

Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

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Supporting Information

A highly stable elastic electrode via direct covalent crosslinking for strain sensor

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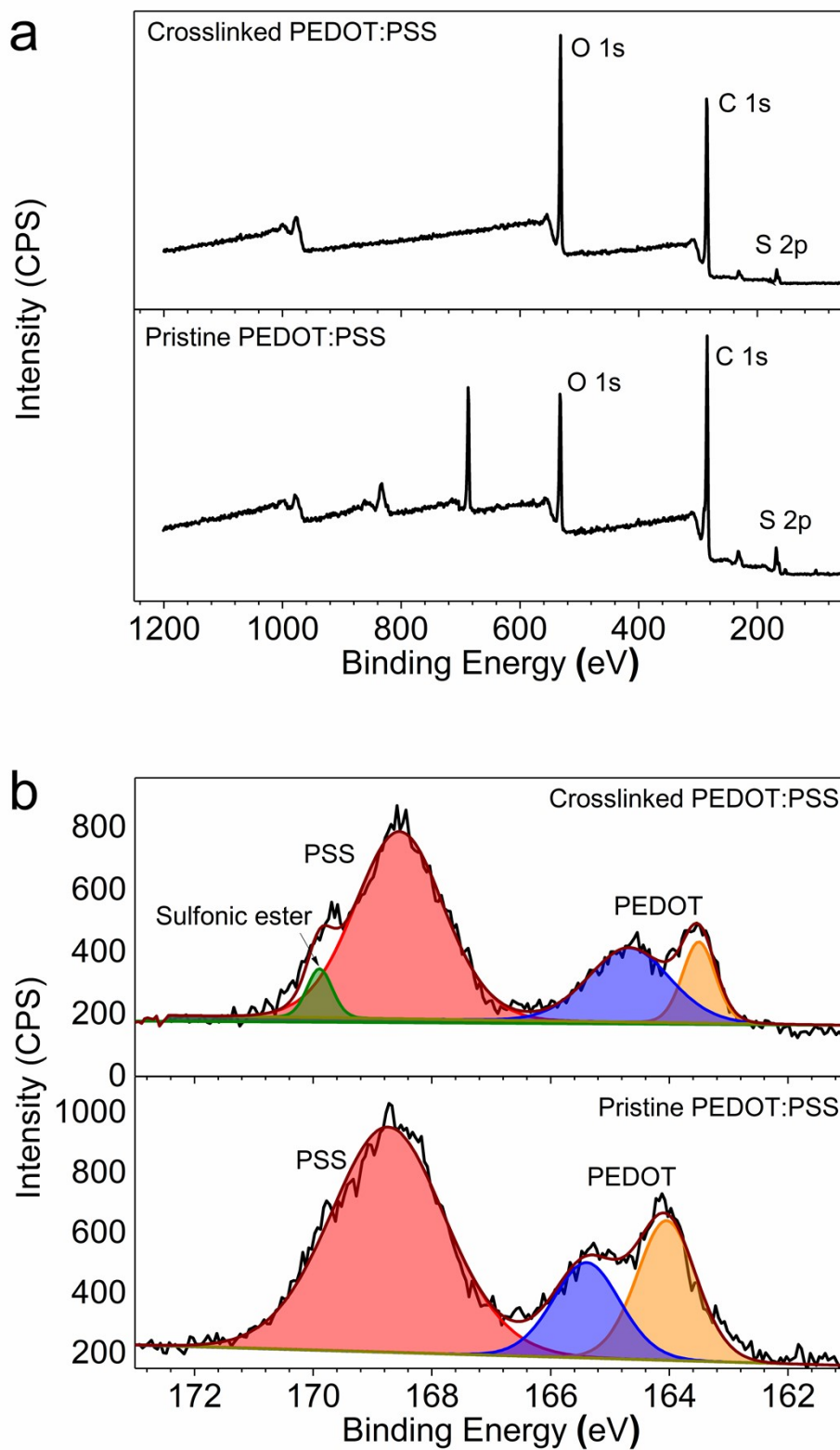


Figure S1. a) Wide-scan XPS spectra and b) high-resolution S 2p XPS spectra of crosslinked PEDOT:PSS and pristine PEDOT:PSS

