Supporting Information

A Rapid Recoverable Shape Memory Polymer with Topologically Well-controlled Poly(ethyl methacrylate) Structures

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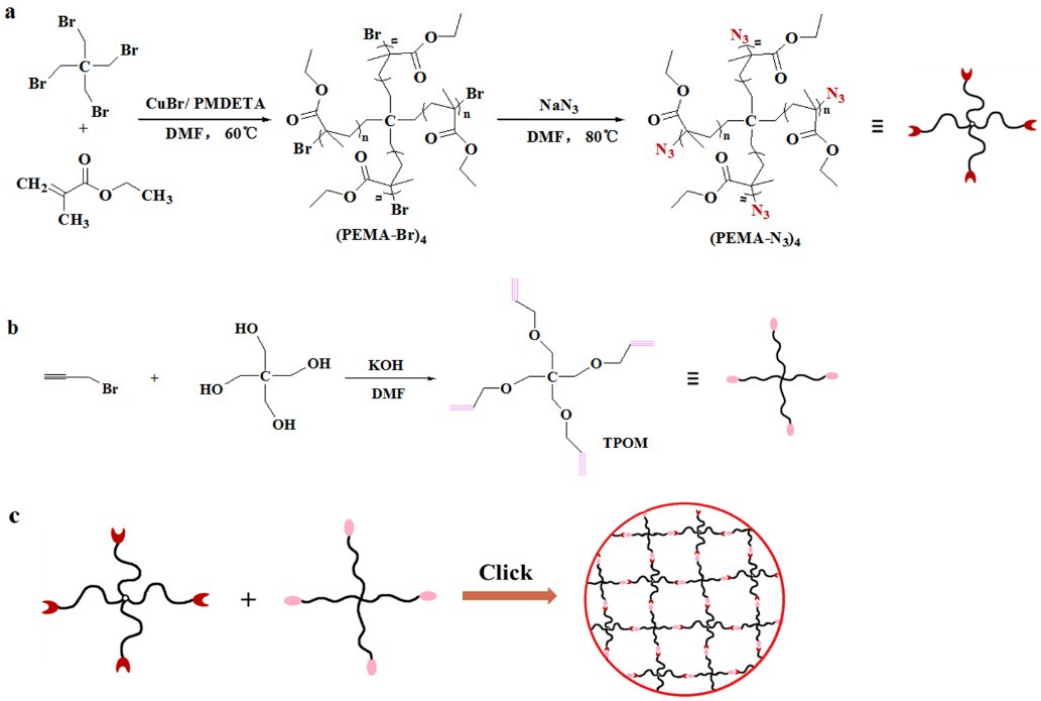

Figure S1. The specific synthesis route of well-controlled shape memory polymer $(PEMA)_4$-TPOM by ATRP and CuAAC reaction

