Supporting Information:

Spatially and Reversibly Actuating Soft Gel Structure by Harnessing Multimode Elastic Instabilities

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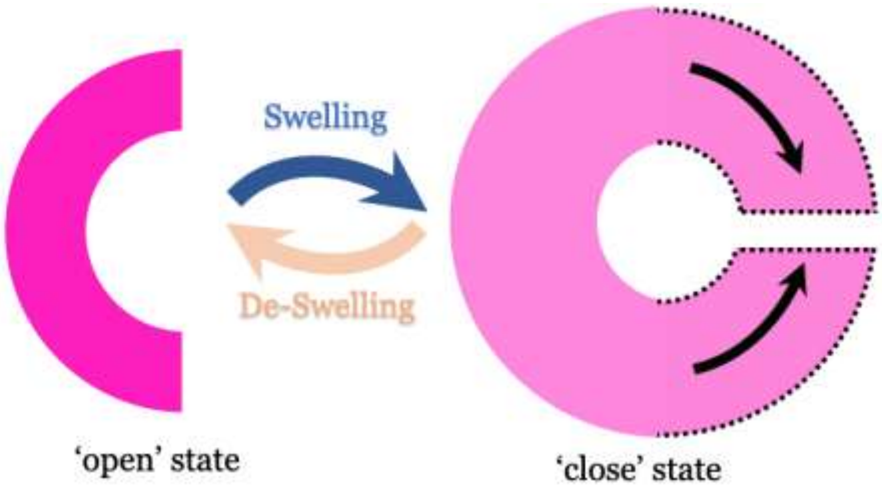

Figure S1. Schematic of reversible morphing of 'semi-cylinder shell' shaped gel part under swelling/de-swelling.

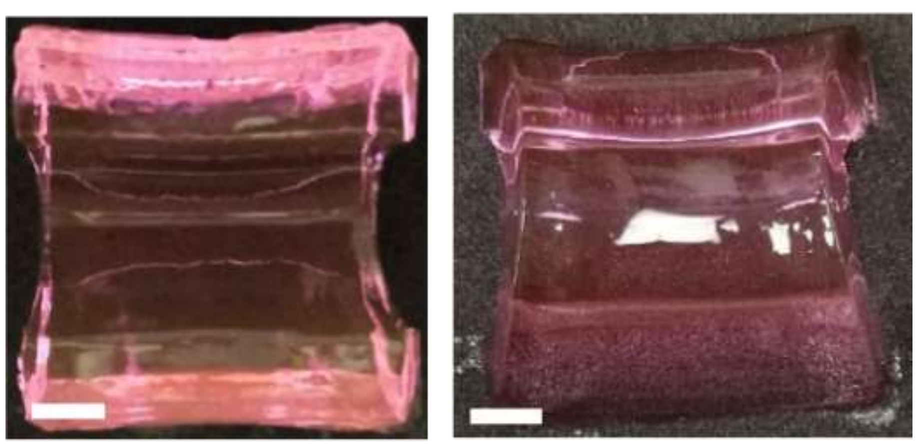

Figure S2. Final equilibrium state of gel structure at an immersion time of 240 min. Observations from the axial edges (left) and circumferential out surface (right). The scale bar is 5 mm.

