Supporting information

A Novel 3D-Printable Hydrogel with High Mechanical Strength and Shape Memory Property

Qiang Zhou, [a] Kaixiang Yang, [a] Jiaqing He, [a] Haiyang Yang * and Xingyuan Zhang*

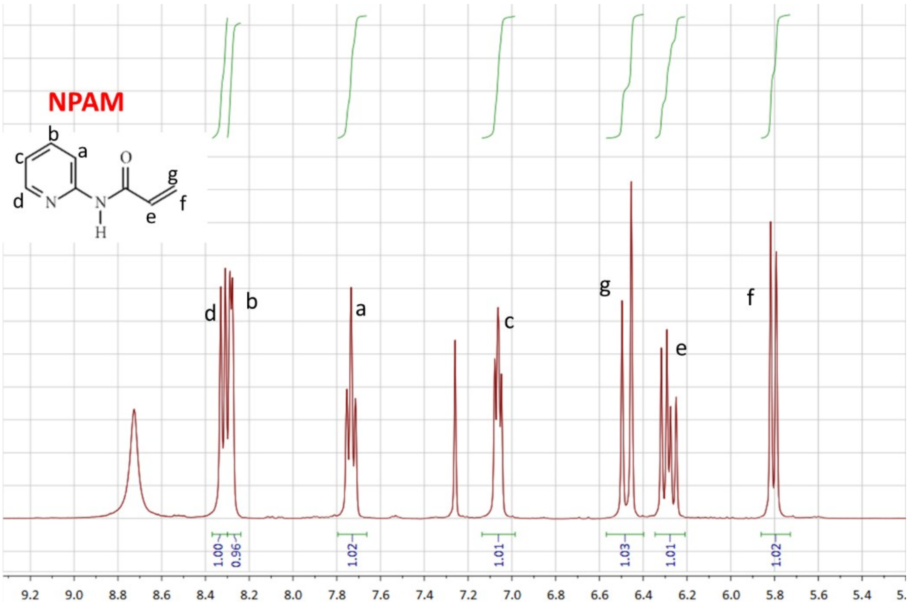

Figure S1. 1H NMR spectrum of the monomer NPAM

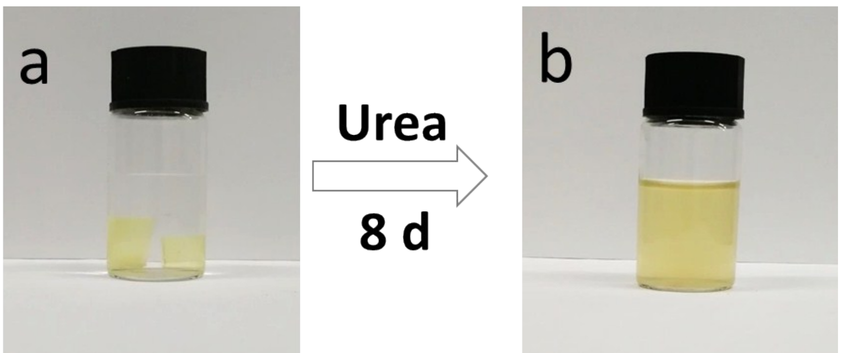

Figure S2. (a) MN_6 hydrogel immersed in 5 M urea solution; (b) after stirring at room temperature for 8 days, the hydrogel sample completely dissolved.

Figure S3. Digital photographs of aqueous solutions: (a) 1 M NPAM transparent solution; (b) after the addition of an equimolar amount of MAAc, a phase separation occurred; (c) after the addition of urea to panel (b), the mixture turned into transparent.

