Supporting information

Highly stretchable conductive MWCNT-PDMS composite with self-enhanced conductivity

Jiang Shao, Liyun Yu, Anne Ladegaard Skov and Anders E. Daugaard*

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Department of Chemical and Biochemical Engineering, Danish Polymer Centre, Technical University of Denmark, 2800, Denmark. E-mail: adt@kt.dtu.dk

Table S1: The dependence of conductivity on concentration of MWCNTs in SC-PDMS and LC-PDMS.

Conductivity (S/m)	**MWCNTs from LC-domain (phr, overall)**				
MWCNTs from SC-domain (phr, overall)	0	0. 2	0. 4	0. 6	0. 8
0. 5	0	0	8.65×10^{-5}	1.75×10^{-4}	---
1	5.03×10^{-4}	1.07×10^{-3}	1.88×10^{-3}	1.83×10^{-4}	6.83×10^{-4}
2	3.28×10^{-5}	1.69×10^{-2}	1.89×10^{-2}	3.81×10^{-2}	1.03×10^{-2}

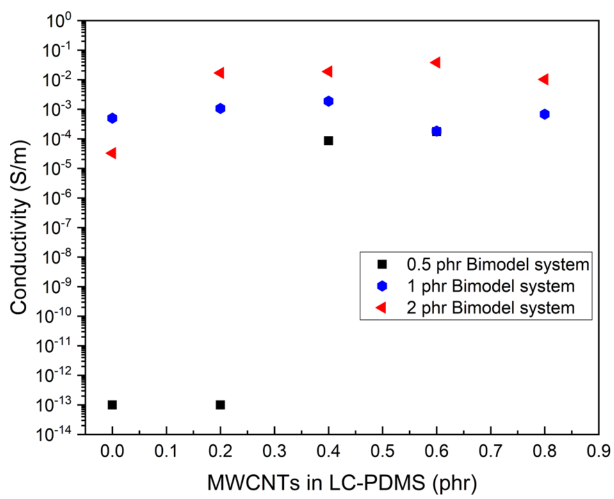

Fig. S1 the dependence of conductivity on concentration of MWCNTs in SC-PDMS and LC-PDMS.

