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

Supporting Information (SI)

Percolation threshold-inspired design of hierarchical multiscale hybrid architecture based on carbon nanotube and silver nanoparticle for stretchable and printable electronics

Songfang Zhao,[a,b] Jinhui Li,[b] Duxia Cao,[a] Yongju Gao,[b] Wangping Huang,[b] Guoping Zhang,*[b] Rong Sun,*[b] Ching-Ping Wong[c]

[a]School of Material Science and Engineering, University of Jinan, Jinan 250022, Shandong, China

[b]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen 518055, China

[c]School of Materials Science and Engineering, Georgia Institute of Technology, 771 Ferst Drive, Atlanta, Georgia, 30332, United States

*E-mail: gp.zhang@siat.ac.cn, rong.sun@siat.ac.cn

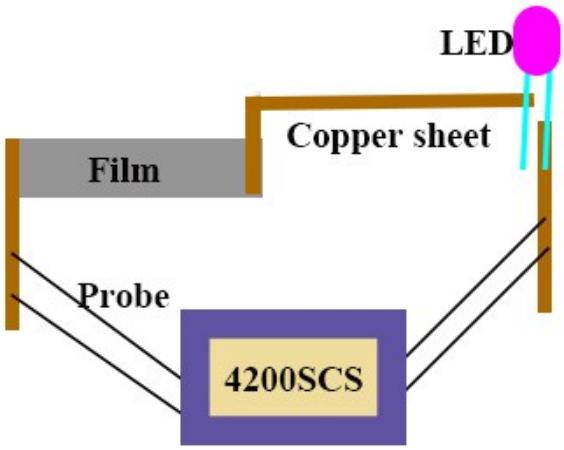

Fig.S1 Connection schematics of the whole measuring circuit

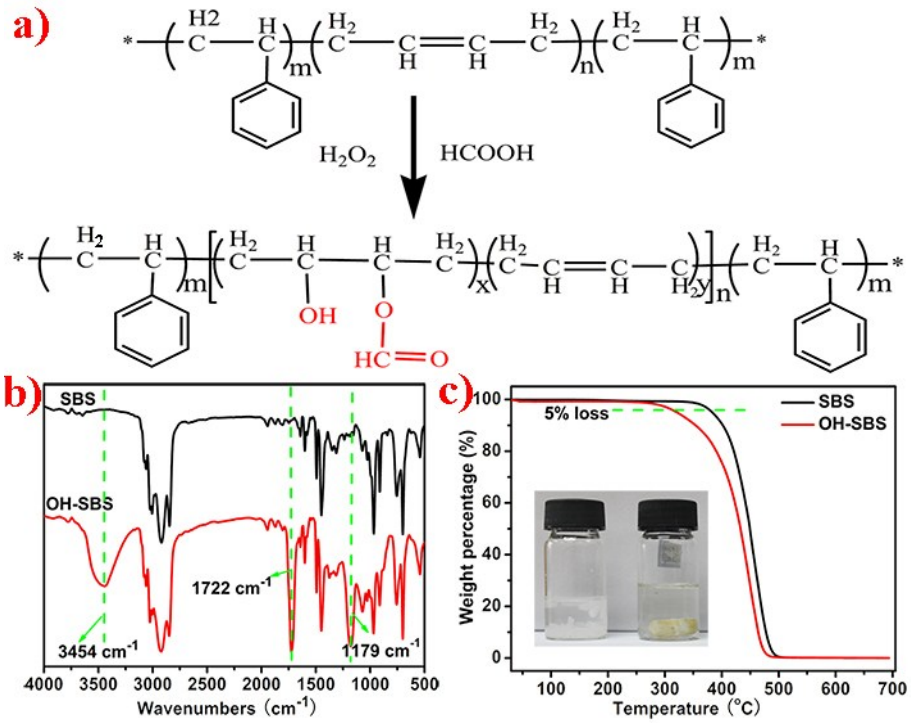

Fig.S2 (a) Modification schematics of SBS via oxidation of H_2O_2 and HCOOH; (b) FTIR spectra of SBS and OH-SBS; (c) TGA curves of SBS and OH-SBS, the inset is the dissolved state of SBS and OH-SBS in DMF