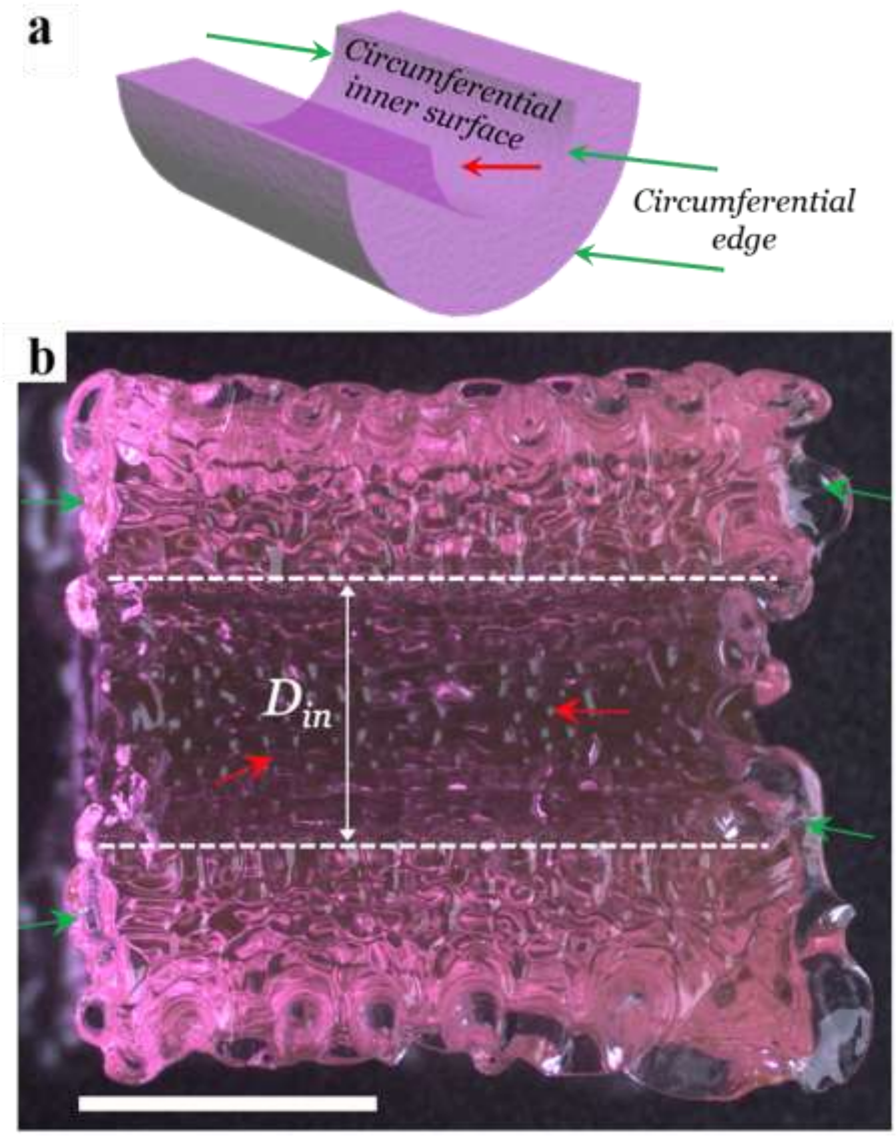

Figure S3. Buckling on circumferential edge and inner zone. (a) The schematic of the circumferential edge (green arrow) and the circumferential inner zone (red arrow). (b) Optical micrograph of gel structure swelling at 2 mins, the dash lines highlight the inner edge with a label D_{in}. The gel structure has initial D_{out}=L_0=10 mm, D_{in}=5 mm, θ=180°. The scale bar is 5 mm.