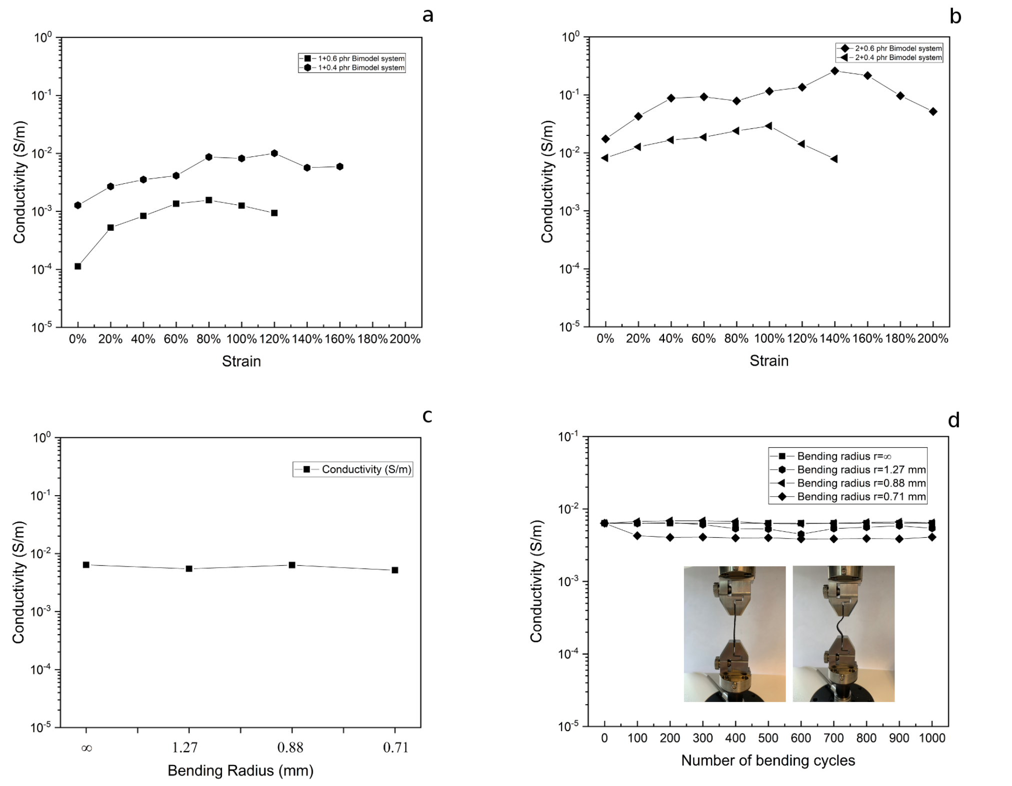

Fig. S2 Electrical properties of MWCNTs/PDMS composites and reference samples: a) Conductivity of MWCNTs/PDMS composites with 1+0.4 phr and 1+0.6 phr MWCNTs under different strains. b) Conductivity of MWCNTs/PDMS composites with 2+0.4 phr and 2+0.6 phr MWCNTs under different strains. c) Conductivity of MWCNTs/PDMS composites with 2+0.6 phr MWCNTs at different bending radiuses. d) Conductivity of MWCNTs/PDMS composites with 2+0.6 phr MWCNTs at different bending radiuses and bending cycles.