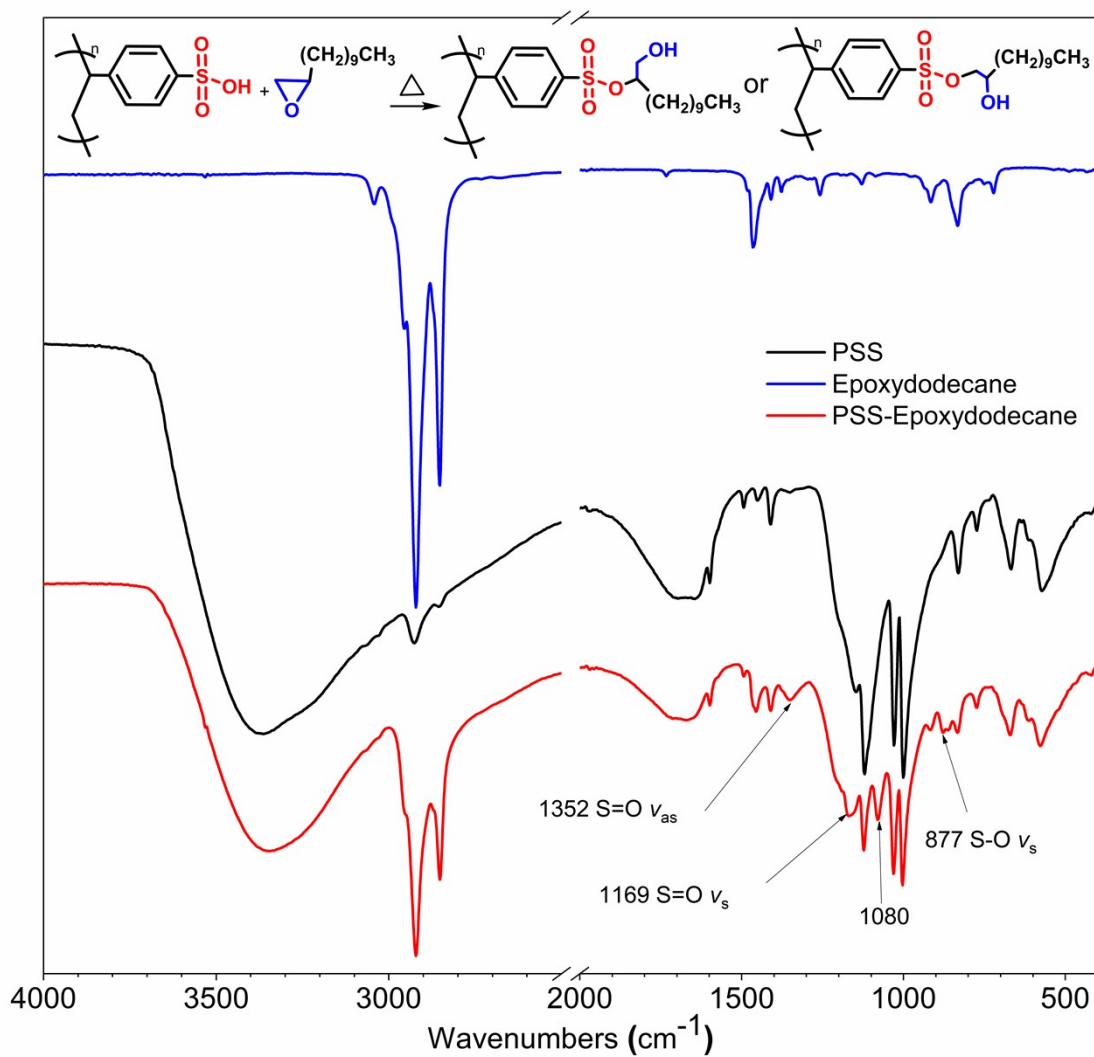


Figure S2. ATR-FTIR spectra of PSS, epoxydodecane, and their product.