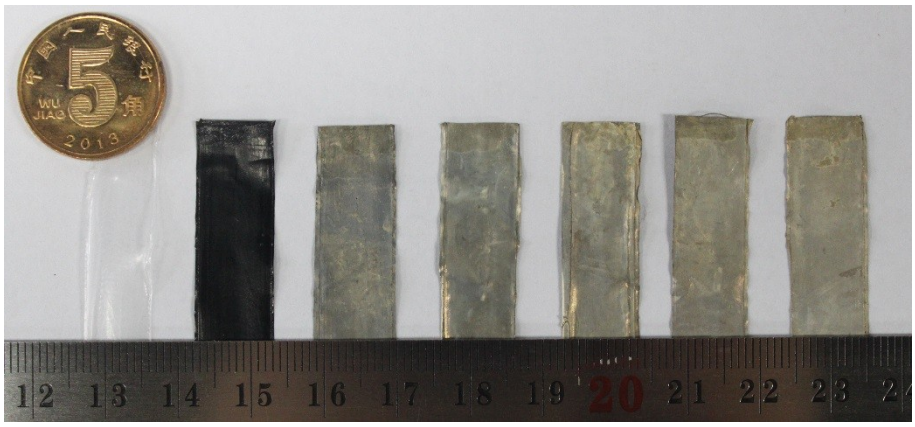

Fig.S3 Digital images of various OH-SBS composites with different content of Ag NPs

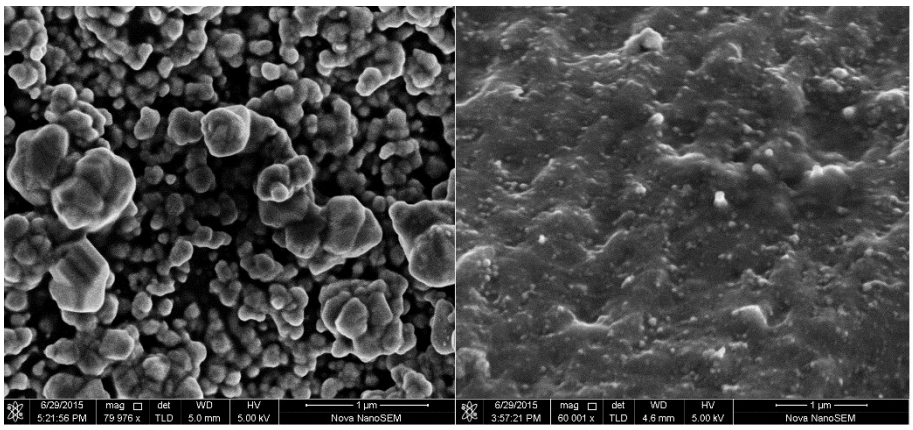

Fig.S4 SEM images of Ag NPs generated on the surface (a) and inner (b) of composite