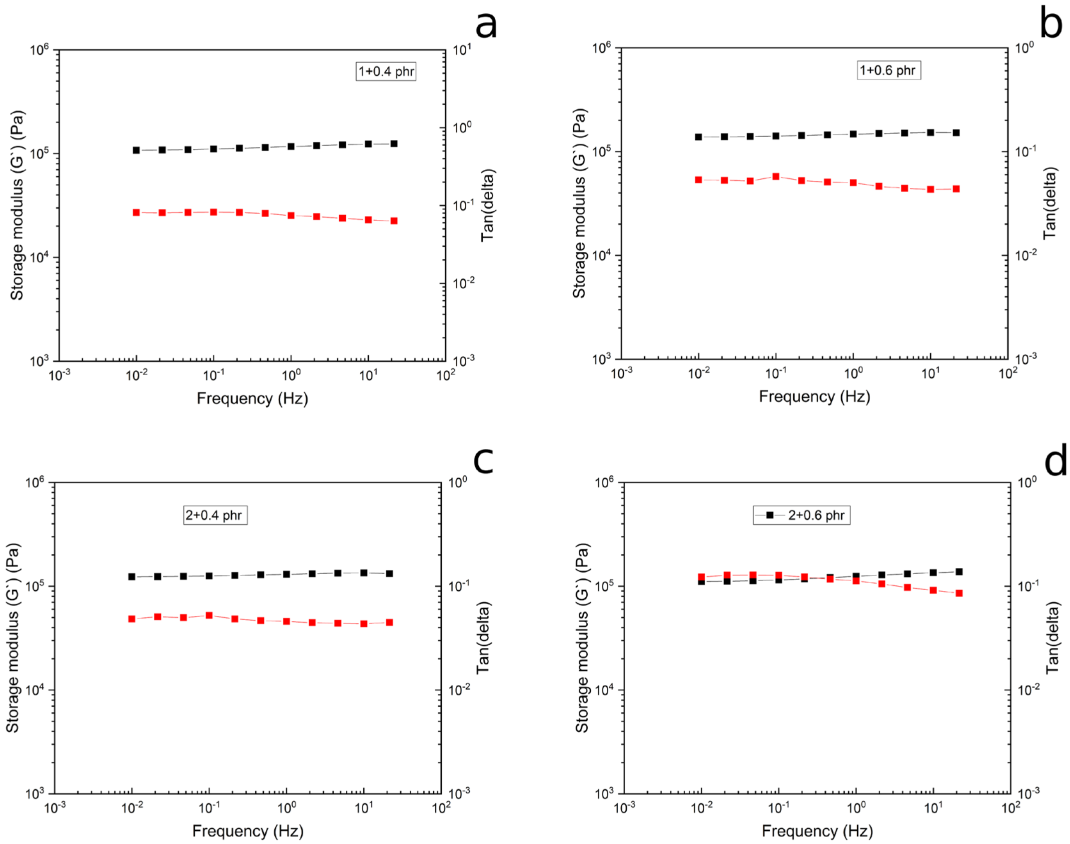

Fig. S3 rheological properties of MWCNTs/PDMS composites: a) rheological properties of MWCNTs/PDMS composites with 1+0.4 phr MWCNTs b) rheological properties of MWCNTs/PDMS composites with 1+0.6 phr MWCNTs. c) rheological properties of MWCNTs/PDMS composites with 2+0.4 phr MWCNTs. d) rheological properties of MWCNTs/PDMS composites with 2+0.6 phr MWCNTs.

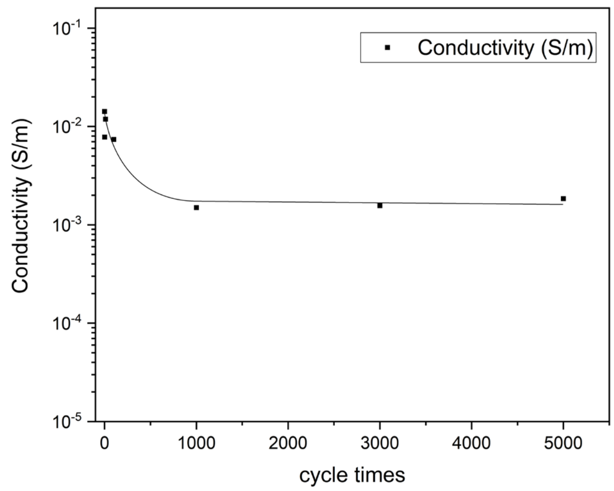

Fig. S4 electrical conductivity of MWCNTs/PDMS composites with 2+0.6 phr MWCNTs as a function of stretching−releasing cycles with 30% strain

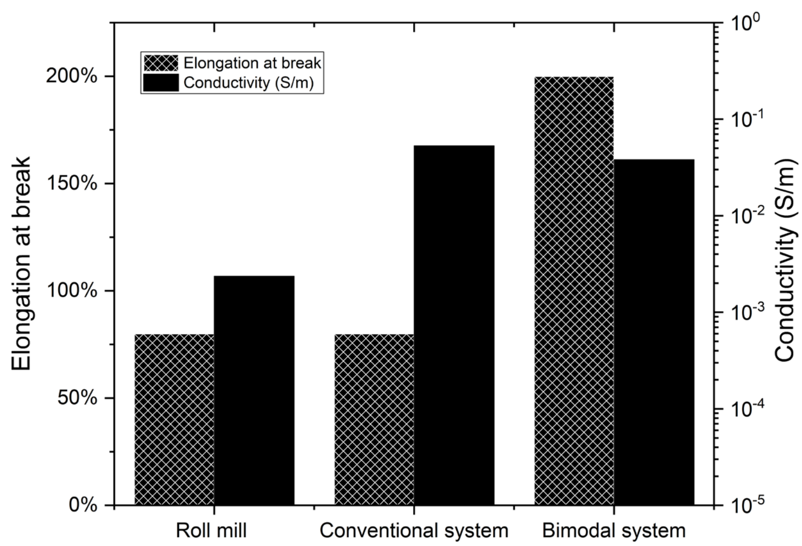

Fig. S5 Stretchability and conductivity of samples prepared by different methods (2.6 phr MWCNTs).

