Electronic Supplementary Material (ESI) for Soft Matter.

Supporting information

Tough, Rapid-Recovery Composite Hydrogel Fabricated Using Synergic Core–Shell Microgel Covalent Bonding and Fe^{3+} Coordination Cross-Linking

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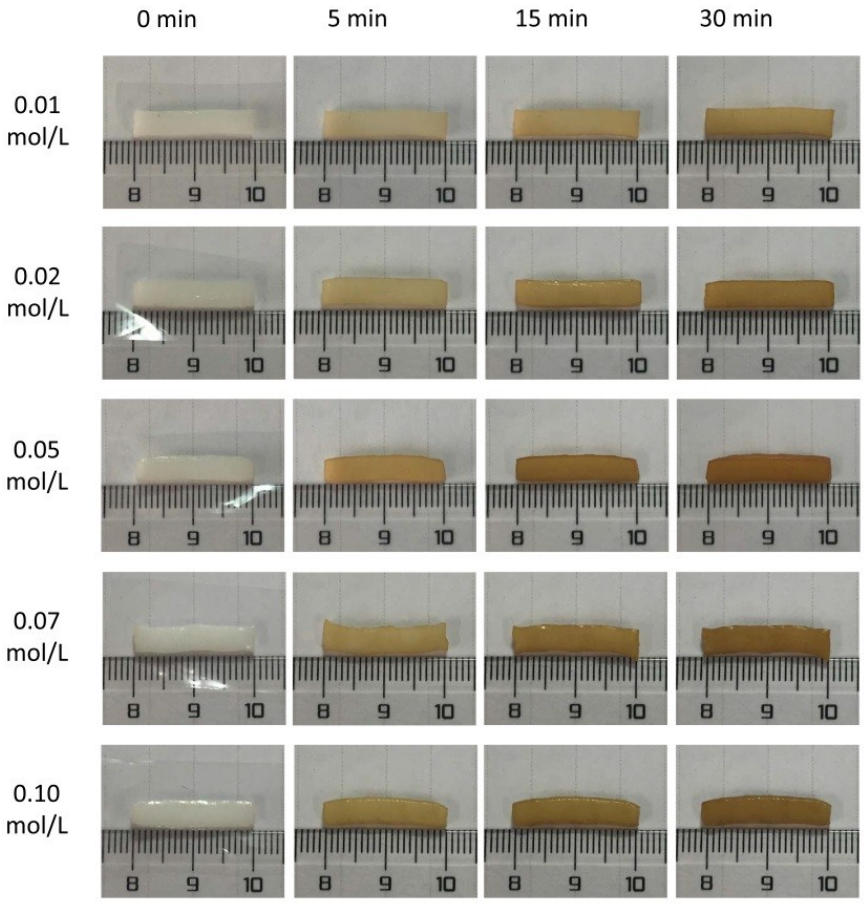

Fig. S1 The photographs of hydrogels immersed in various concentrations of $FeCl_3$ within 30 min. The size of each photograph is 2.5 cm × 3.0 cm.

Table S1 The polymer volume fractions of hydrogels immersed into 0.05 mol/L $FeCl_3$ solution.

Soaking time / $C_{(Fe^{3+})}$	0 min v/v%	5 min v/v%	15 min v/v%	30 min v/v%	1 h v/v%	2 h v/v%	3 h v/v%	6 h v/v%	18 h v/v%
0.05 mol/L	25.32	25.08	24.67	23.83	21.08	20.33	19.57	19.51	19.45

The polymer volume fractions were calculated by V_{dry}/V, where V_{dry} was the volume of dry hydrogel, and V was the volume of hydrogel before dying. The volumes were measured by displacement method, and the solvent was n-hexane.

Table S2 The polymer volume fractions of hydrogels immersed into various concentrations of $FeCl_3$ solution within 30 min.