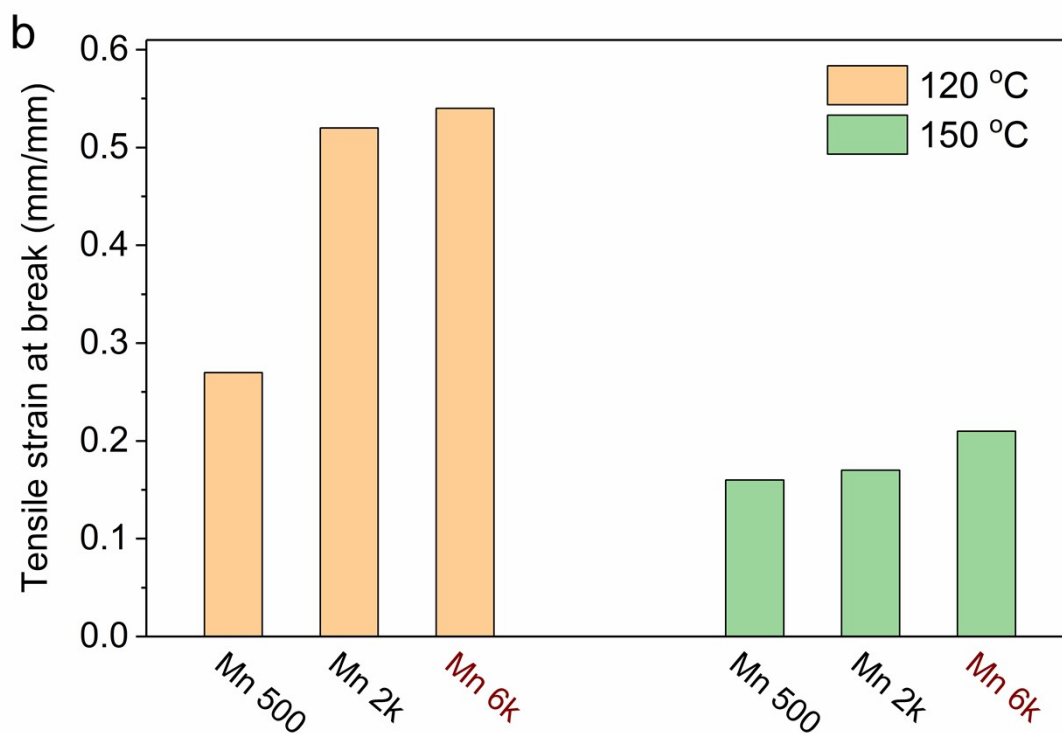
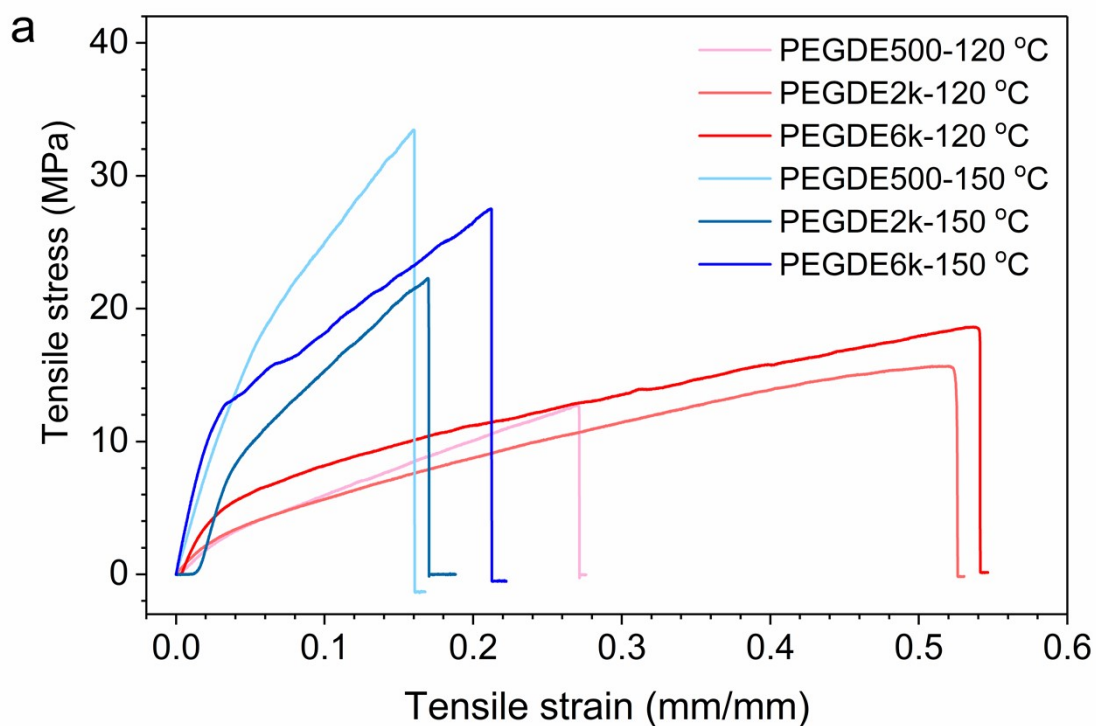


Figure S3. a) Strain-stress curves and b) tensile strain at break of bulk crosslinked PEDOT:PSS films using PEGDE crosslinkers with different molecular weights and heated at different temperatures. Sample “PEGDE500-120 °C” represents crosslinked PEDOT:PSS with PEGDE500 reacted at 120 °C.

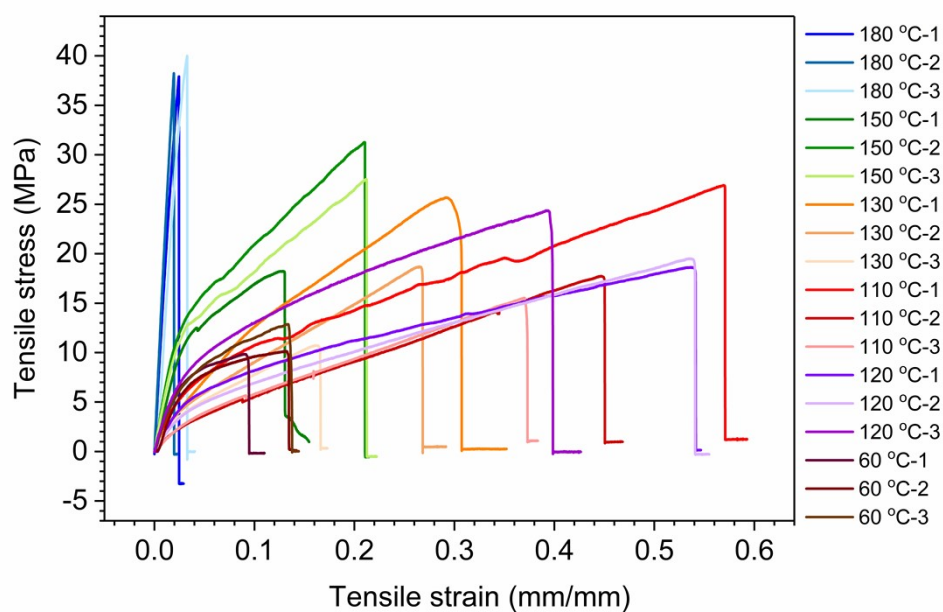


Figure S4. Strain-stress curves of bulk crosslinked PEDOT:PSS thick films heated at various temperatures from 60 °C to 180 °C. Tests of each sample were conducted 3 times. Sample “180 °C-1” represents the crosslinked PEDOT:PSS heated at 180 °C for the first strain-stress test. The ratio of PEGDE 6k was 50 wt% for all samples.

