Supporting Information

Sustainable Castor Oil-derived Cross-linked Poly(ester-urethane) Elastomeric Films for Stretchable Transparent Conductive Electrodes and Heaters

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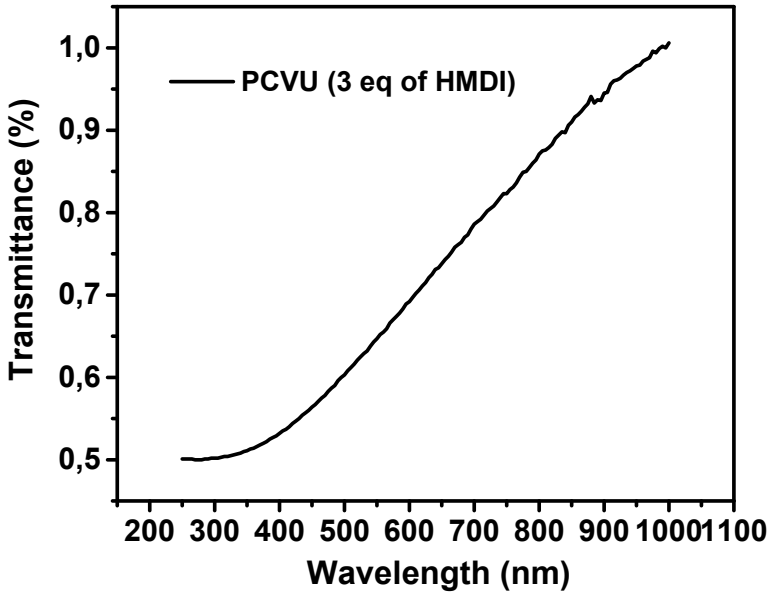

Fig. S1 Transmittance profile of PCVU elastomer that prepared using prepolymer and HMDI in 1:3 molar ratios.

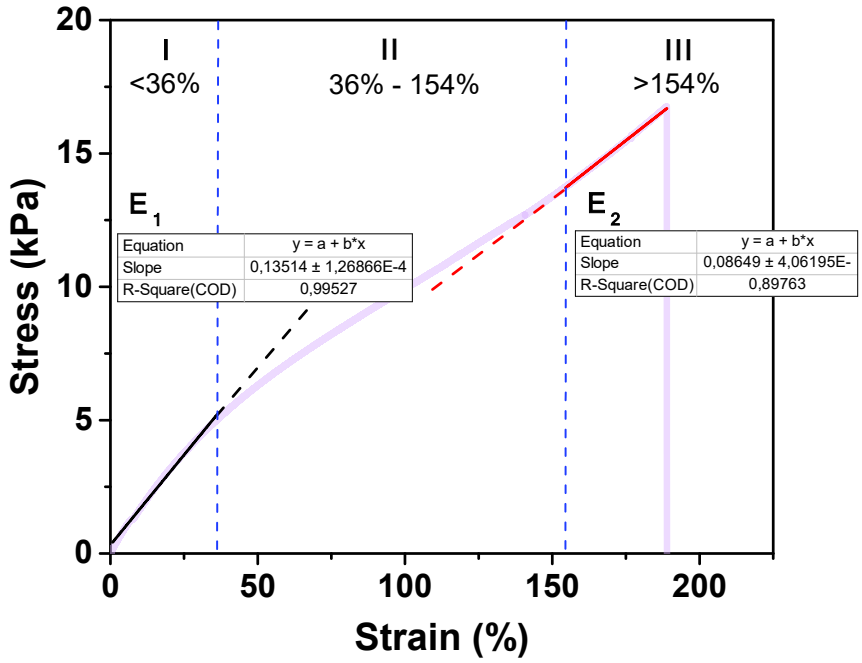

Fig. S2 Elastic moduli calculation using two linear fits at E1 and E2 regions in the stress-strain curve of PCVU elastomer.

Table S1. Weight change of PCVU substrate exposed in different organic solvents over time.