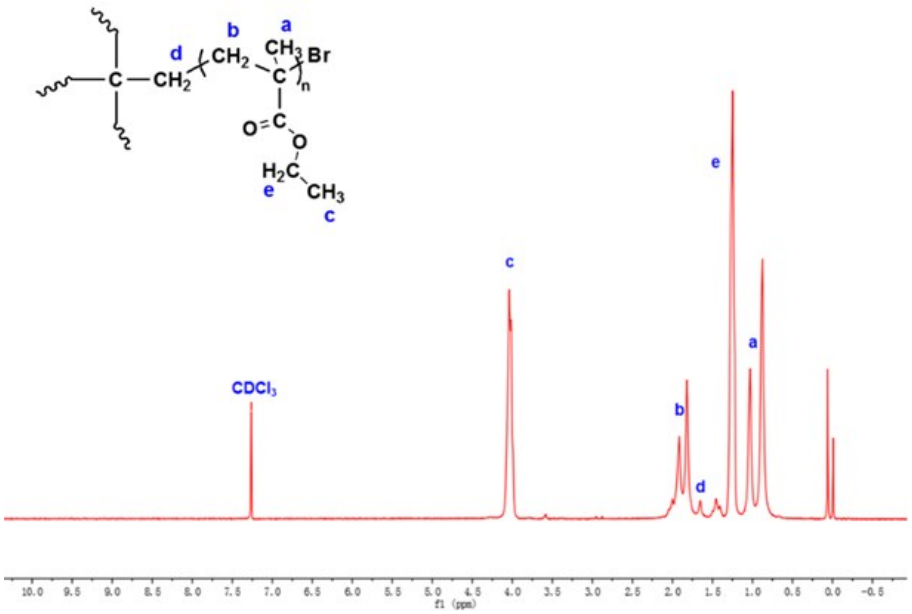

Figure S2. The ^{1}H-NMR of tetra-arm $(PEMA\text{-}Br)_4$

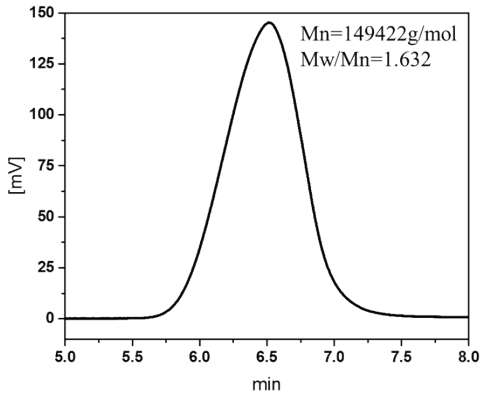

Figure S3. The GPC trace of well-controlled tetra-arm $(PEMA\text{-}Br)_4$ polymer monomer

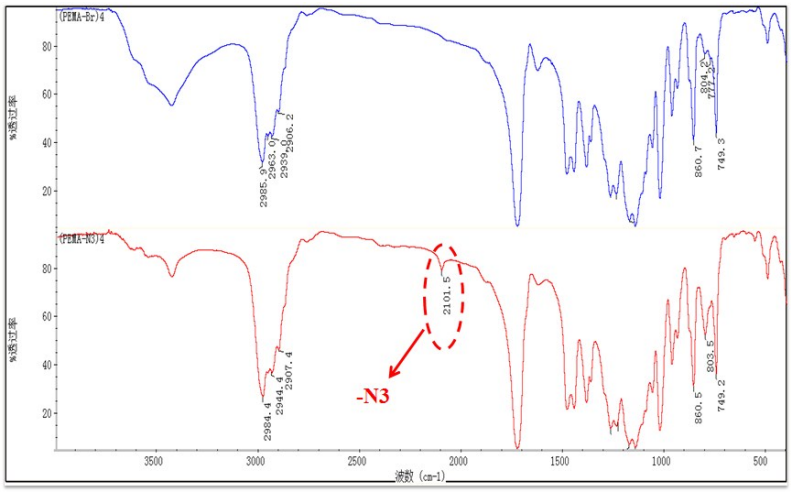

Figure S4. Compared with the FT-IR spectra of four arm $(PEMA\text{-}Br)_4$ before and after modification