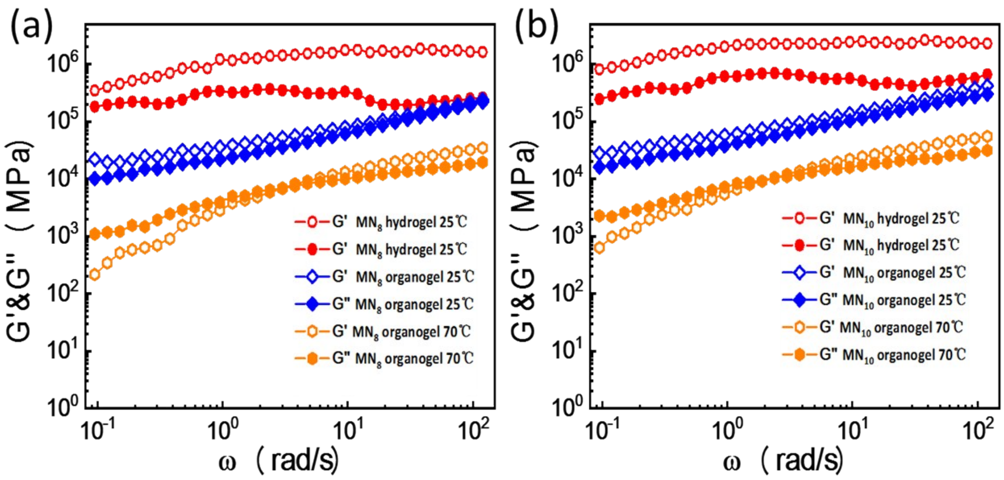

Figure S4.(a)Viscoelastic behavior curve of the MN_8 gels and (b) MN_{10} gels in the frequency sweep at different temperature, γ = 0.5%.

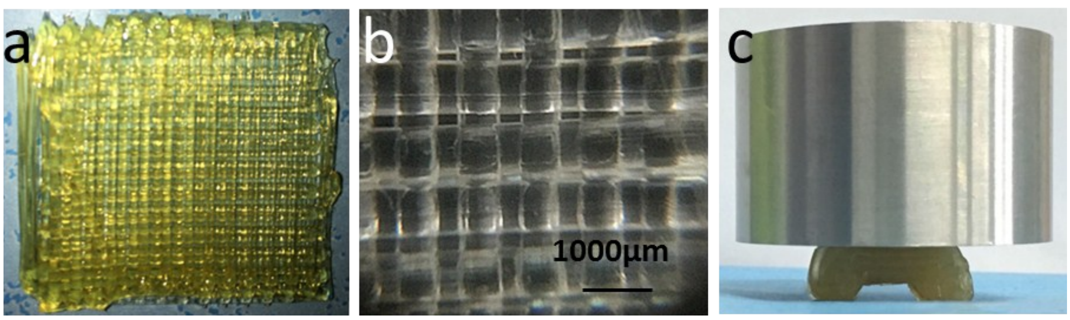

Figure S5. (a) Top view of a 4-layer grid of MN_6 organogel. (b) The microscopic image of the MN_6 organogel after 40 times magnification. (c) 3D–printed MN_6 hydrogel with arch bridge shape bears a steel block of 1 kg in weight.

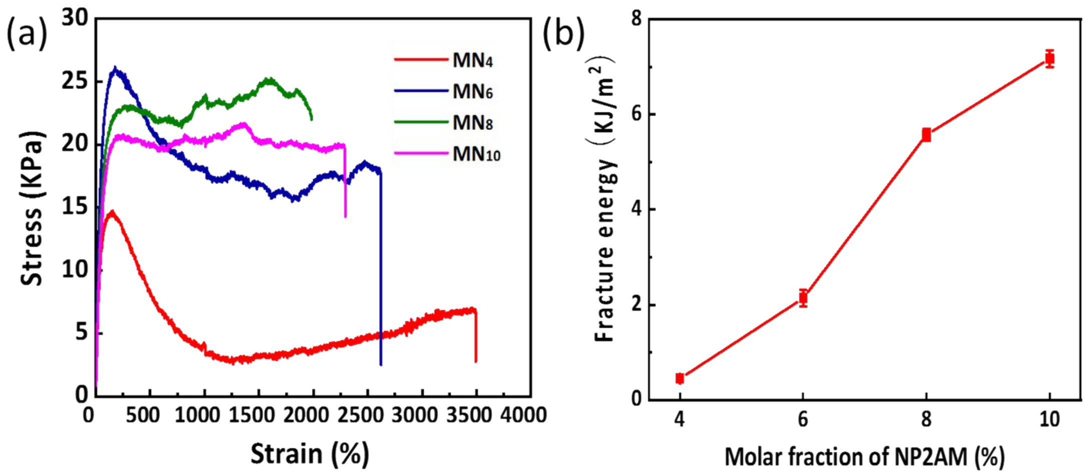

Figure S6. (a) Tensile stress-strain curve of MN_4, MN_6, MN_8 and MN_{10} organogels. (b) Fracture energy of MN_4, MN_6, MN_8 and MN_{10} hydrogels.