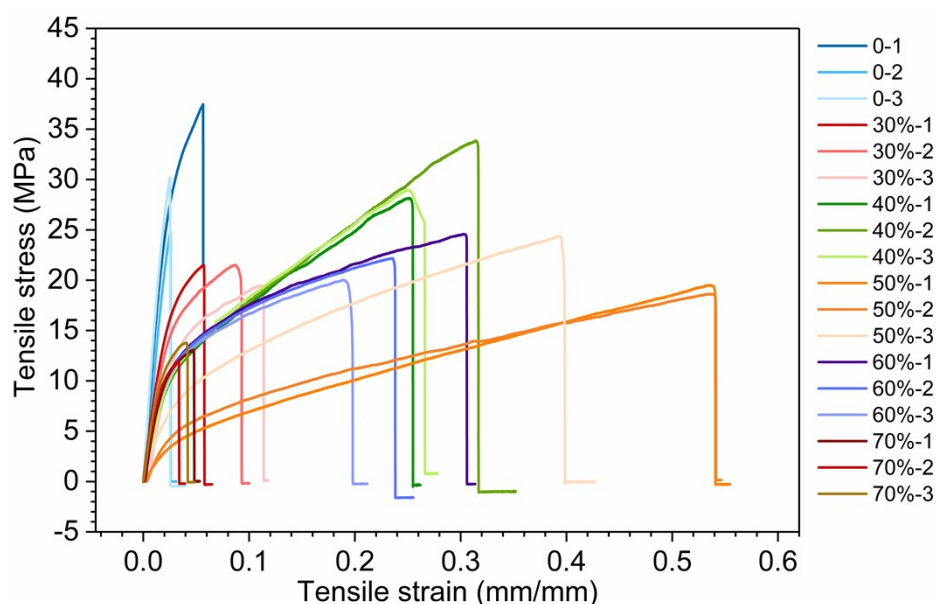


Figure S5. Strain-stress curves of bulk crosslinked PEDOT:PSS thick films mixed with different weight ratio of PEGDE. Tests of each sample were conducted 3 times. Sample “30%-2”, for example, represents the crosslinked PEDOT:PSS with PEGDE ratio of 30 wt% for the second strain-stress test. All the films were crosslinked at 120 °C.