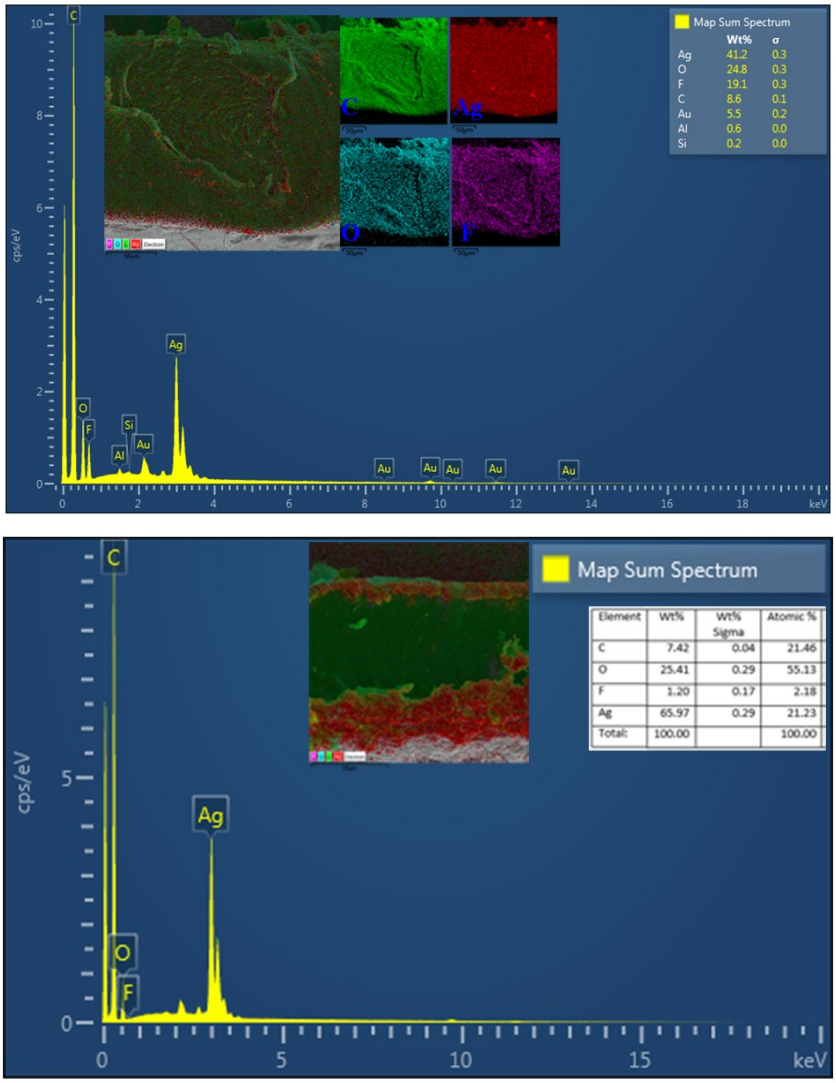

Fig.S5 The EDS spectrum and their corresponding EDS mapping images: (a) OH-SBS/CNTs/STA, (b) OH-SBS/CNTs/Ag NPs

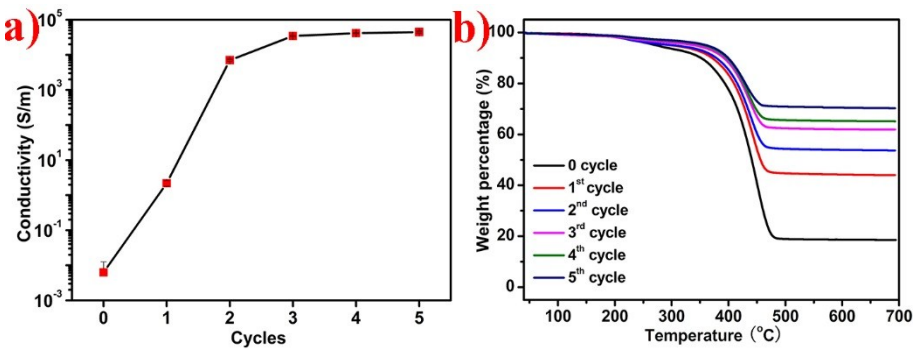

Fig.S6 (a) Initial conductivity of CNTs (18.5 wt%)-Ag NPs embedded composites depending on the number of repeated process for Ag ions absorption and reduction; (b) TGA curves of the CNTs-Ag NPs embedded composites for different cycles of absorption and reduction of Ag ions

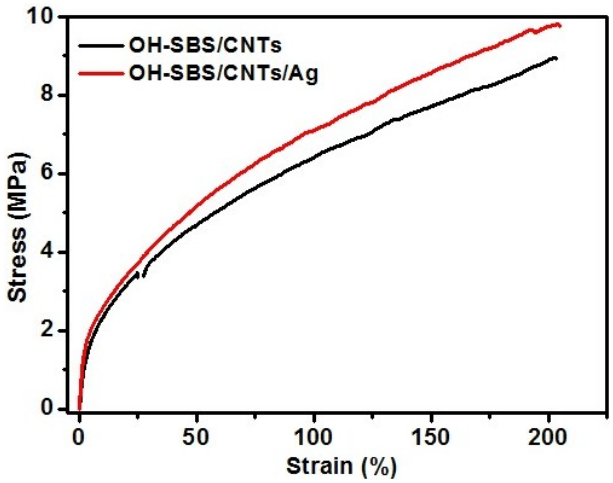

Fig.S7 Stress-strain curves of CNTs (18.5 wt%)/OH-SBS composite and CNTs (18.5 wt%)/Ag NPs/OH-SBS composite