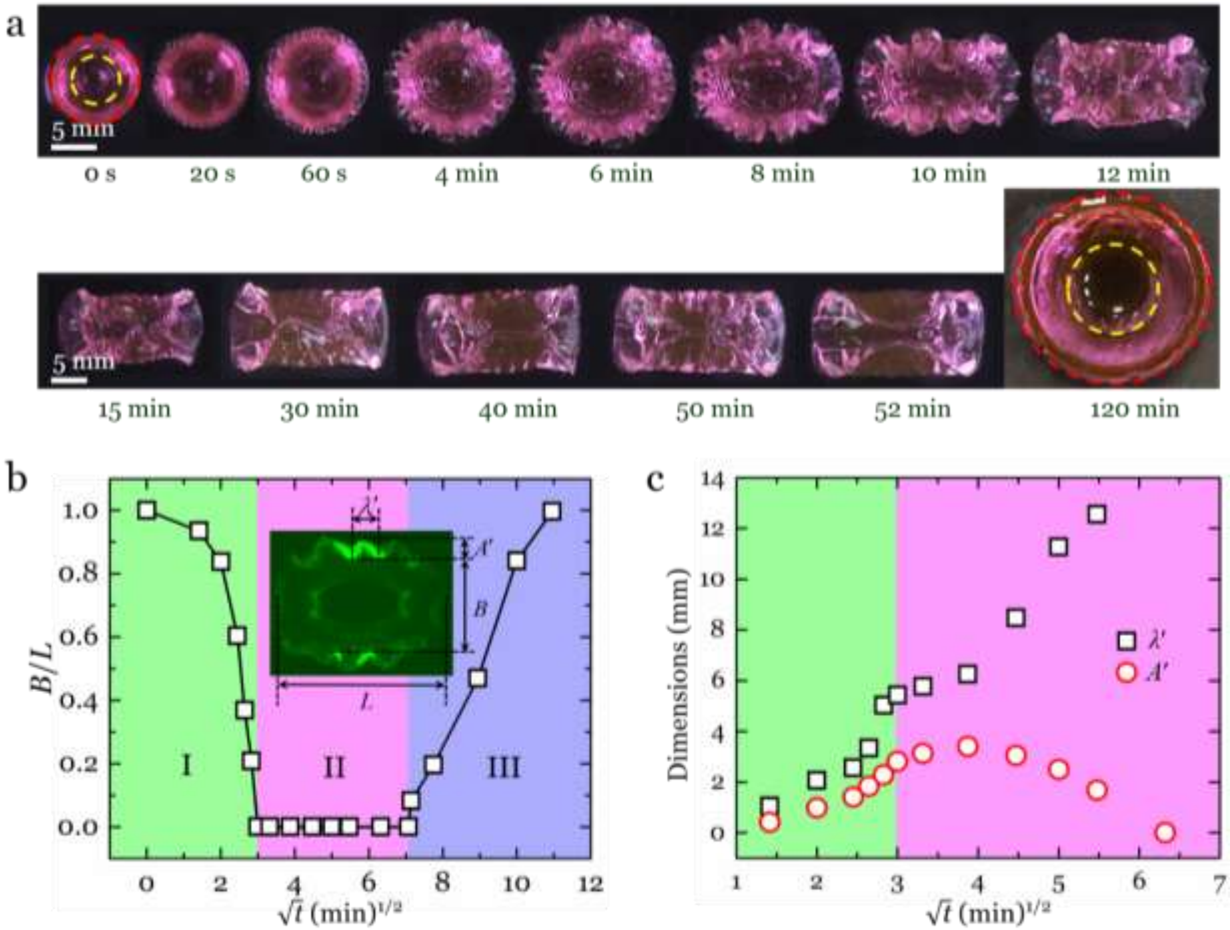

Figure S4. Swelling-induced mechanical instabilities of the hemispherical shell hydrogel. (a) The observations of morphologies at various time intervals of the hemispherical shell hydrogel under optical microscope. The analytical plots of time dependent evolutions of structure deformation during swelling: (b) B/L, where B refers to the gap distance between edges, L is defined as the structure length of swollen hydrogel, green area: I-closing regime, pink area: II-holding regime, purple area: III-reopening regime; (c) wavelength (λ') and amplitude (A') of buckling.

