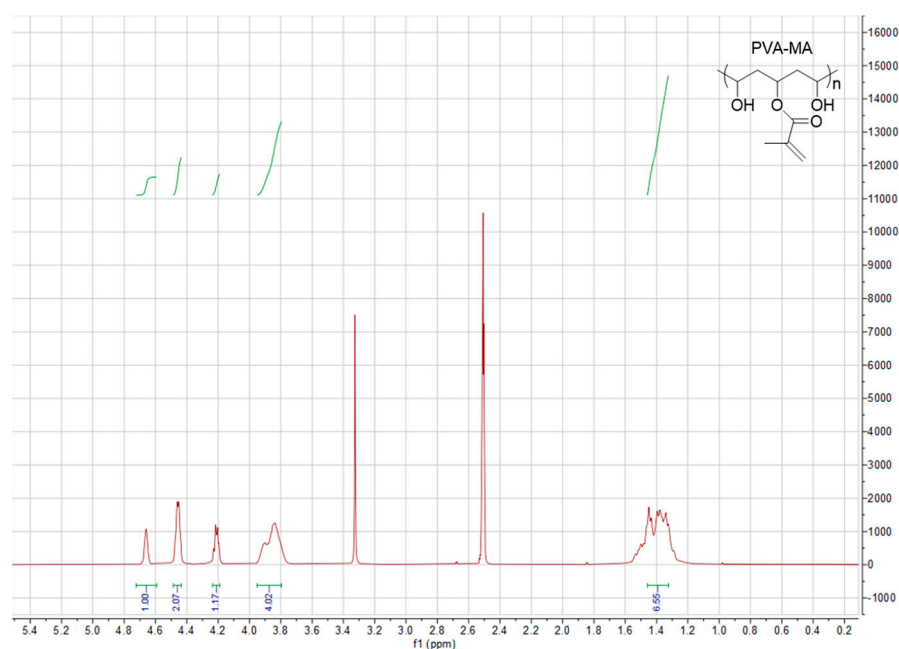


# Fabrication of Thermo-Responsive Controllable Shape-Changing Hydrogel

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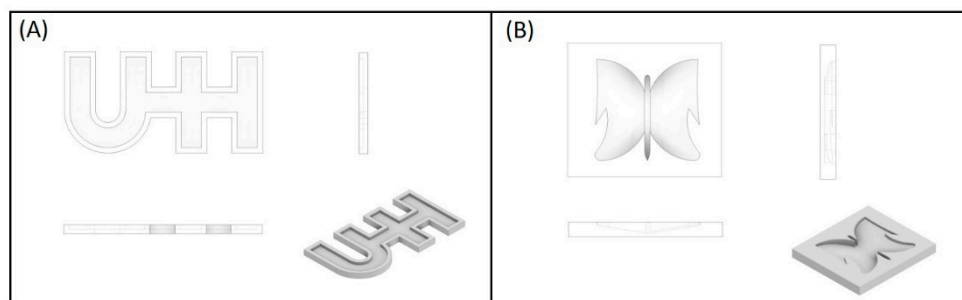
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**Figure S1.** NMR spectra of PVA-MA.

**Table S1.** Length (L), final length change (LC), and its linear rate constant ( $R_{LC}$ ) of PVA10/(PVA-MA)-g-PNIPAAm while cycling in 30 min, first 5 min, and first 10 min intervals between 25 °C and 50 °C in deionized water.

operation	all 30 min			first 5 min			first 10 min		
	L (%)	LC (%)	$R_{LC}$ (%/min)	L (%)	LC (%)	$R_{LC}$ (%/min)	L (%)	LC (%)	$R_{LC}$ (%/min)
heat 1	80,24	19,76	0,66	90,10	9,91	1,98	85,77	14,23	1,42
cool 1	87,82	7,58	0,25	81,89	1,64	0,33	83,40	3,16	0,32
heat 2	74,32	13,50	0,45	78,11	9,71	1,94	76,93	10,89	1,09
cool 2	84,71	10,39	0,35	77,80	3,48	0,70	82,75	8,43	0,84
heat 3	72,15	12,56	0,42	74,98	9,73	1,95	73,52	11,19	1,12
cool 3	83,54	11,39	0,38	75,45	3,31	0,66	78,68	6,54	0,65
heat 4	70,64	12,90	0,43	74,00	9,54	1,91	72,61	10,92	1,09
cool 4	81,84	11,21	0,37	74,82	4,19	0,84	77,68	7,05	0,70
heat 5	69,56	12,29	0,41	72,29	9,55	1,91	71,05	10,80	1,08
cool 5	79,87	10,32	0,34	72,59	3,04	0,61	74,97	5,41	0,54



**Figure S2.** Illustration of the 3d model. UHH logo (A) and Butterfly (B).