Supporting Information

for

L-Methionine sulfoxide and L-alanine copolymers for ice control

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1. Experimental sections

Differential Scanning Calorimetry (DSC). The melting and freezing points of L-methionine sulfoxide and L-alanine copolymers (MSACPs) aqueous solutions (130 mg/mL) were determined by differential scanning calorimetry (Q2000, TA, USA). The ca. 5 mg aqueous solutions were kept at a constant mass for 7 days prior to testing. The sample was cooled from 25 °C to -50 °C at a rate of 2 °C/min to detect the freezing point, with temperature equilibrium at -50 °C for 5 min. Then it was raised to 25 °C at a rate of 2 °C/min to test MSACPs melting point.

2. Supporting Figures

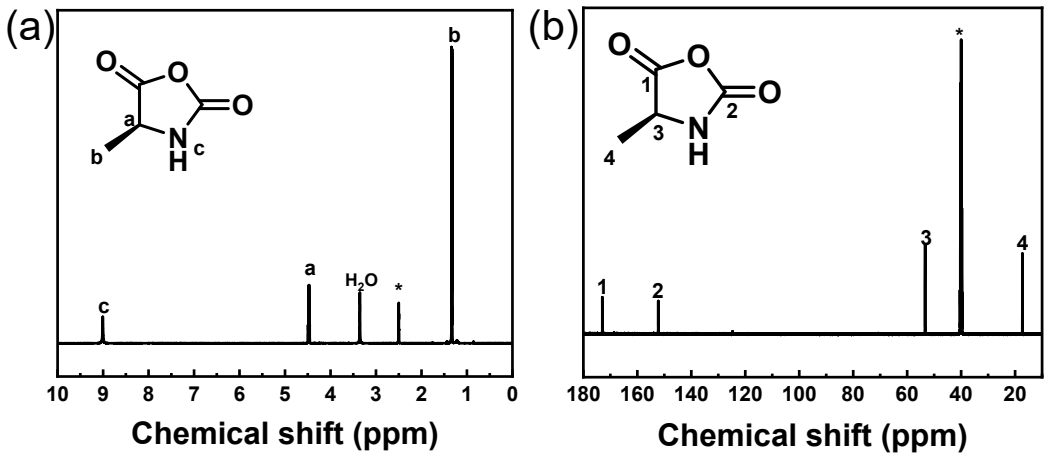


Fig. S1. (a) ^{1}H and (b) ^{13}C NMR spectra of Ala-NCA in DMSO-d_6.

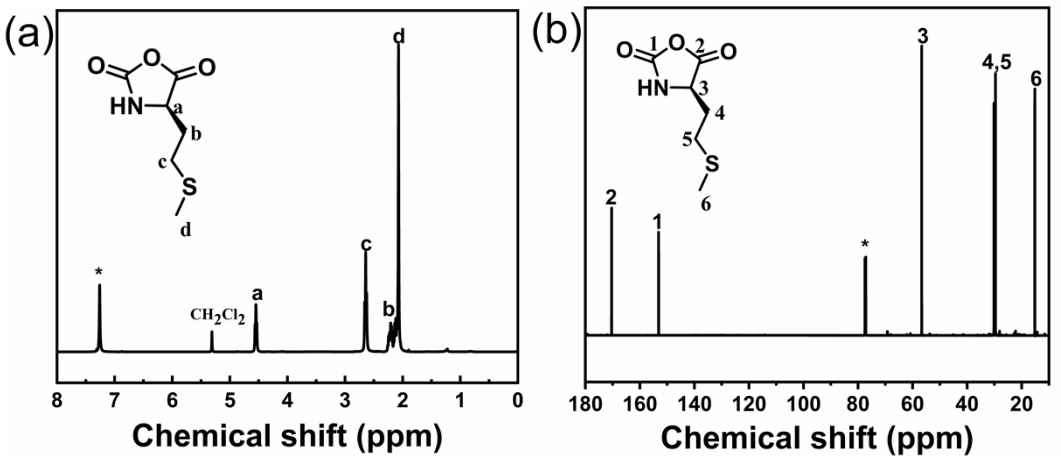
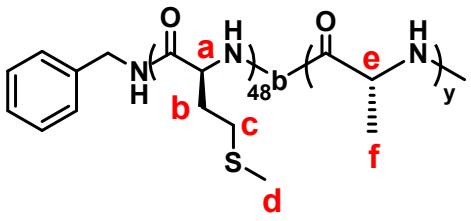


Fig. S2. (a) ^{1}H and (b) ^{13}C NMR spectra of Met-NCA in $CDCl_3$.