Test time (h)	Weight of PCVU after exposing in different organic solvents (mg)				
	Methanol	Ethanol	Isopropanol	Dichloromethane	Dimethylformamide
0h (no solvent exposure)	135,3	93,0	72,4	47,4	107,1
1h	135,4	96,9	74,3	47,7	108,9
2h	134,3	96,9	72,2	47,0	108,2
5h	133,6	93,9	71,3	47,1	107,2
19h	132,6	92,2	71,2	47,1	106,2
24h	133,0	94,01	71,1	46,5	107,1

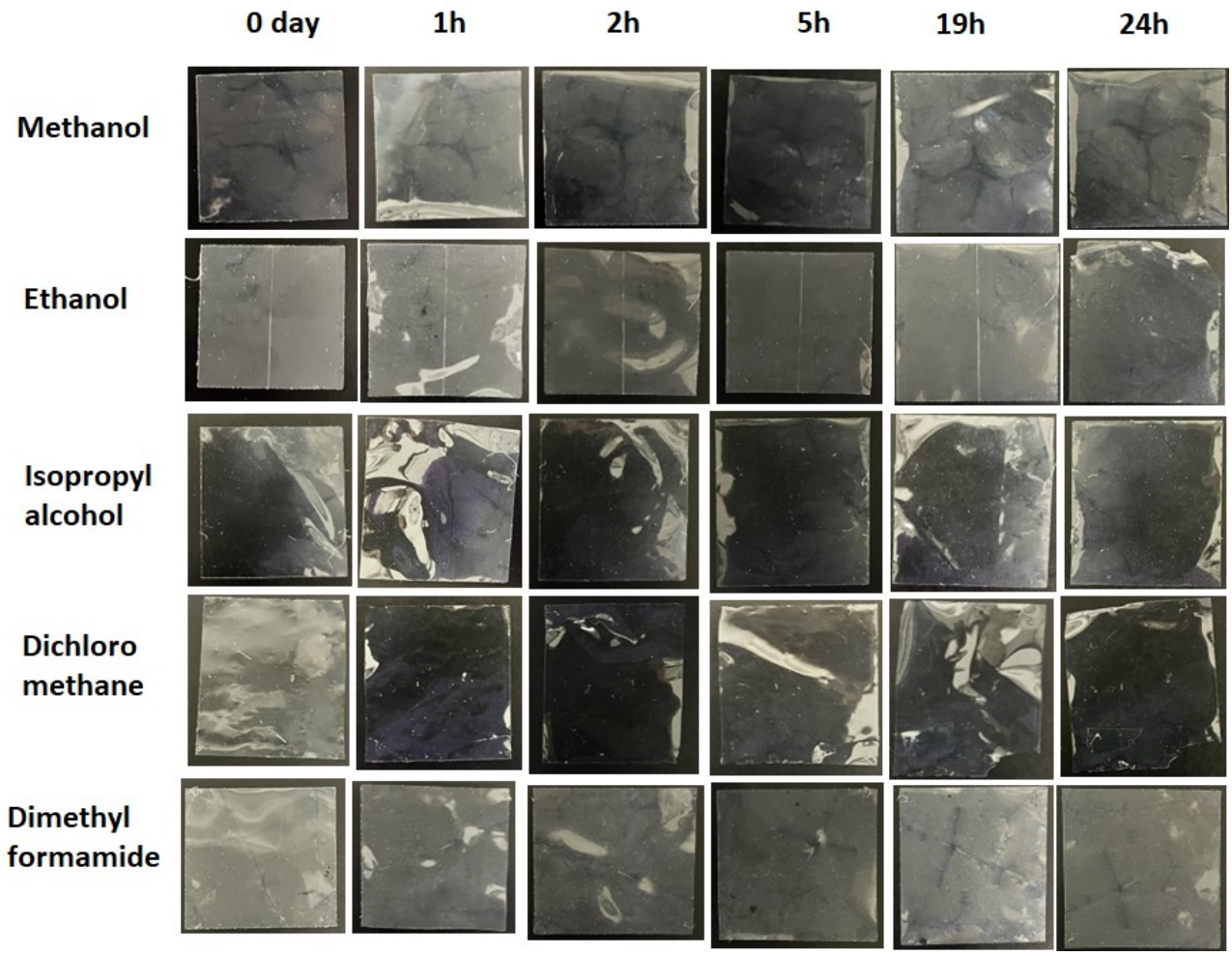

Fig. S3 Camera images PCVU substrates underwent exposure in different organic solvents (methanol, ethanol, isopropanol, dichloromethane and dimethylformamide) over time (1h, 2h, 5h, 19h, and 24h).