$C_{(Fe^{3+})}$	polymer volume fraction, v/v%
0.01 mol/L	24.07
0.02 mol/L	23.67
0.05 mol/L	23.83
0.07 mol/L	23.90
0.10 mol/L	23.81

Table S3 The polymer volume fractions of hydrogels with various AAm/AAc molar ratios and monomer contents. (0.05 mol/L $FeCl_3$, 30 min)

Name	polymer volume fraction, v/v%	Name	polymer volume fraction, v/v%
H-15-(93/7)	25.32	Fe^{3+}-H-15-(93/7)	23.83
H-15-(86/14)	26.08	Fe^{3+}-H-15-(86/14)	24.15
H-15-(79/21)	25.75	Fe^{3+}-H-15-(79/21)	23.48
H-10-(93/7)	24.02	Fe^{3+}-H-10-(93/7)	21.71
H-20-(93/7)	27.37	Fe^{3+}-H-20-(93/7)	25.67
MBA (0.1 mol%)	25.03	Fe^{3+}-MBA (0.1 mol%)	22.05

Table S4 The polymer volume fractions of hydrogels immersed into EDTA-2Na/urea solution.

Solvent	polymer volume fraction, v/v%
H_2O	16.05
0.01 M EDTA-2Na	16.64
0.02 M EDTA-2Na	16.29
0.05 M EDTA-2Na	15.84
0.5 M $CO(NH_2)_2$	16.88

The swelling ratios of hydrogel samples were fixed at 1.5 times.

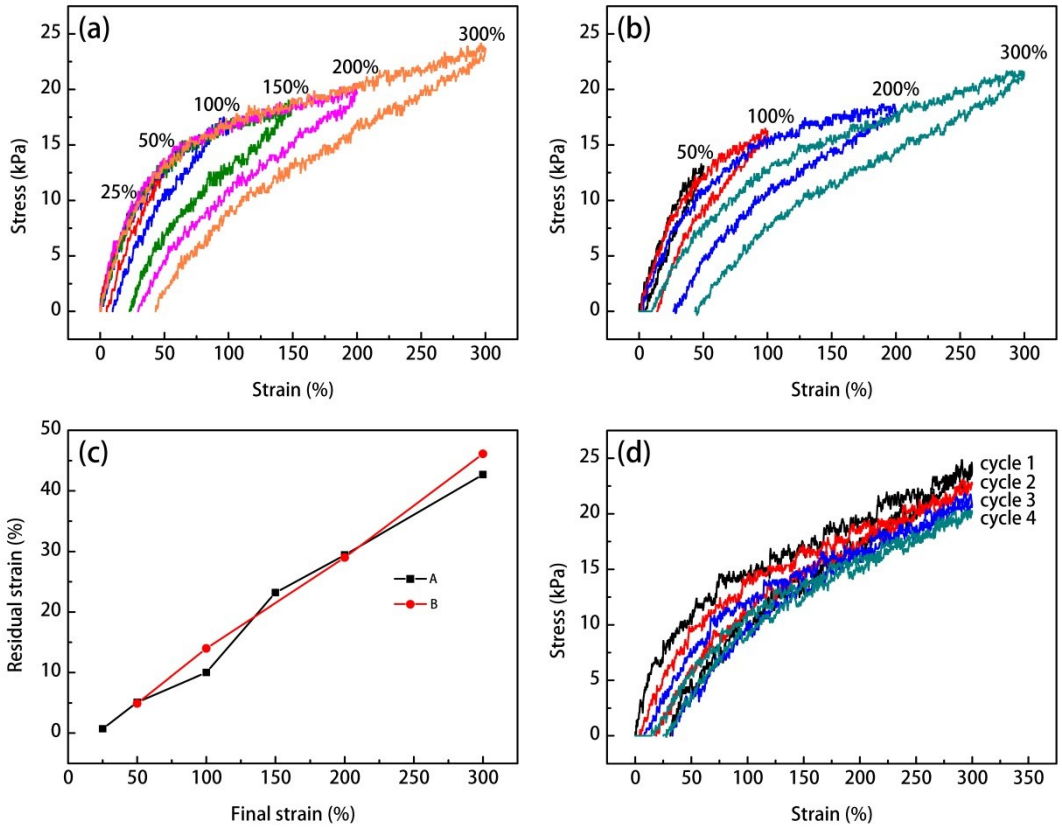

Fig. S2 Cyclic loading–unloading of H-15-(93/7) hydrogel under various conditions: (a) tensile loading–unloading under different strains (25%, 50%, 100%, 150%, 200%, 300%), (b) continuous cyclic tensile tests under incremental strain (50%, 100%, 200%, 300%), (c) the residual strain vs. final strain of Fig. S2a (A) and of Fig. S2b (B), (d) four successive cyclic tensile tests under a strain of 300%.