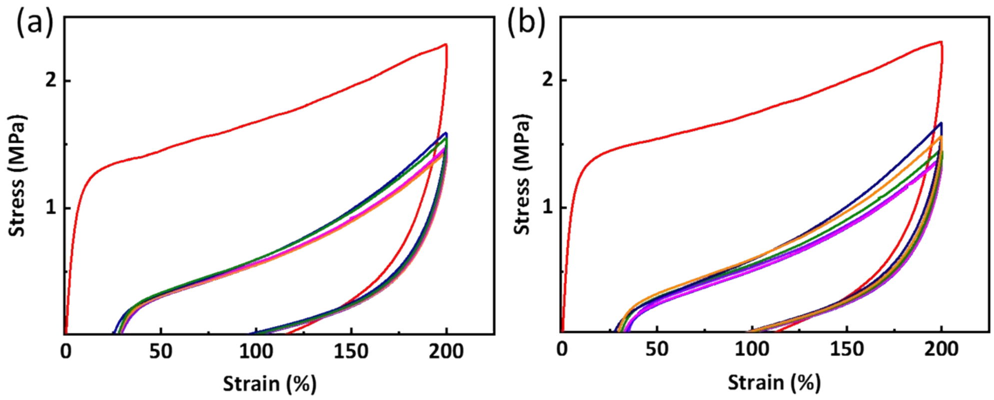

Figure S7. (a)MN_6 hydrogel for the first time and (b) 12 h after room temperature recovery eight consecutive cycles of stretching-recovery curve at 200% strain.