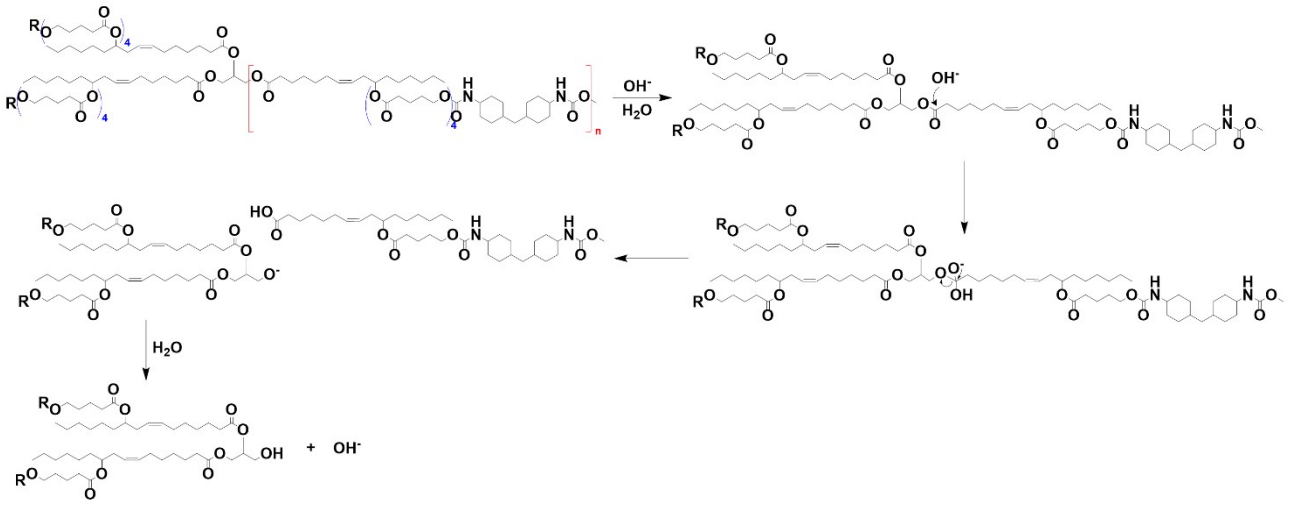

Fig. S4 Possible mechanism for the hydrolytic cleavage of ester bonds in PCVU catalyzed by OH^- in the pH = 14 aqueous solutions.