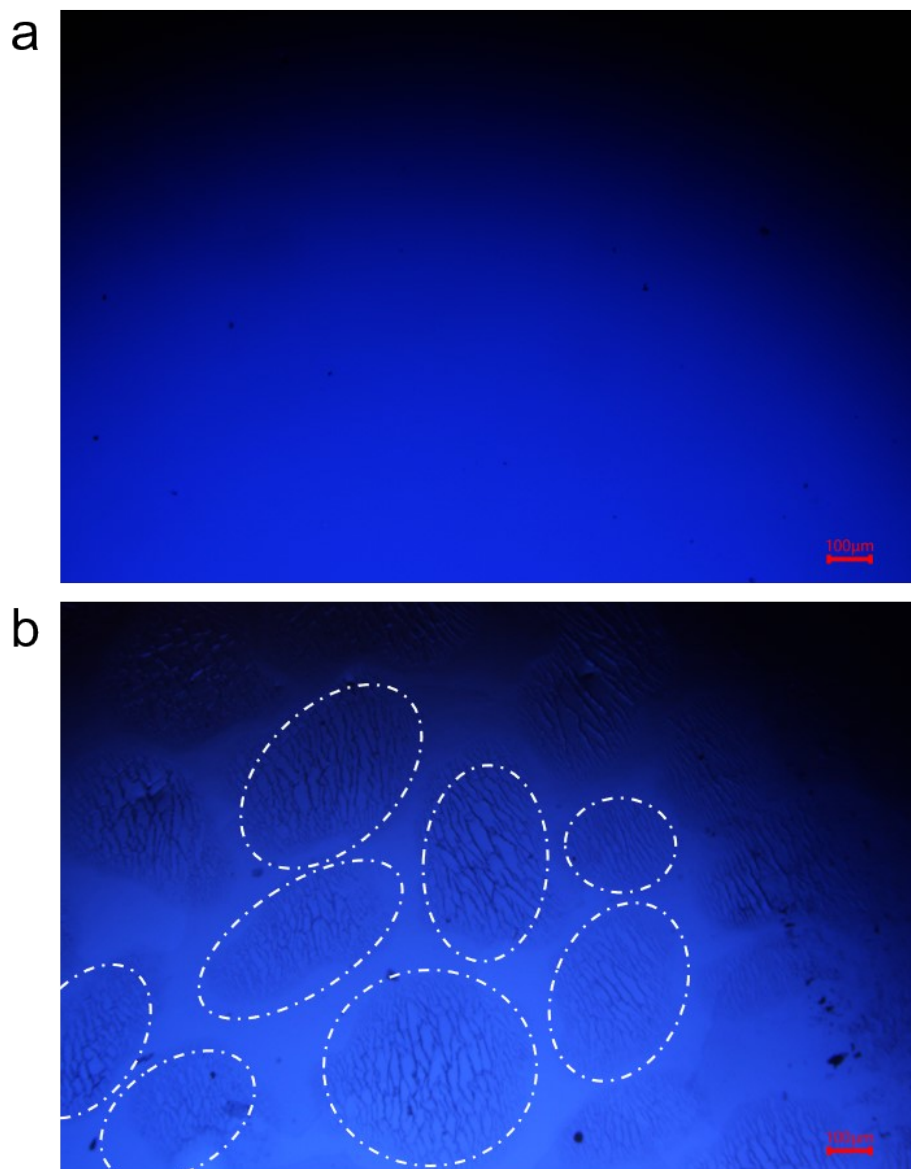


Figure S6. Optical microscope images of crosslinked PEDOT:PSS with the PEGDE ratio at a) 50 wt% and b) 70 wt%.

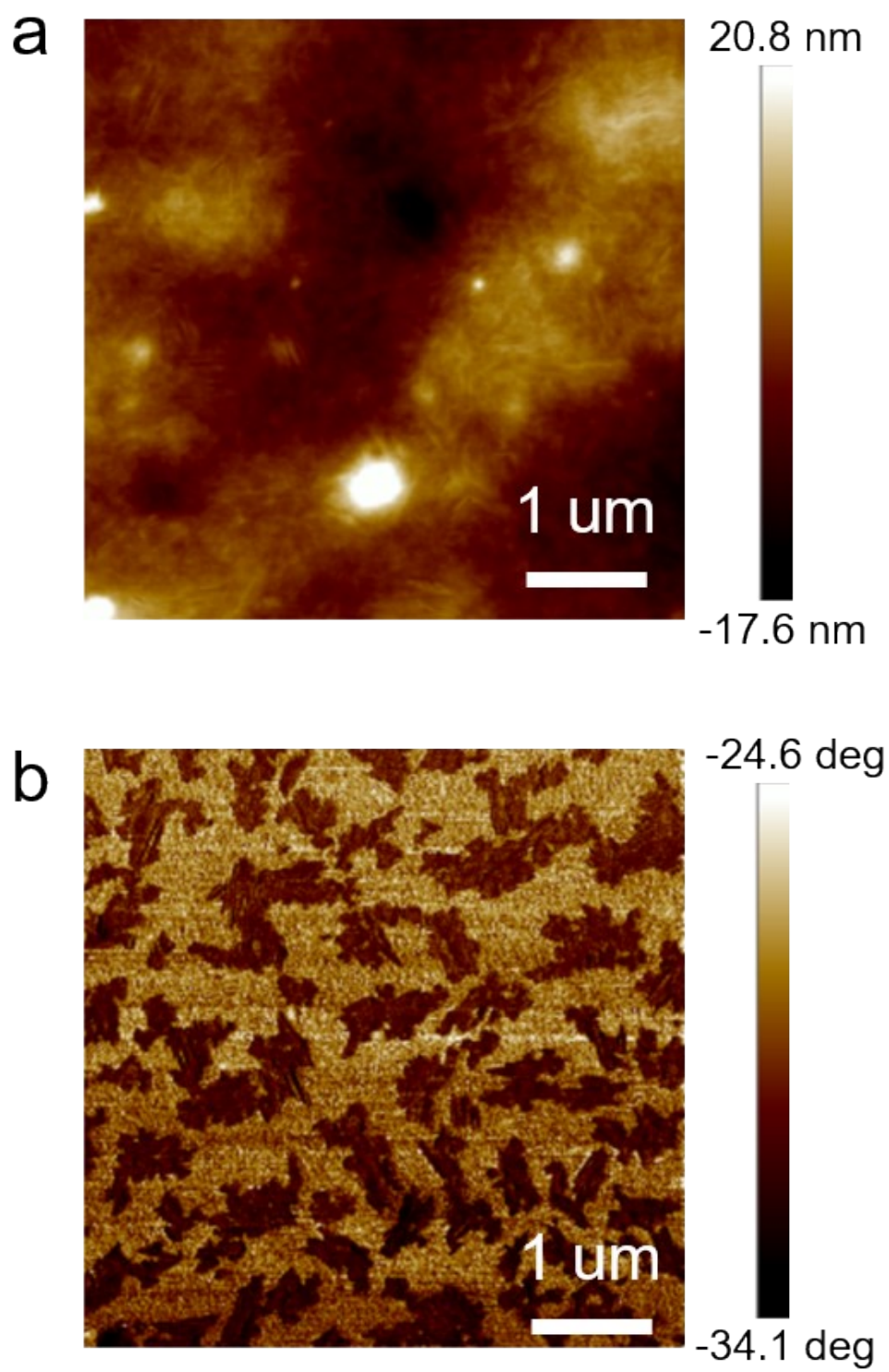


Figure S7. a) AFM height images and b) phase images of crosslinked PEDOT:PSS.