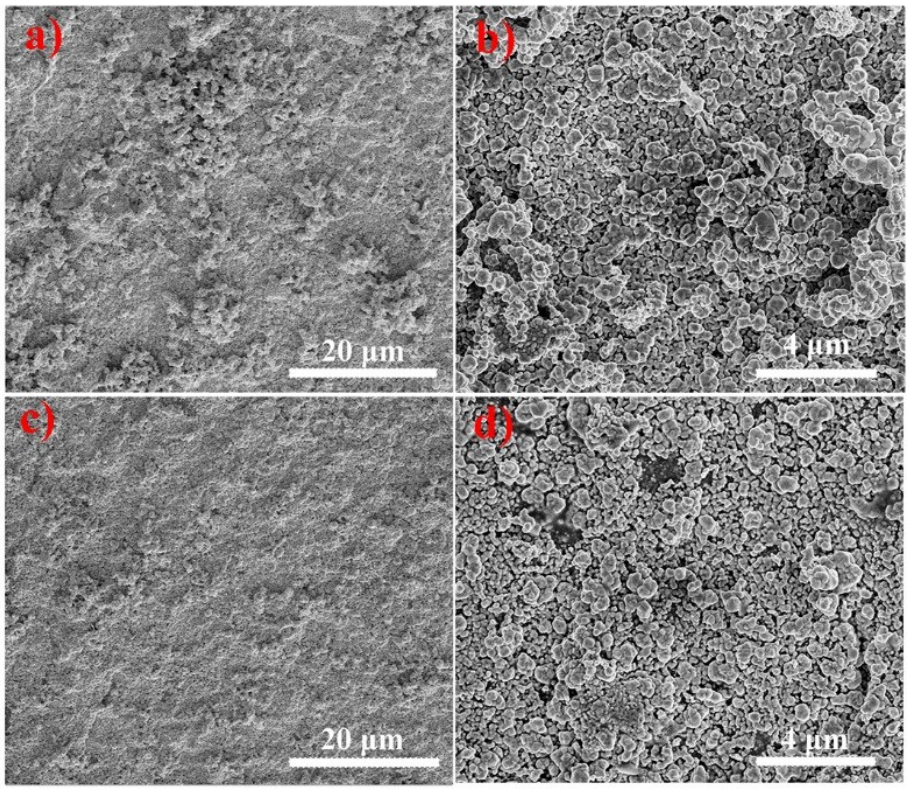

Fig.S8 SEM images of CNTs (2 wt%)-Ag NPs embedded composites: (a) before scraping; (b) after scraping of the Ag NPs using common tape

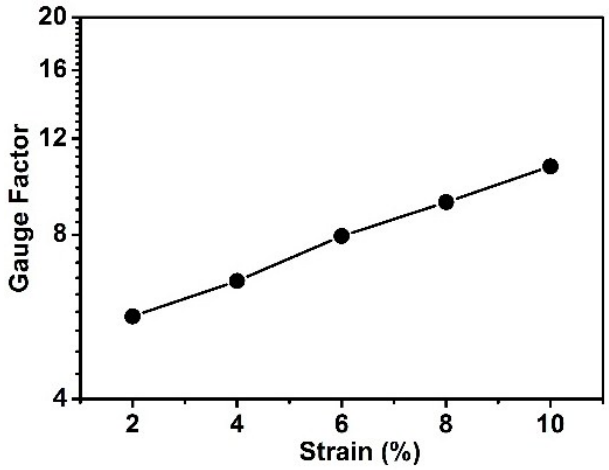

Fig.S9 Gauge factor as a function of tensile strain (<10%)