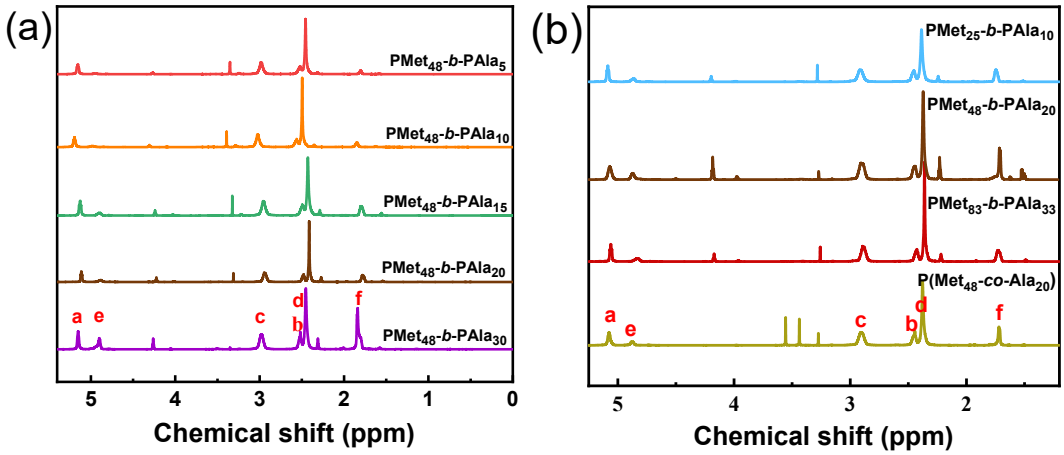
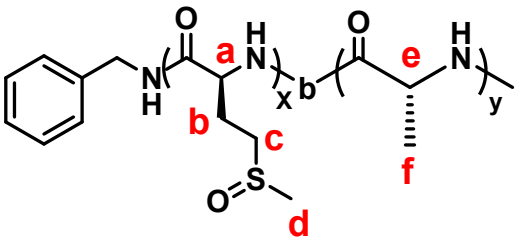


Fig. S3. ^{1}H NMR spectra of $PMet_{48}$ and unoxidized MSACPs in CF_3COOD.



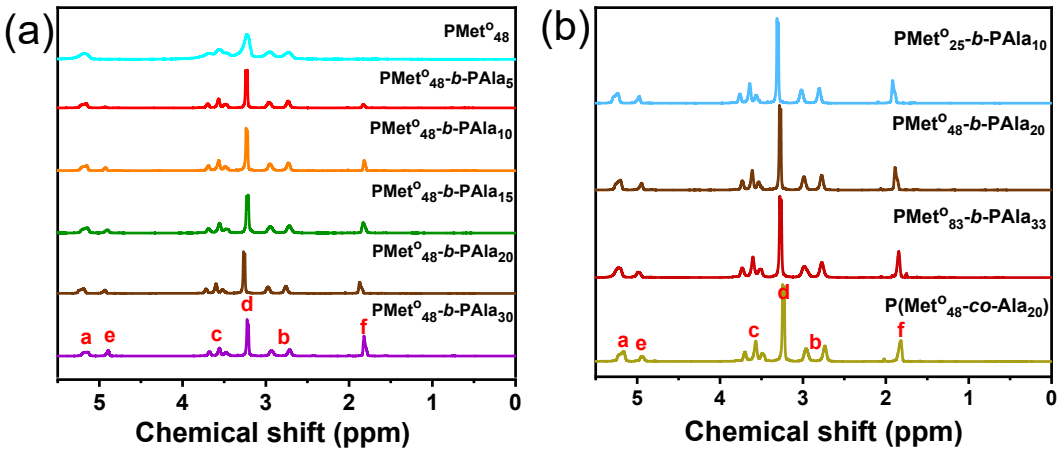


Fig. S4. ^{1}H NMR spectra of $PMet^{o}_{48}$ and MSACPs in CF_3COOD.