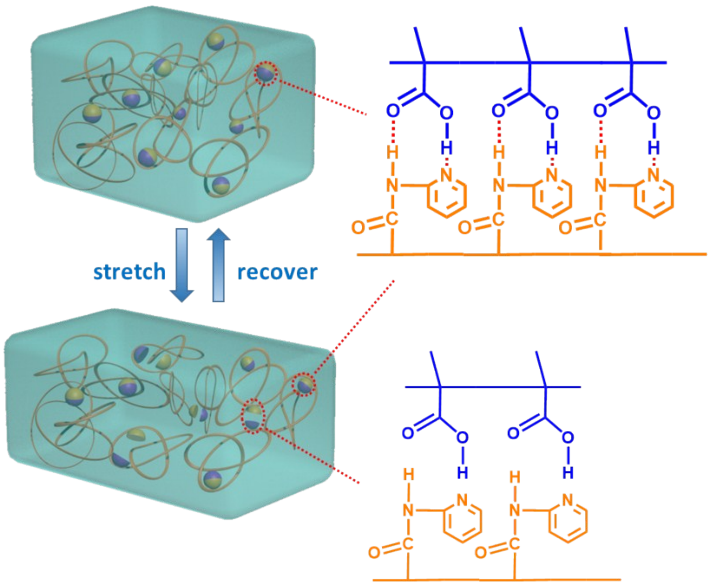

Figure S8. The energy dissipation mechanism of poly (MAAc-co-NPAM) hydrogels

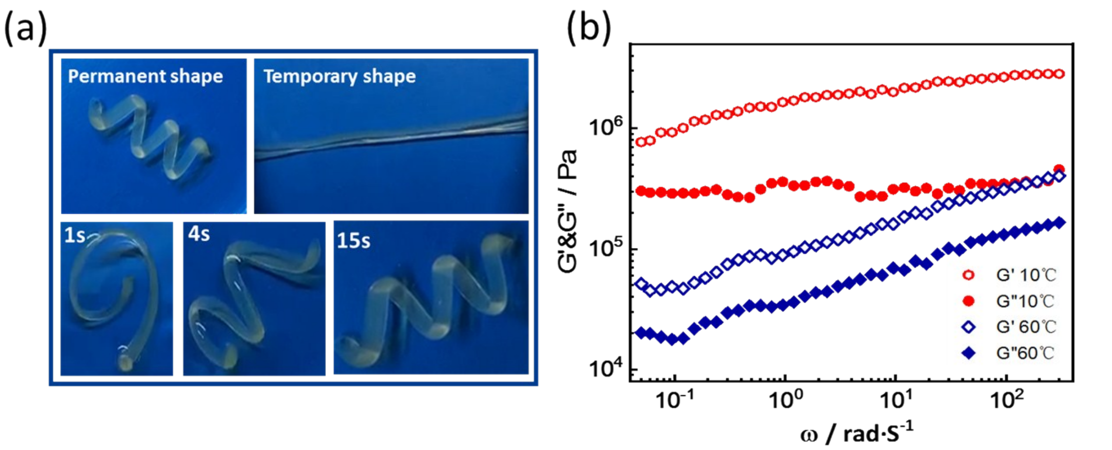

Figure S9. (a)Temperature-induced shape memory performance with spiral shape. (b)Frequency sweep of MN_6 hydrogel at different temperatures (10, 60 ^oC) γ = 0.5%, ω = 6.2 rad·s^{-1}.

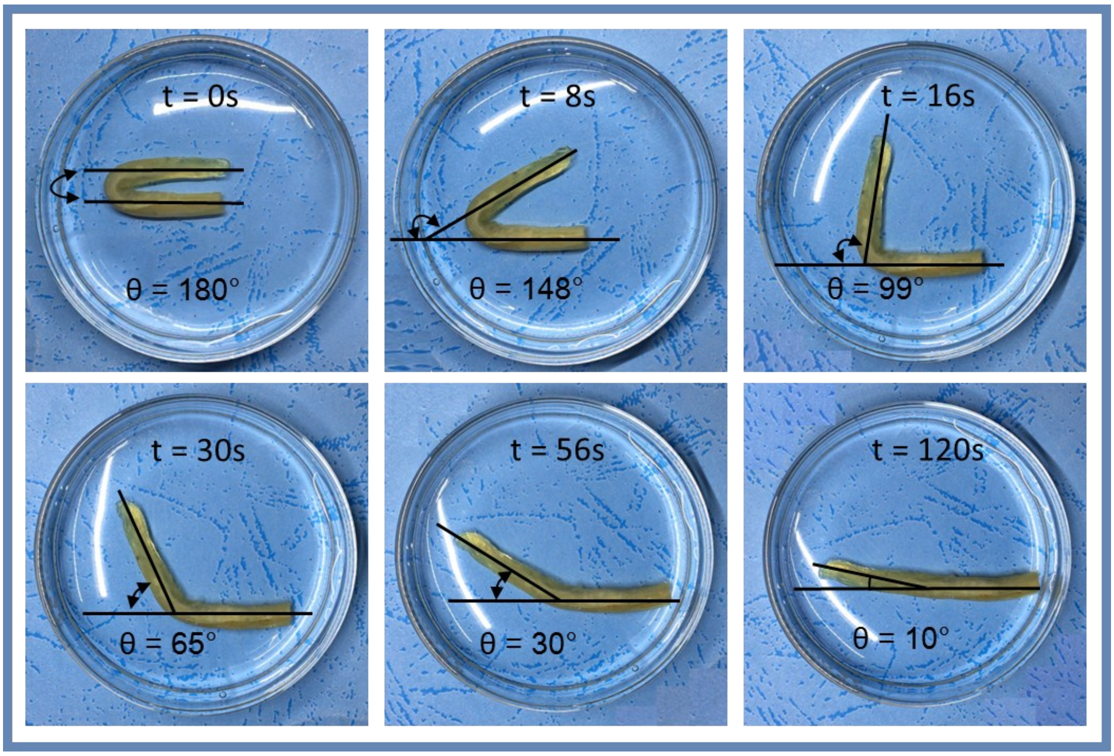

Figure S10. Images demonstrating the transition from the temporary shape to the permanent shape for the temperature-activated SME. The recovery takes about 120 s after immerse in deionized water at 60℃. The given angle is 180°and the final angle is 10°.