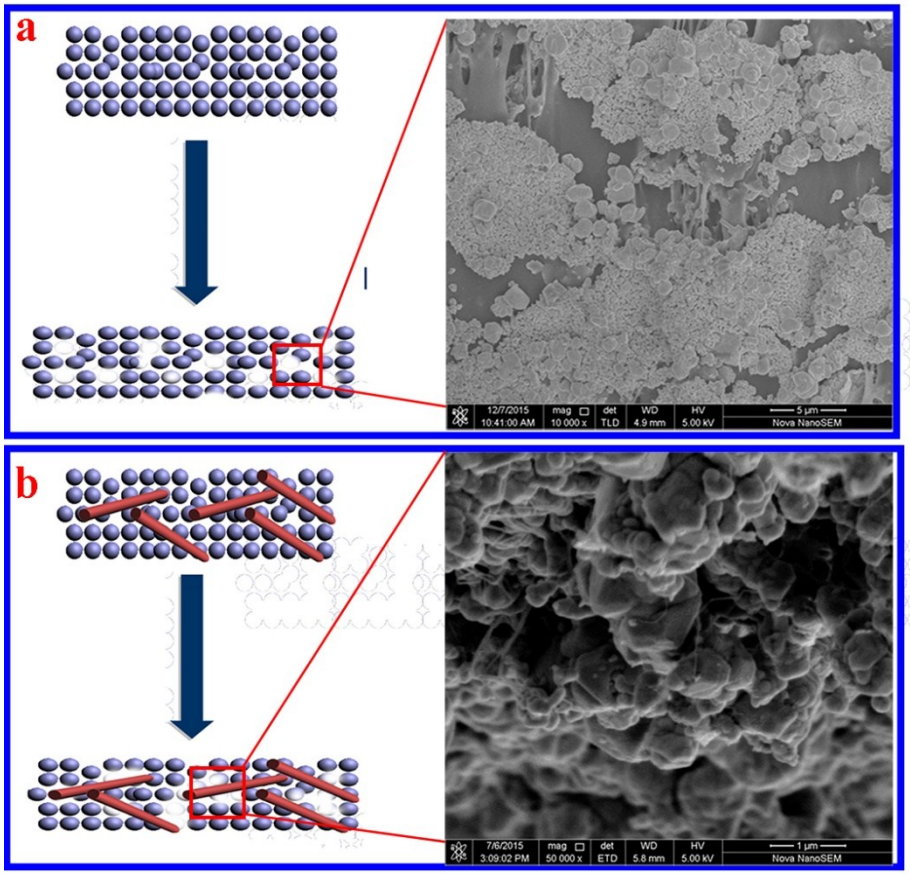

Fig.S10 Schematic illustration of CNTs as bridges between separated Ag NPs under stretching: (a) without CNTs; (b) with 2.0 wt% CNTs

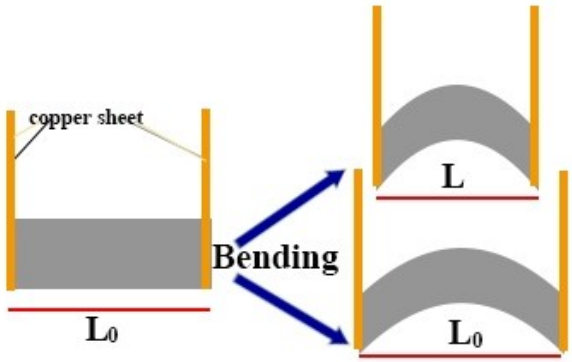

Fig.S11 Two different schematics of bending process

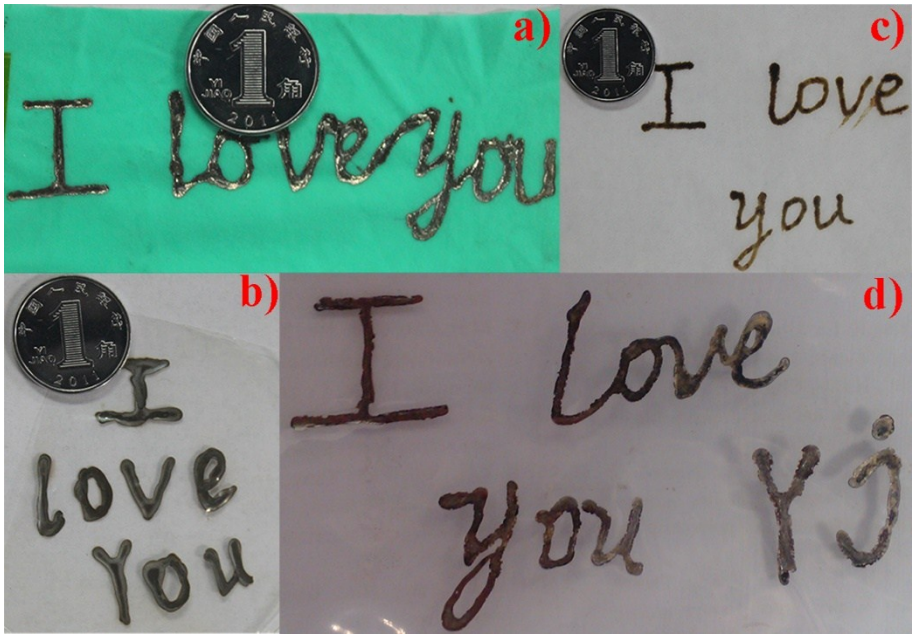

Fig.S12 Electronic circuits written by our electronic paste on various substrates: (a) Nitrile butadiene rubber (NBR); (b) Common A4 paper; (c) SBS; (d) Laboratory ziplock bag

