Supporting Information

Stretchable strain sensor of composite hydrogels with high fatigue resistance and low hysteresis

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Movie S1: The composite hydrogel strain sensor is used to monitor the beating of a porcine heart *in vitro*. We use the portable pulsatile pump to generate pulsatile flow of water and connect it to the porcine heart. Water flows in the anterior vena cava, generates a pulsatile systole/ diastole of the heart, and flows out from the pulmonary artery. The inflow and outflow of water induce the heart to beat for 500 cycles (elapsed time, 1000s) at a frequency of 0.5Hz. The composite hydrogel strain sensor is attached to the heart to obtain the beating signal. The resistance changes accordingly and stably with the beating of the heart.

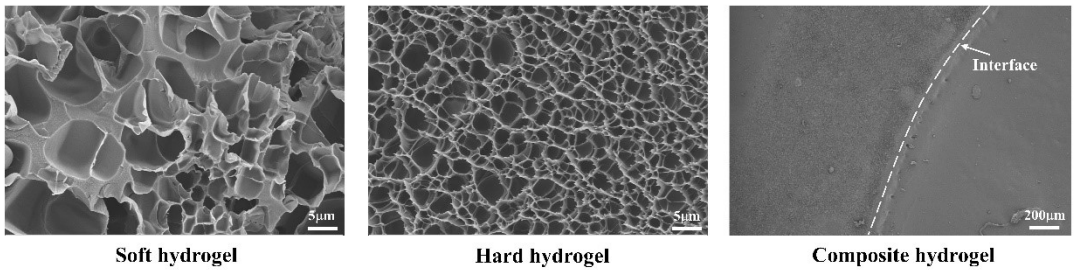

Figure S1. SEM images of the freeze-dried soft hydrogel, hard hydrogel and composite hydrogel.

Table S1. Comparison of the composite hydrogel in this work with previously reported hydrogels or elastomers.

Refs.	Materials	Stretch λ	Hysteresis
This work	**Composite hydrogel**	**3.0**	**＜3%**
[35]	PNDU-CNF@$CNT_{1\%}$ hydrogel	2.5	~38.6%
[34]	P(AM3−$APBA_{0.06}$) $NaCl_{1.72}$ hydrogel	3.0	~10%
		4.0	~10%
[33]	PAAFC-L hydrogel	3.0	~30%
[36]	P(AAm-co-MAAc) hydrogel	2.0	~32%
[37]	PAM/PF127 hydrogel	1.3	~15%
		1.5	~17%
		1.7	~21%
[26]	PDMS composite	1.5	~4%
		1.8	~5%
[38]	2D PVA/GO hydrogel	1.8	~32%
[39]	Alginate-polyacrylamide	1.2	~20%
[40]	PAAm-PVA hydrogel	1.4	~39.6%
[41]	PAMPS/PAAm DN hydrogel	1.5	~22.8%
		1.65	~46%
		1.8	~56.8%

Table S2. Comparison of the composite hydrogel strain sensor in this work with previously reported flexible sensors.

Refs.	Materials	Strain ε	Hysteresis
This work	**Composite hydrogel**	**2.0**	**＜3%**
[42]	Lattice-structure PIFS	0.7	~2.4%
[43]	AuNWs/latex	2.0	~25.8%
[44]	AgNWs/PDMS	0.6	~47.2%
[45]	AgNW/PDMS	0.5	~2.7%
[46]	G-PDMS/RGO	1.0	~47.3%
[47]	AgNWs/PDMS	0.6	~30%
[48]	PEDOT:PSS/hydrogel	0.8	~39.1%
[49]	PEDOT:PSS/PDMS	0.1	5.4%
		0.2	2.2%
		0.3	9%