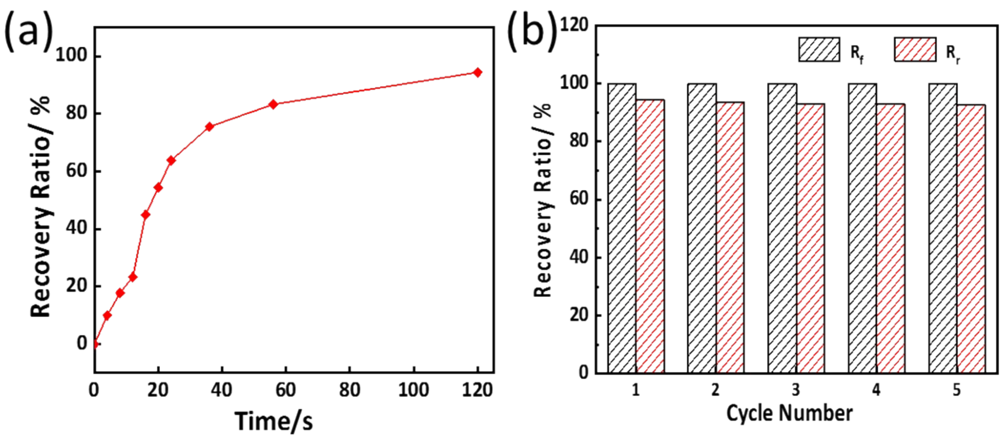

Figure S11. (a) Shape recovery ratio (Rr) for the temperature-activated SME shown as a function of time at 60 ℃; (b) evaluation of the temperature-activated shape memory cycles at 60 ℃.

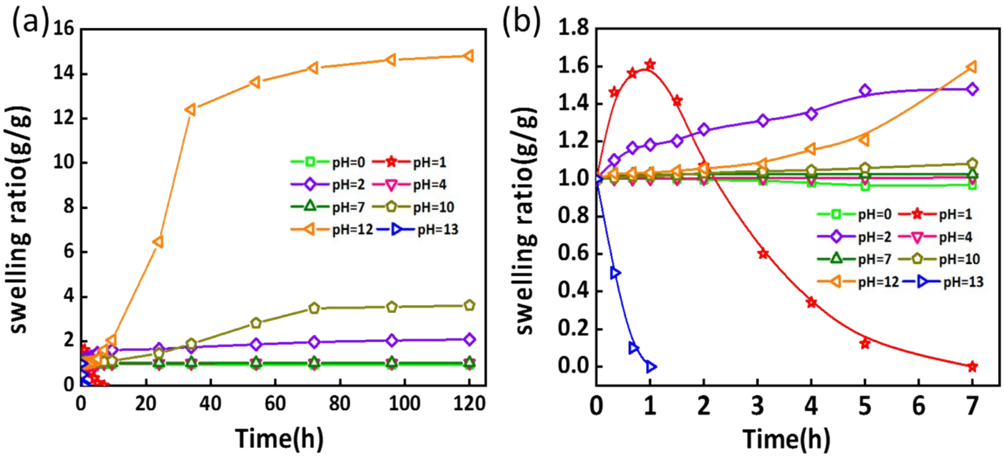

Figure S12. (a)Time dependence of the swelling ratios for the MN_6 hydrogels swelled in different pH solutions within 120h. (b) Time dependence of the swelling ratios for the MN_6 hydrogels swelled in different pH solutions within 7h.

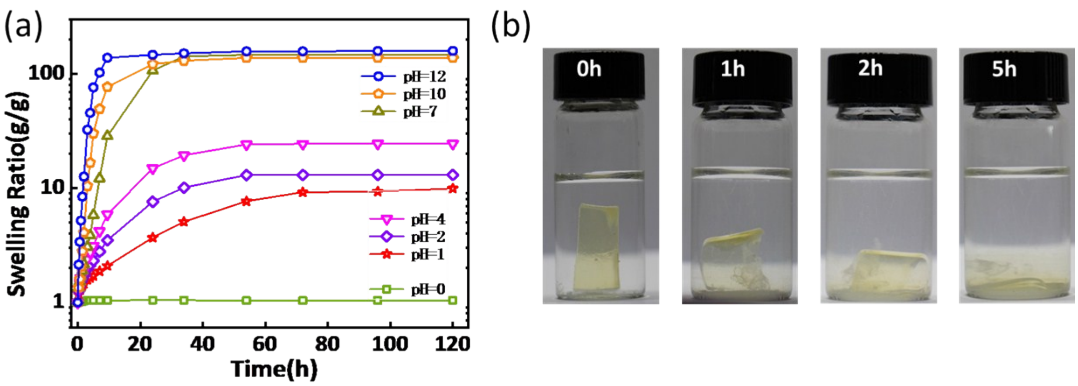

Figure S13. (a) Time dependence of the swelling ratios for the PMAAc hydrogels swelled in different pH solutions within 120h. (b) Time dependence of the swelling ratios for the MN_6 hydrogels swelled in pH=1 solutions.