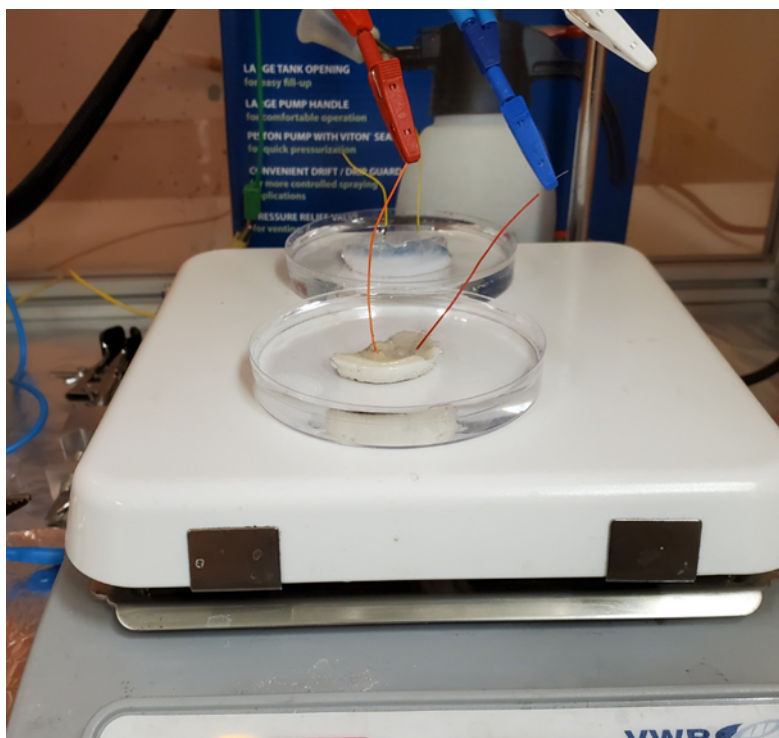
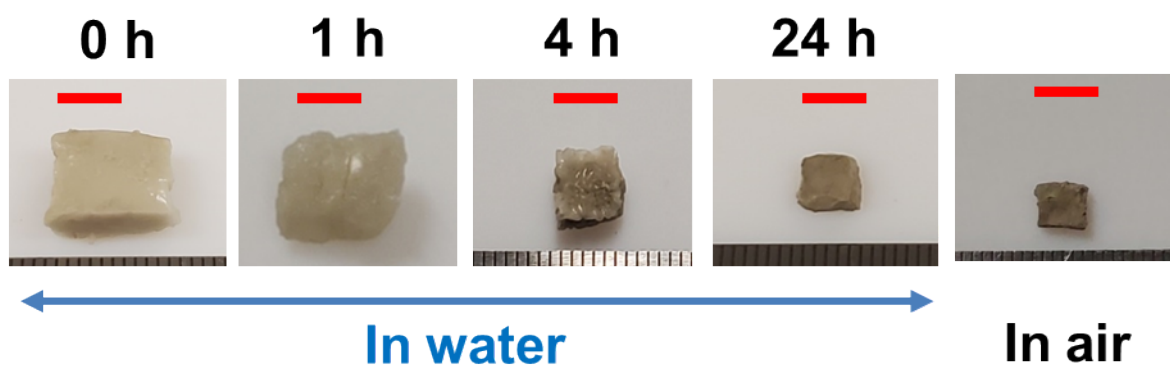


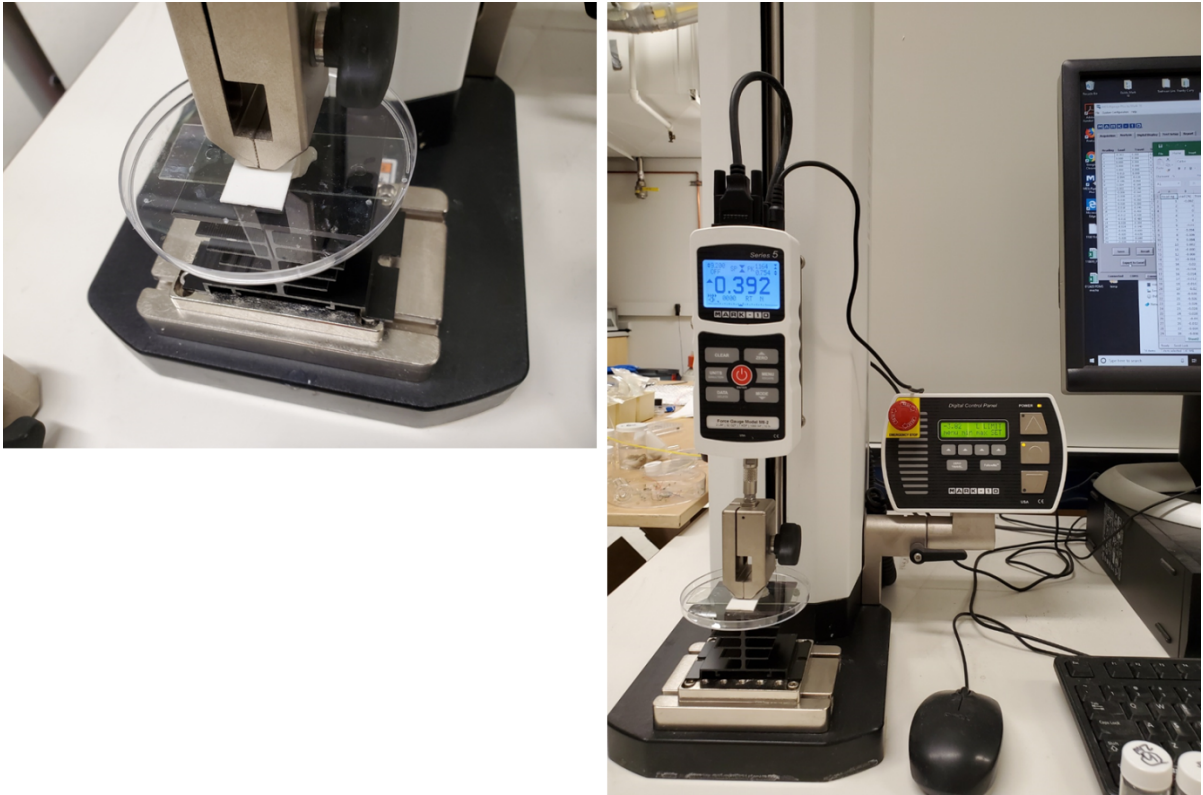
**Fig. S1** (a) Image of the setup to measure electrical conductivity by two-plane method that was suggested in previous study [45]. (b) SEM BSE of dehydrated Ag-PNIPAM; cross-section was obtained by cutting after cryo-fixation (under liquid nitrogen). (c) SEM BSE of magnified cross-section (b); The image demonstrated non-homogeneity of the Ag-PNIPAM composition after shrunk. This is a major clue why we exclude the two-plane method to measure electrical conductivity change. (d) Conductivity measurement result by two-plane method; it is hard to confirm the change with volume switches.



**Fig. S2** Image of the setup to measure electrical conductivity by CV method, which was suggested in the previous study [48].



**Fig. S3** Images of Ag-PNIPAM hydrogel with heating times. Scale bar represents 5 mm.



**Fig. S4** Images of the setup to measure elastic properties of fully expanded Ag-PNIPAM hydrogels.