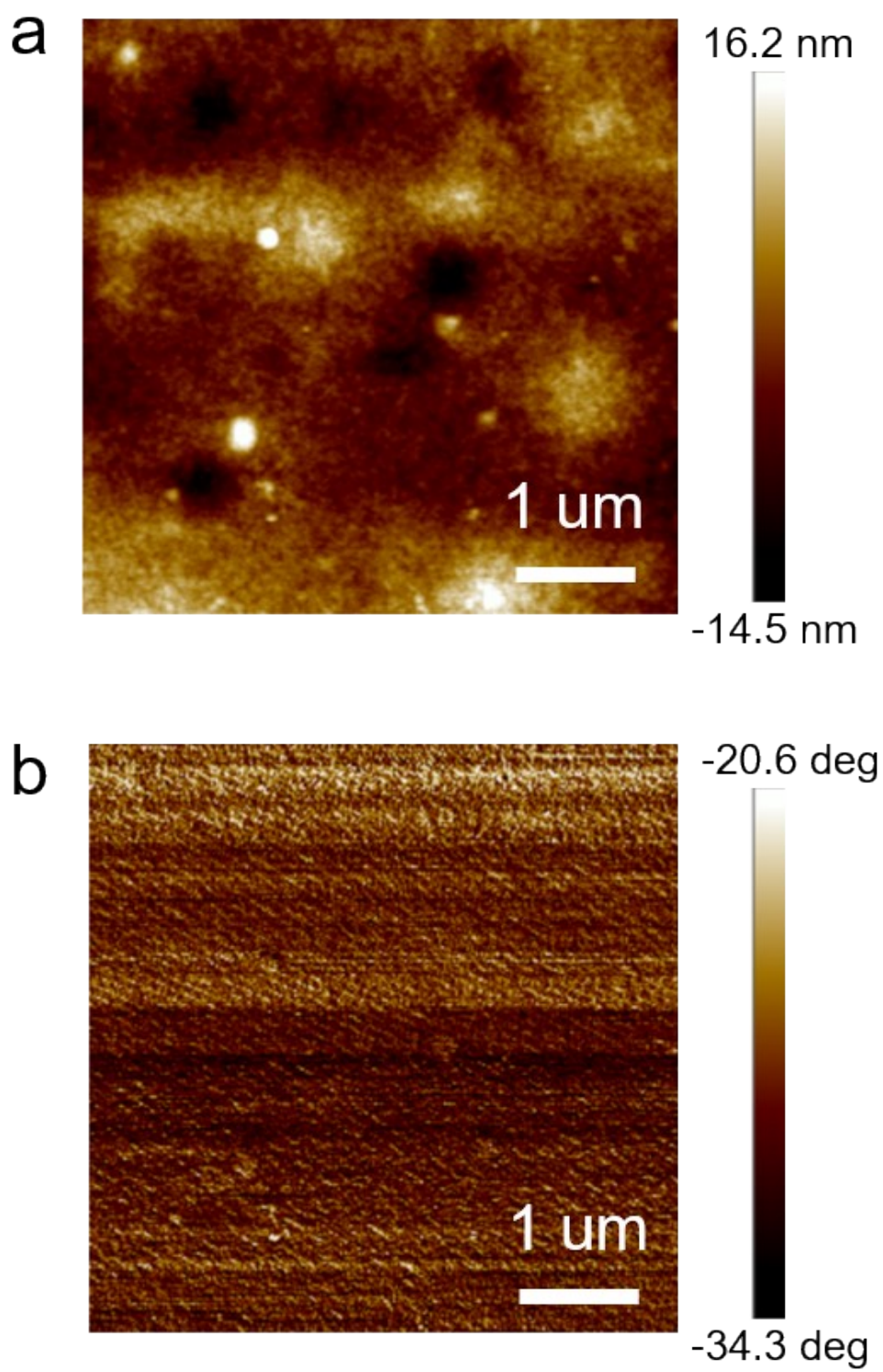


Figure S8. a) AFM height images and b) phase images of pristine PEDOT:PSS.

Table S1. Mechanical and electrical properties of crosslinked PEDOT:PSS in this work compared to representative stretchable PEDOT:PSS conductors reported in literature.

Mixed materials	Conductivity (S m ⁻¹)	Break	Modulus (MPa)	R/R0 at 50% strain	R/R0 at 100% strain	Ref.
	60800	133%	55	/	/	
Ionic liquid+DMSO	42000	112%	28	/	/	Sci. Adv. 2017, 3, e1602076
	28800	176%	47	/	/	
Triton X-100	7800	57%	/	1.6	/	Adv. Mater. 2016, 28, 4455
Zonyl	/	/	/	2	18	Chem. Mater. 2012, 24, 373
Sorbitol	67100	67%	1.9	2	12	ACS Appl. Mater. Interfaces 2019, 11, 26185
WPU+Sorbitol	~40000	~45%	~60	1.15 at 30% strain		Nat. Commun 2020, 11, 4683
PVA+DMSO	<5000	3.50%	/	~10	~150	
PAA+DMSO	12500	45%	/	~5	25	J. Mater. Chem. C, 2020, 8, 6013
PMAA+DMSO	<5000	3%	/	>200	>200	
PEO1000K	5260	38%	/	/	/	ACS Appl. Mater. Interfaces 2015, 7, 18415
PVA89k+DMSO	14200	55%	/	/	/	
PR-PEGMA	11000	150%	~800	1.5	2.5	Science 2022, 375, 1411
PEGM+PEGDM	55000	13%	<10	1.1	30	Adv. Funct. Mater. 2020, 2001251
PEGDM+FS30	~300000	/	/	/	/	Science 2021, 373, 88
PEGDE	13100	50%	251	2.2	9.5	This work