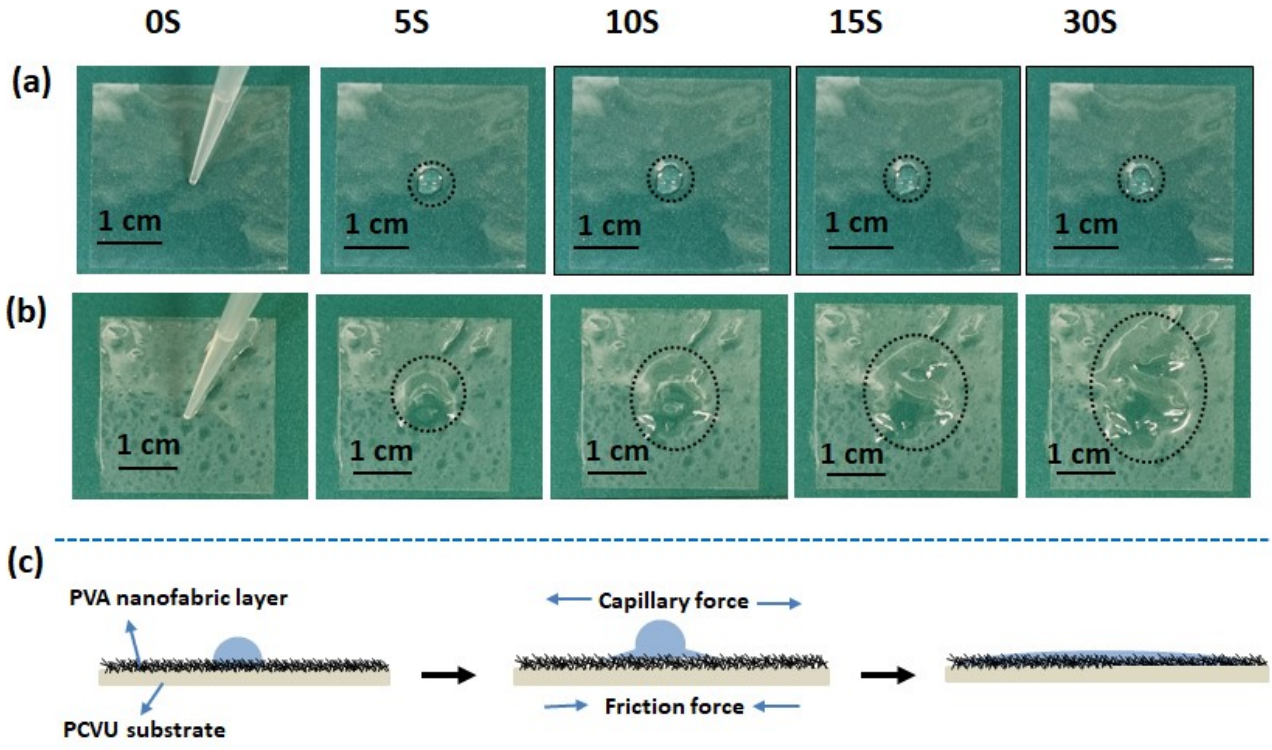

Fig. S5 Camera images of AgNWs in ethanol-water droplets on PVA-coated and uncoated PCVU substrates: (a) No spreading of droplets on the uncoated PCVU substrate at time intervals of 0s, 5s, 10s, 15s, and 30s. (b) Spreading of droplets on the PVA-coated PCVU substrate at the same intervals. (c) Mechanism of spreading for ethanol-water droplets on the PVA-coated PCVU substrate.