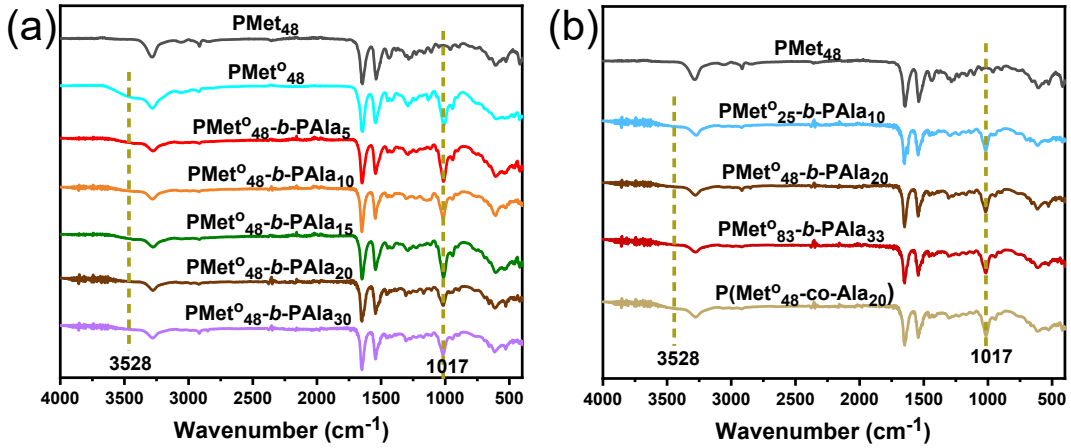


Fig. S5. FTIR spectra of $PMet_{48}$, $PMet^{o}_{48}$ and MSACPs.

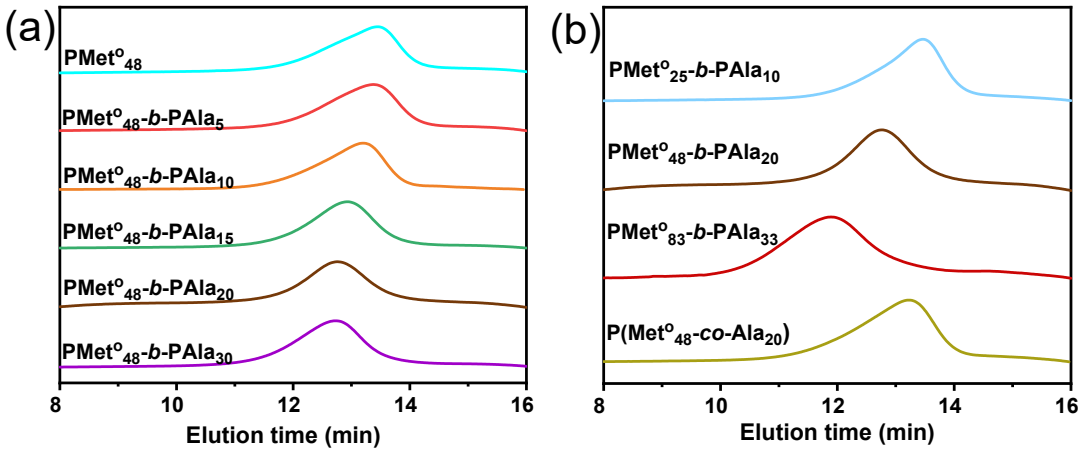


Fig. S6. GPC curves of the MSACPs with HFIP as the eluent.

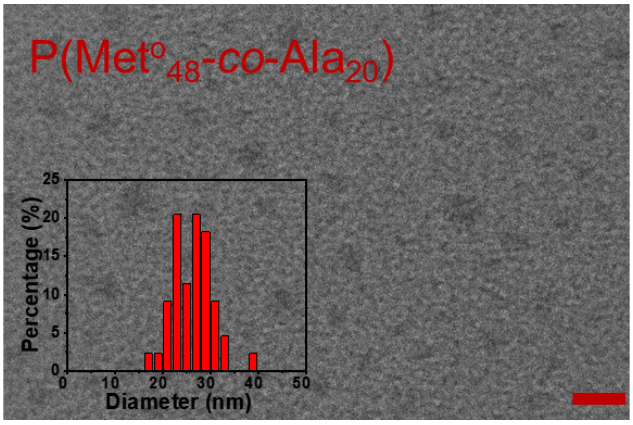


Fig. S7. TEM image of P(Met°$_{48}$-*co*-Ala$_{20}$) after self-assembly in aqueous solution (5 mg/ml). The scale bar is 50 nm.