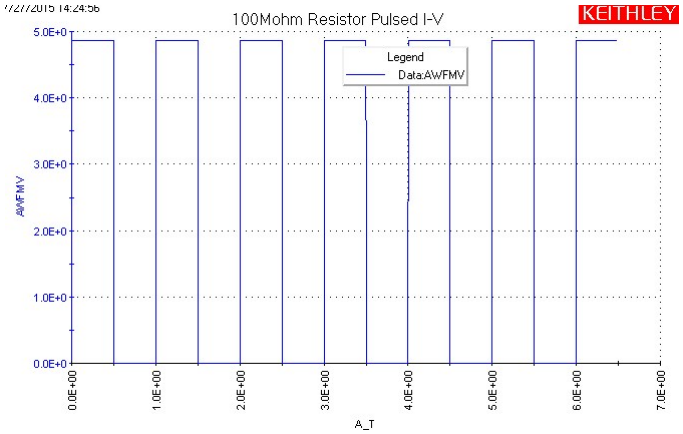

Fig.S13 Interval voltage applied to the “I love you” circuit

Table S1 Selected parameters extracted from our work and the reported papers on strain gauge sensors

Matrix	Conductive filler	Max. Strain	Initial conductivity (S cm^{-1})	Gauge factor	Printability	References and year
Polyurethane (PU)	Silver nanoflowers	150%	20,500	211	No	2015[1]
Polystyrene-block-polyisoprene-polystyrene	Ag NPs	200%	0.8 Ω·cm^{-1}	25	Yes	2016[2]
Styrene-butadiene-styrene (SBS)	Ag NWs	N/A	4,000	6	Yes	2015[3]
Poly(m-phenylene isophthalamide) (PMIA)	FWCNTs	220%	109.63	5.4	No	2015[4]
Polydimethylsiloxane (PDMS)	Ag NWs	35%	34,000	20	No	2015[5]
Styrene-butadiene-styrene (SBS)	Ag NWs, Ag NPs	900%	2,450	15	No	2015[6]
Polydimethylsiloxane (PDMS)	Crumpled graphene	100%	N.A.	7.1	No	2014[7]
Nitrile Butadiene rubber (NBR)	Ag flakes, nAg-MWNTs	600%	37,521	0.007	Yes	2012[8]
Polyvinylidenefluoride (PVDF)	Ag flakes, nAg-MWNTs	140%	5,710	N.A.	Yes	2010[9]
Polydimethylsiloxane (PDMS)	Ag NPs, CNTs	2.4%	3,000	95	Yes	2014[10]
Eco-flex	Ag NWs	460%	N.A.	1.52	Yes	2012[11]
Polydimethylsiloxane (PDMS)	CNTs, graphene	80%	0.27	N.A.	No	2014[12]
Styrene-butadiene-styrene (SBS)	Ag NPs	140%	5,450	10	Yes	2012[13]
Eco-flex	Ag NWs, SWCNTs	460%	N.A.	<7	No	2014[14]
Polyethylene terephthalate (PET)	Au NPs	10%	0.05	90	No	2011[15]
Poly(vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP)	Ag NPs, nAg-MWNTs	350%	2,681	8,000	No	2014[16]
Polyurethane	PEDOT:PSS	350%	25	6	No	2014[17]
Poly[styrene-b-(ethylene-co-butylene)-b-styrene]	Eutectic gallium indium	800%	$3*10^{-5}$ Ω·cm^{-1}	6	No	2013[18]
Nature rubber	graphene	800%	0.001	35	No	2014[19]
Styrene-butadiene-styrene (SBS)	Ag NPs, CNTs	550%	1665	26500	Yes	Our work

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