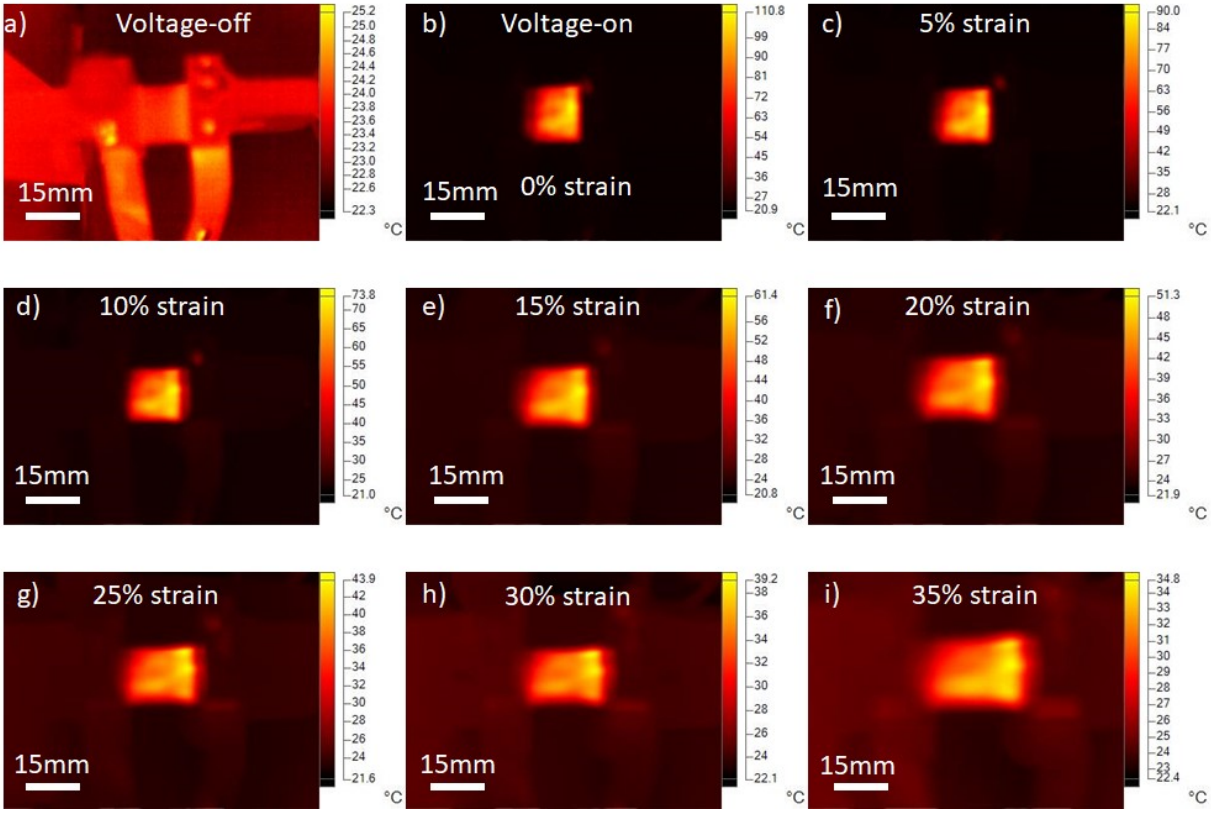

Fig. S6 IR thermal images showing reversible heating characteristics with the applied strain at 4V: (a) Heater at voltage-off state; heating performance of the heater at voltage-on (4V) state at (b) 0% strain, (c) 5% strain, (d) 10% strain, (e) 15% strain, (f) 20% strain, (g) 25% strain, (h) 30% strain, (i) 35% strain.

Table S2. Comparison of high-performance flexible heaters reported in the literature with PCVU heater reporting in this work.

Type of heater	Response time (s)	cooling time (s)	maximum temperature (°C)	Voltage (V)	Degradability	Transparency (%)	Reference
PCVU-based heater	**15 s**	**15s**	**160 °C**	**5.5V**	**yes**	**~75%**	**Present work**
AgNWs/Leaf heater	5-10s	15s	125 °C	6V	yes	80-86%	[1]
ANF/AgNW paper-based heater	10–30 s	-	~200 °C	5V	-	40%	[2]
all-polymeric transparent thin film heaters	250-385 s	400s	45-114°C	10V	no	87-90%	[3]
AgBMs/ePI conducting film heater	8s	15s	~204 °C	8V	no	70%	[4]
AgNW@rGO based flexible transparent heater	50s	80s	366oC	7V	no	90%	[5]
Ag NMs/ePLLA heater	6 s	-	111.8 °C	3V	yes	50%	[6]
cupronickel-based micromesh film heater	60s	100s	225 °C	9V	no	85.6%	[7]
PPFC/Ag bilayer thin film heater	300s	150s	136.7 °C	6.8V	no	80%	[8]
Hanji cellulose paper-based heater	150s	-	175 °C	10V	yes	-	[9]

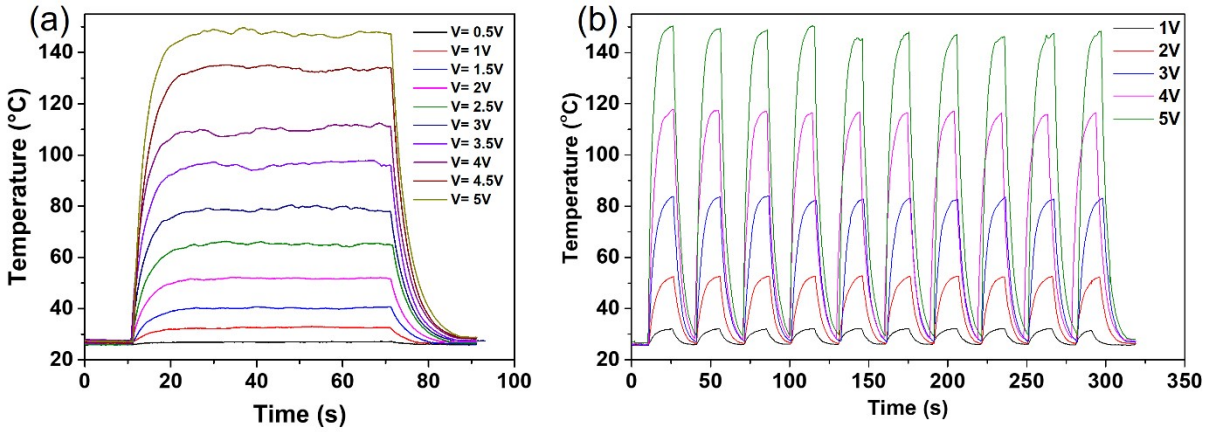

Fig. S7 Two months old heater data. (a) Time-dependent temperature profile of the heater at different applied voltages for 60 sec (0.5-5V). (b) Temperature response to voltage on-off studies testing under various voltages (1V to 5V).

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