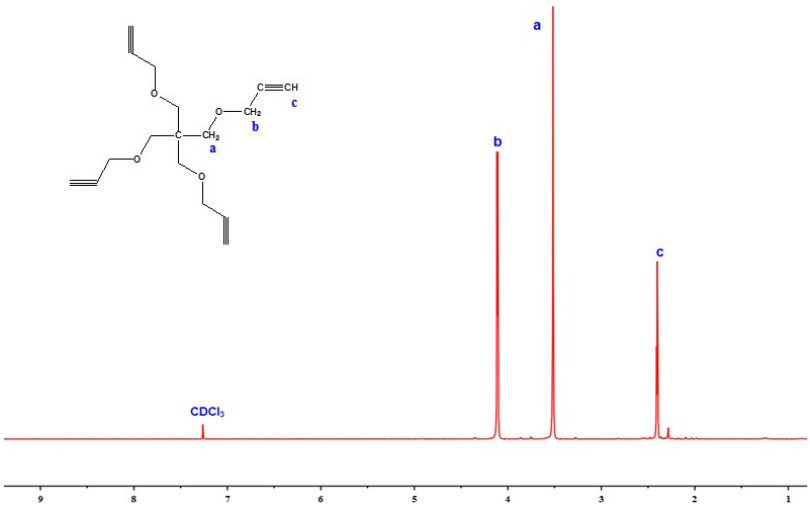

Figure S5. The ^1H NMR spectrum of TPOM

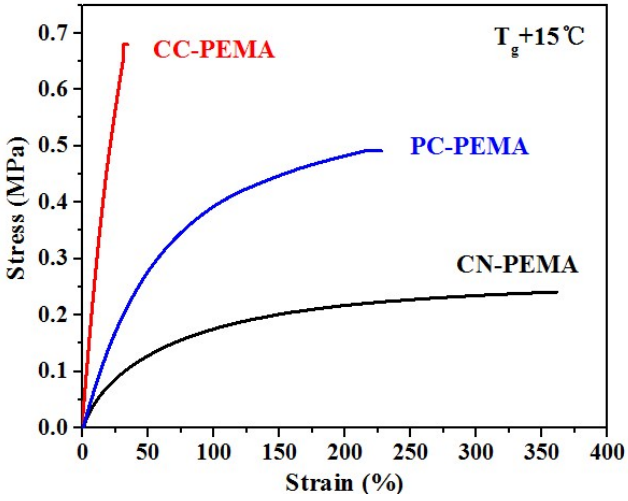

Figure S6. Tensile stress-strain curves obtained by DMA for CN-PEMA, CC-PEMA and PC-PEMA samples