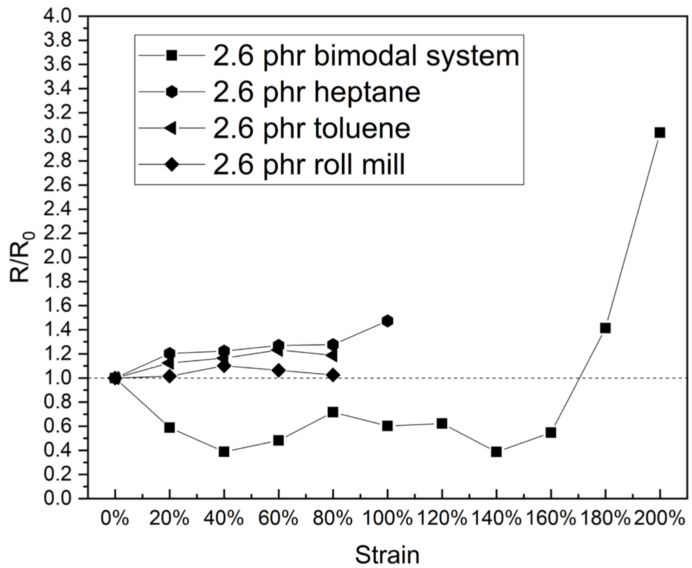

Fig. S6 Behaviour of normalized resistances of MWCNTs/PDMS composites and reference samples under different strains (All samples are from a formulation point of view identical but the preparation schemes are varied).

Table. S2 comparison of our results with other published results.

Fillers/polymer	Filler content	Conductivity (S/m)	Reference
MWCNT/PDMS	3 wt%	~ $1x10^{-3}$	Hassouneh S S, et al.[1]
MWCNT/PDMS	1 wt%	~ $1x10^{-6}$	Goswami K, et al.[2]
SWCNT/epoxy	5 wt%	~ $1x10^{-3}$	Kim B, et al.[3]
SWCNT/polystyrene	8.5 wt%	$1.3x10^{-5}$	Barraza H J, et al.[4]
MWCNT/PDMS	2.3 wt% (2.6 phr)	$3.8x10^{-2}$	Shao J, et al. (This work)

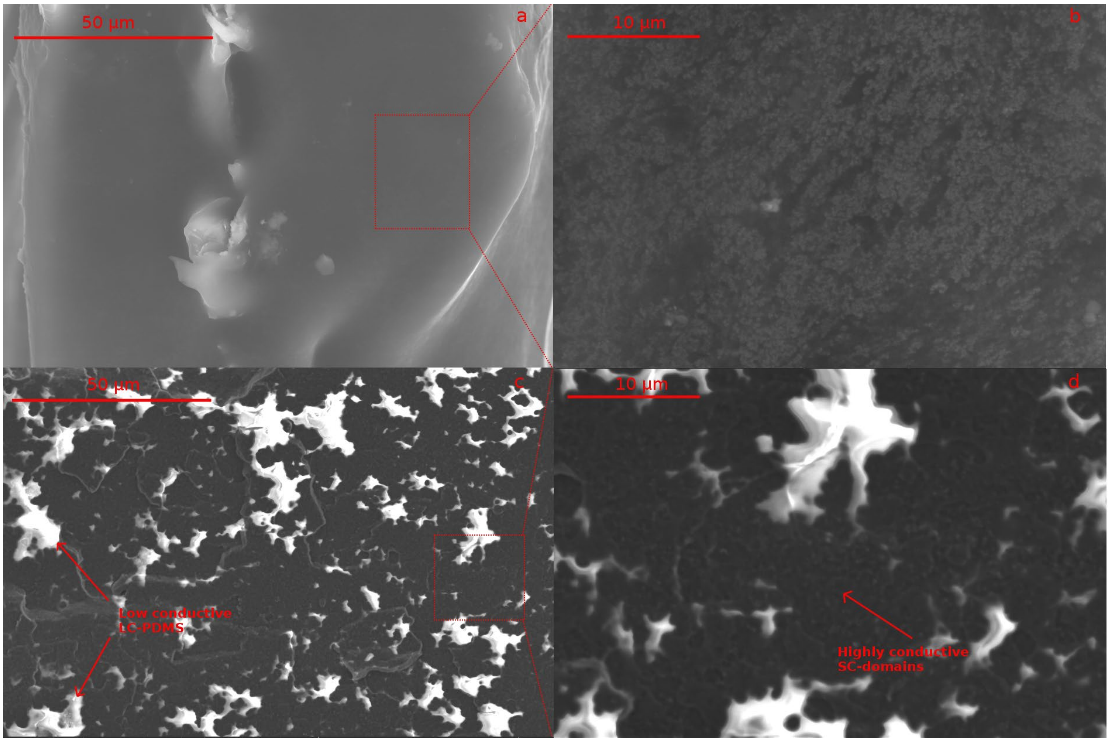

Fig. S7: SEM micrographs of uniformly dispersed MWCNT in PDMS at 2.6 phr (a, b), and the corresponding biomodal MWCNT/PDMS system with 2+0.6 phr MWCNT (c, d). The anisotropic distribution from the biomodal mixing process is clear from the mixture of highly conductive and isolating regions in the sample.