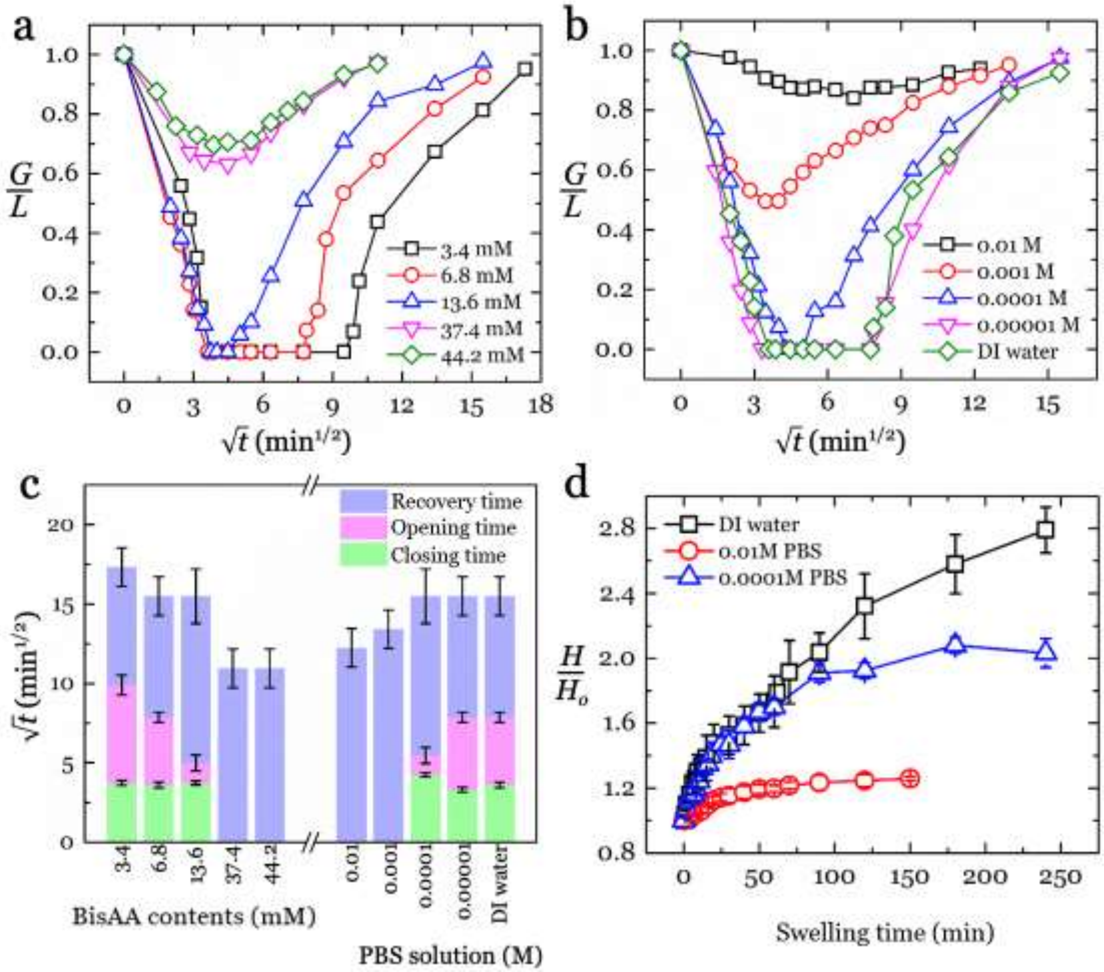

Figure S5. Spontaneous shape transformation of the gel structure controlled by the swelling ratio. Time evolution of the shape deformation of gel structure with initial D_{out}=L_0=10 mm, D_{in}=5 mm, θ=180°: (a) with different BisAA contents swelling in DI water, (b) swelling in PBS with different concentrations. (c) The influence of crosslinking and solution on shape deformation times of gel structure. (d) The swelling ratio as function of time in different PBS.

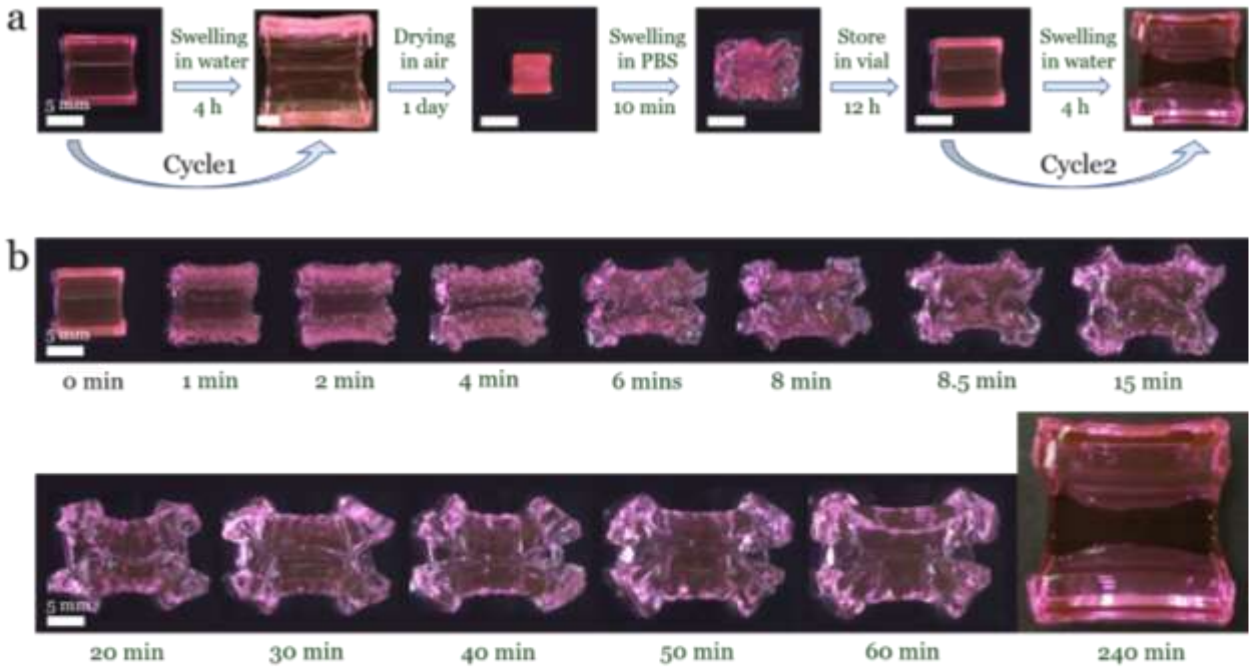

Figure S6. Reproducibility of the actuating gel structure. (a) The experiment design. (b) Time evolution of shape deformation of gel structure with initial D_{out}=L_0=10 mm, D_{in}=5 mm, θ=180° during cycle 2.

Supplementary Movie S1. Development of the wavy buckling profile on the axial edges by an optical microscope.

Supplementary Movie S2. Finite element analysis results.

Supplementary Movie S3. Demonstration of gripping strength using a designed hydrogel gripper to pick up a magnetic stirrer from water.