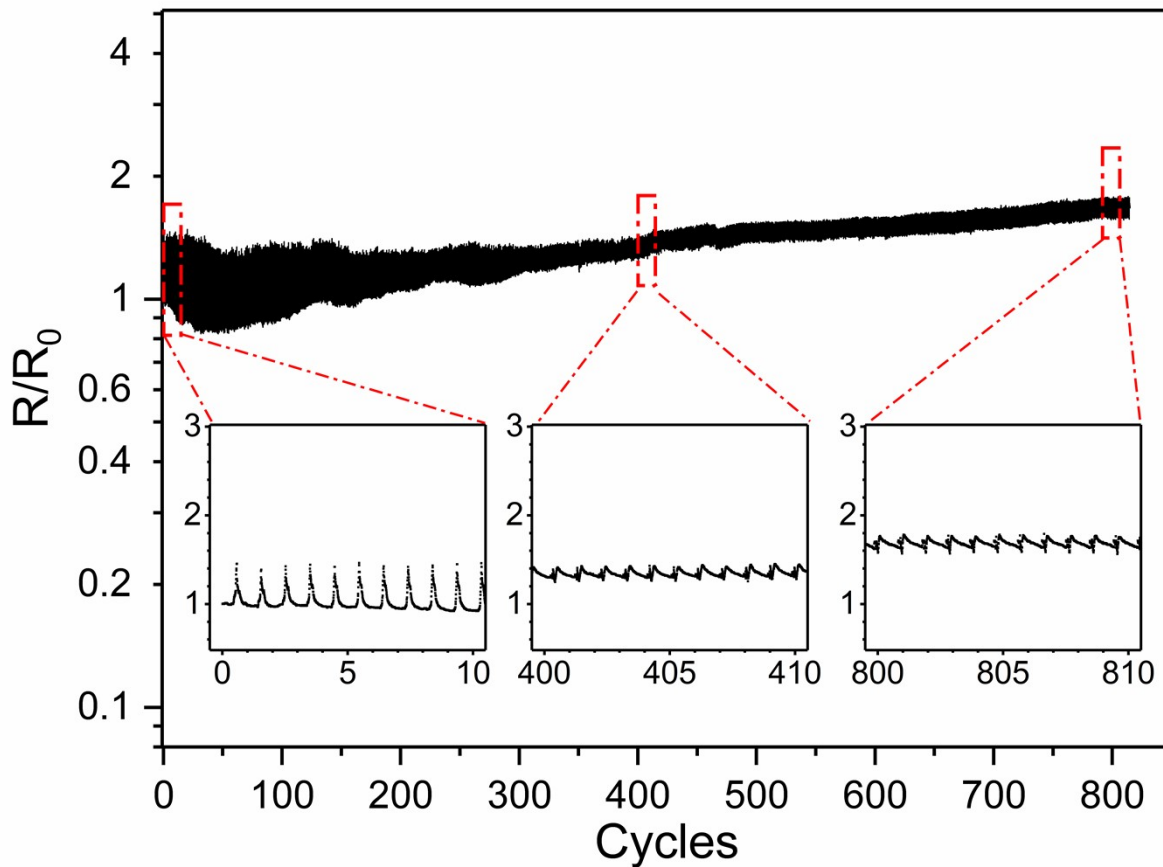


Figure S9. Relative changes in resistance of bulk PEDOT:PSS film under cyclic strains of 30% versus cycle time.