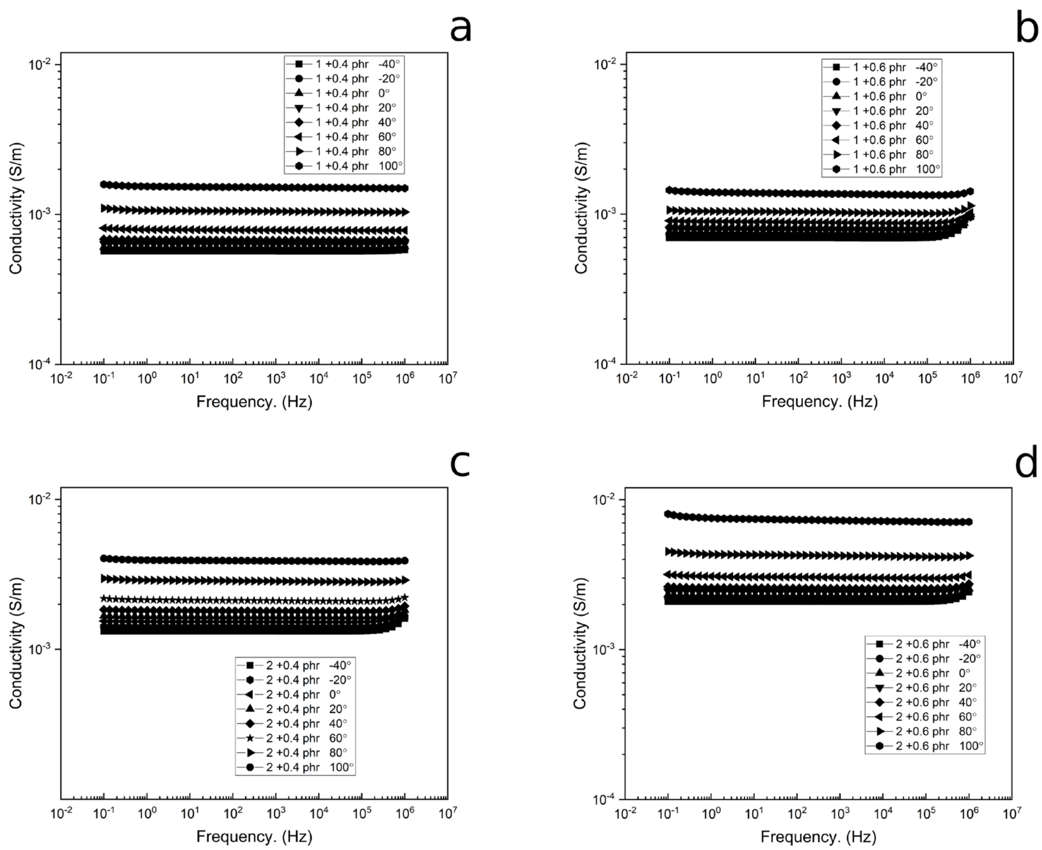

Fig. S8 dielectric spectroscopy of MWCNTs/PDMS composites: a) dielectric properties of MWCNTs/PDMS composites with 1+0.4 phr MWCNTs b) dielectric properties of MWCNTs/PDMS composites with 1+0.6 phr MWCNTs. c) dielectric properties of MWCNTs/PDMS composites with 2+0.4 phr MWCNTs. d) dielectric properties of MWCNTs/PDMS composites with 2+0.6 phr MWCNTs.

References:

[1] S.S. Hassouneh, L. Yu, A.L. Skov, A.E. Daugaard, Soft and flexible conductive PDMS/MWCNT composites, J. Appl. Polym. Sci. 134 (2017) 1–9. https://doi.org/10.1002/app.44767.

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