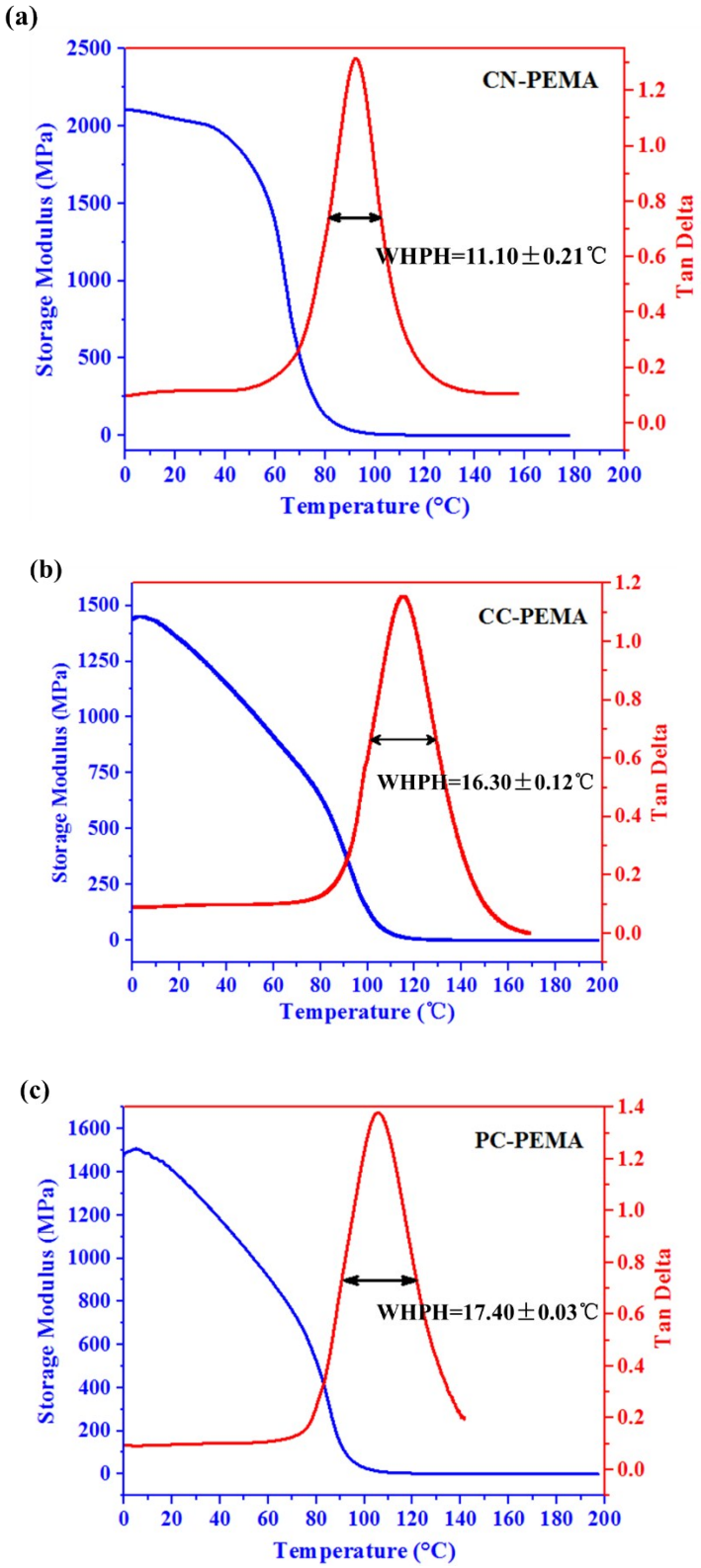

Figure S7. The storage modulus (E′) and loss angle (tan δ) for (a) CN-PEMA, (b) CC-PEMA and (c) PC-PEMA

Table S1. The WHPH and reference of various acrylate-based SMPs

Number	Polymer systems	WHPH(℃)	Reference
Copper(I)-catalyzed azide-alkyne cycloaddition network			
(a)	CN-PEMA-SMP	11.3	In this work
Conventional cross-linked networks			
(b)	CC-PEMA-SMP	16.4	In this work
(c)	PC-PEMA-SMP	17.4	In this work
AB copolymer networks			
(d)	MMA-co-PEGDMA	22.5-26.3	29
(e)	MMA-co-poly(ethylene glycol) dimethacrylate	34-38	30
(f)	PMMA-poly(ε-caprolactone) (40%) co-network	33	31
(g)	PMMA/poly(L-lactide) (50%)	24	32
Semi-IPNs			
(h)	PMMA/PEG (35%) semi-IPNs	28-32	30
(i)	Poly[MMA-co-(N-vinyl-2-pyrrolidone)]/PEG	31	33
(j)	PMMA/SPEG semi-IPNs	31-55	23
(k)	PMMA-PEG semi-IPN	38.5	34

Table S2. Measured shape memory property parameters from six shape memory cycles for CN-PEMA sample with the deformation strain of over 30% after removing heat history

Cycle	ε_n (%)	ε_m (%)	ε_u (%)	ε_p (%)	R_f (%)	R_r	V_r (%℃$^{-1}$)
1st	0.288	35.7	34.72	1.692	97.23	95.92	9.79
2nd	1.692	36.18	35.22	3.03	97.22	96.01	10.84
3rd	3.03	36.73	35.72	4.031	97.00	96.94	12.14
4th	4.031	36.62	35.71	4.705	97.21	97.87	12.44
5th	4.705	36.51	35.7	5.157	97.45	98.54	12.56
6th	5.157	36.44	35.7	5.626	97.63	98.46	12.58

Table S3. Measured shape memory property parameters from three shape memory cycles for CC-PEMA sample with the deformation strain of over 30% after removing heat history

Cycle	ε_n (%)	ε_m (%)	ε_u (%)	ε_p (%)	R_f (%)	R_r	V_r (%℃$^{-1}$)
1st	0.118	31.21	30.56	2.087	97.91	93.53	6.94
2nd	2.087	32	31.23	2.893	97.43	97.23	7.23
3rd	2.893	33.04	32.22	3.897	97.28	96.58	7.55

Table S4. Measured shape memory property parameters from three shape memory cycles for PC-PEMA sample with the deformation strain of over 30% after removing heat history

Cycle	ε_n (%)	ε_m (%)	ε_u (%)	ε_p (%)	R_f (%)	R_r	V_r (%℃$^{-1}$)
1st	0.393	34.94	31.57	1.681	90.25	95.87	5.55
2nd	1.681	34.65	31.58	2.972	90.69	95.68	5.62
3rd	2.972	34.84	31.65	4.16	89.99	95.86	5.86