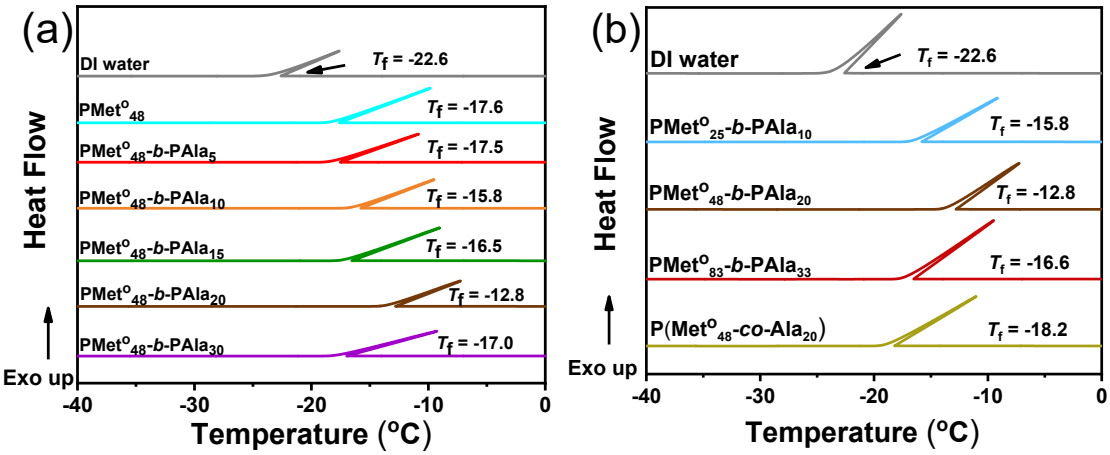


Fig. S8. DSC cooling thermograms of the MSACPs aqueous solutions at 130 mg/mL. Effect of the (a) composition and (b) molecular weight and structure on freezing point.

Fig. S9. Sucrose-assisted DIS assay images for 40 wt % sucrose solution. The scale bar is 100 µm.

Fig. S10. Images of 10 mg/mL PMet°$_{48}$-*b*-PAla$_{20}$ and PMet°$_{48}$-*b*-PAla$_{30}$ 40 wt % sucrose aqueous solutions.

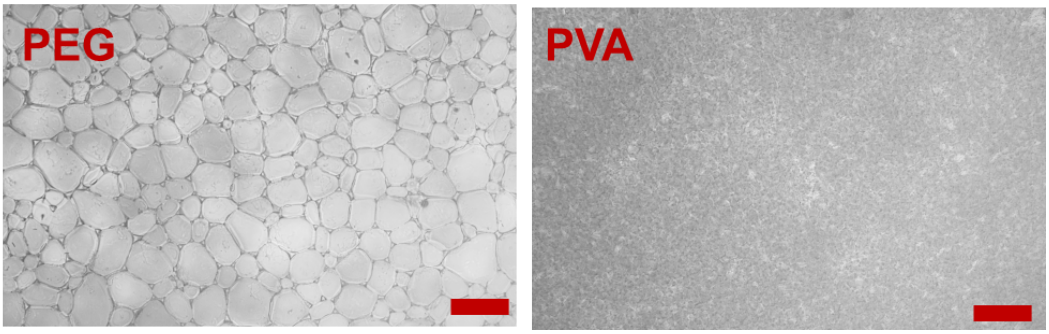


Fig. S11. Images of ice crystals formed from PEG and PVA solutions in PBS at 5 mg/mL.

Table S1 Percentages of each secondary structure in the MSACPs[a].

Polymer	α-Helix (%)	β-Sheet (%)	β-Turn (%)	Random coil (%)
$PMet^{o}_{48}$	0	0	0	100
$PMet^{o}_{48}$-*b*-$PAla_{5}$	0	0	30.3	69.7
$PMet^{o}_{48}$-*b*-$PAla_{10}$	0	45.1	7.4	47.5
$PMet^{o}_{48}$-*b*-$PAla_{15}$	14.1	38.7	3.9	43.3
$PMet^{o}_{48}$-*b*-$PAla_{20}$	14.4	40.5	2	43.1
$PMet^{o}_{48}$-*b*-$PAla_{30}$	14.7	48	1	36.3
$PMet^{o}_{25}$-*b*-$PAla_{10}$	19.5	46.6	1	32.9
$PMet^{o}_{83}$-*b*-$PAla_{33}$	8.6	47.3	0	44.1
P(Met^{o}_{48}-*co*-$PAla_{20}$)	0	30.8	7.1	62.1

[a] Calculated by the software jwstda and Spectra Manager after converting ellipticity to molar ellipticity [θ].