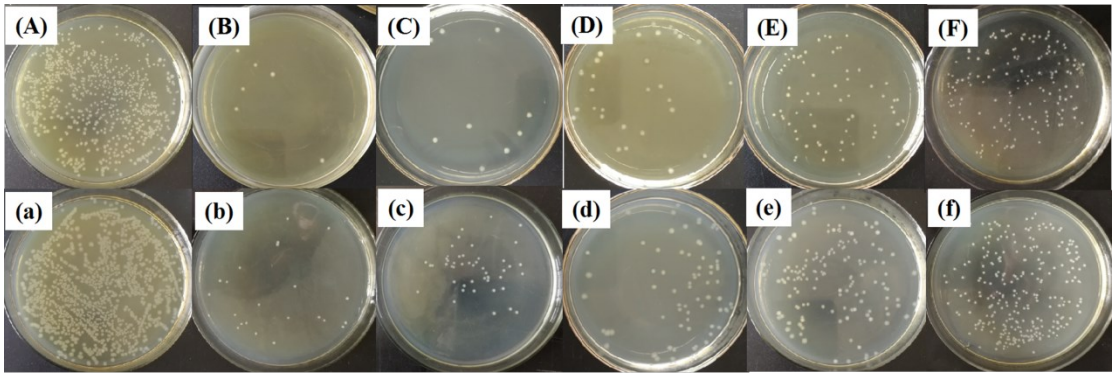


**Fig.S10** Number of colony forming units (CFU) of *E. coli* (A-E) and *S. aureus* (a-e) treated with PIL-C4 brushes having different grafting density ($\sigma$) for 3 h. (A, a) initiator-functionalized silicon wafer without PIL brushes; (B, b) $\sigma$= 0.46 nm$^{-2}$; (C, c) $\sigma$= 0.38 nm$^{-2}$; (D, d) $\sigma$= 0.29 nm$^{-2}$; (E, e) $\sigma$= 0.23 nm$^{-2}$ and (F, f) 0.17nm$^{-2}$.