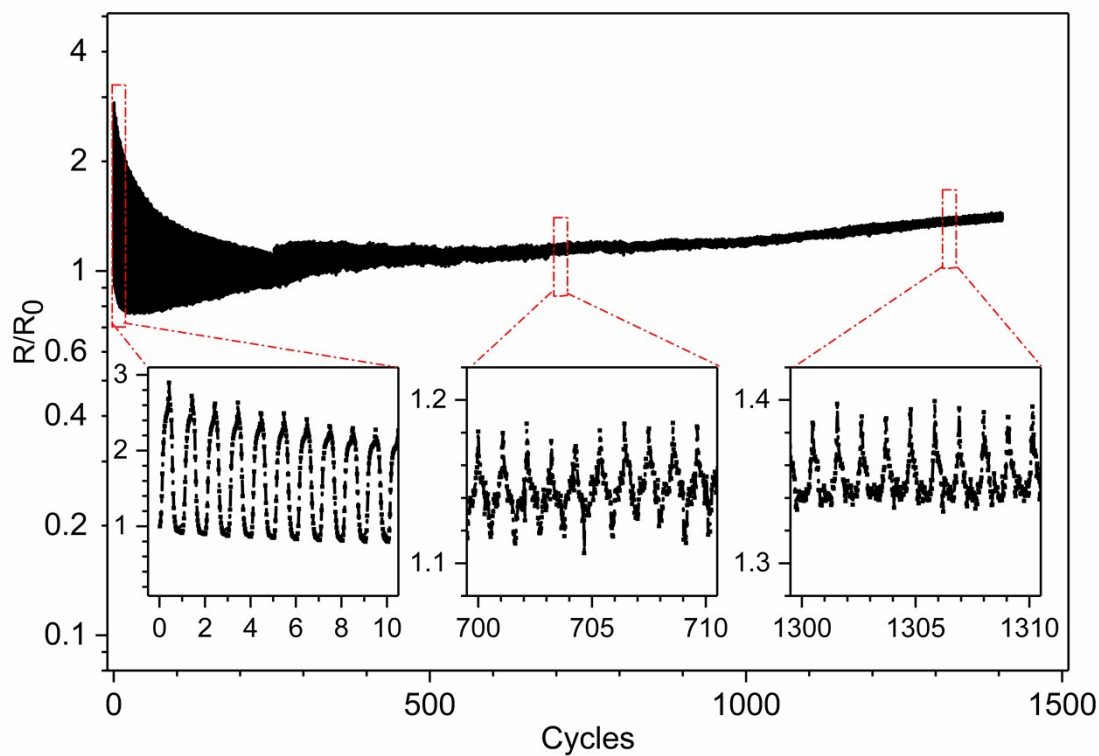


Figure S10. Relative changes in resistance of crosslinked PEDOT:PSS thin films under cyclic strains of 50% versus cycle times.

Table S2. Key parameters of C/C_0 linear fitting curve

Linear fitting curve	at 10% strain	at 20% strain	at 30% strain	at 40% strain	at 50% strain
Intercept	0.991	0.989	0.995	0.996	1.001
Slope	0.717	0.720	0.740	0.749	0.723
R square	0.993	0.992	0.999	0.997	0.999

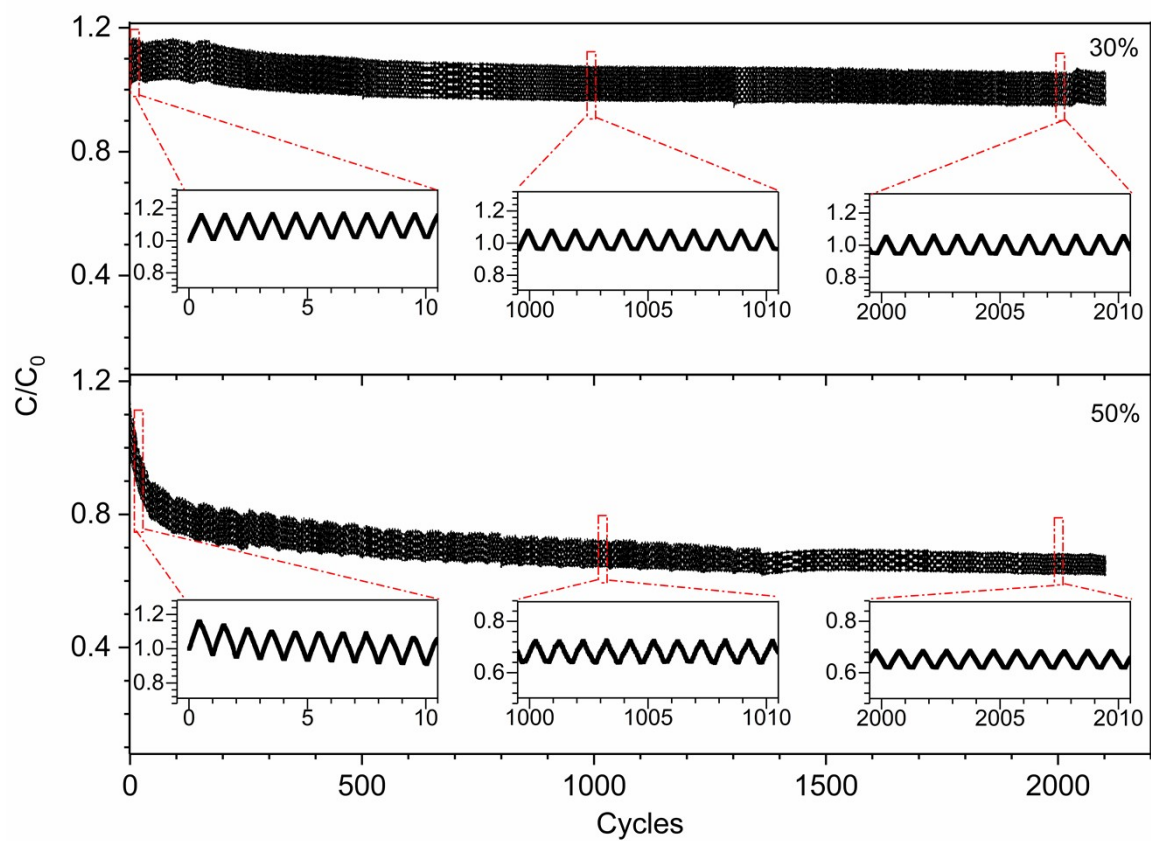


Figure S11. Relative change in capacitance of sensors under cyclic stretching of 30% and 50% versus cycle times.