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Improvements of the Output Performance of the Polyethylene Oxide Based Triboelectric Nanogenerators by Introducing the Shell-core Ag@SiO_2 Particles

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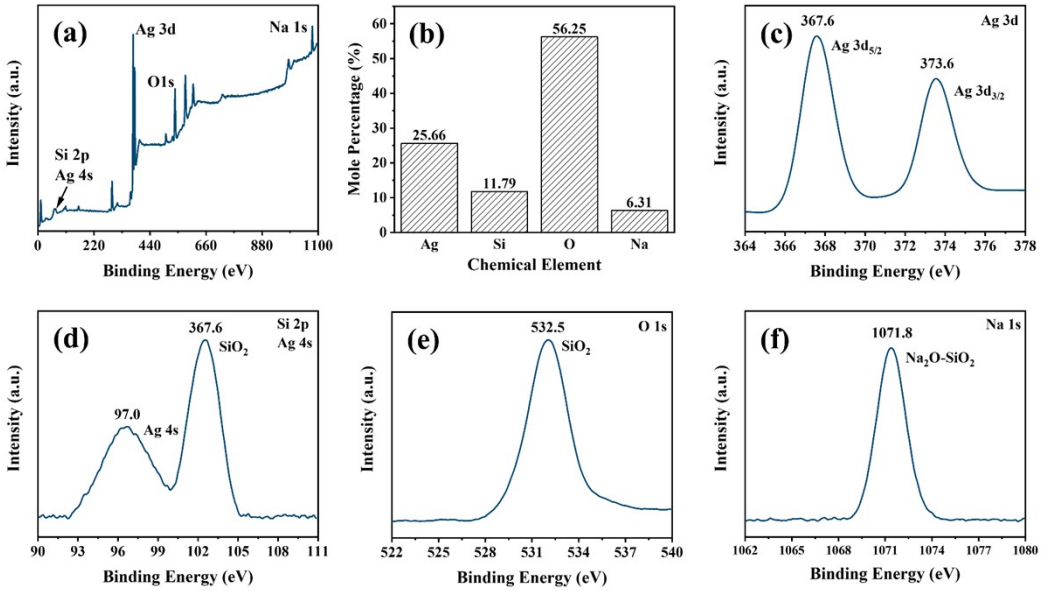

Fig. S1 (a) The XPS survey spectrum and (b) the proportion of the element of the surface of the Ag@SiO_2 particles. (c-f) The XPS analysis of the chemical compositions of the surface of the Ag@SiO_2 particles.

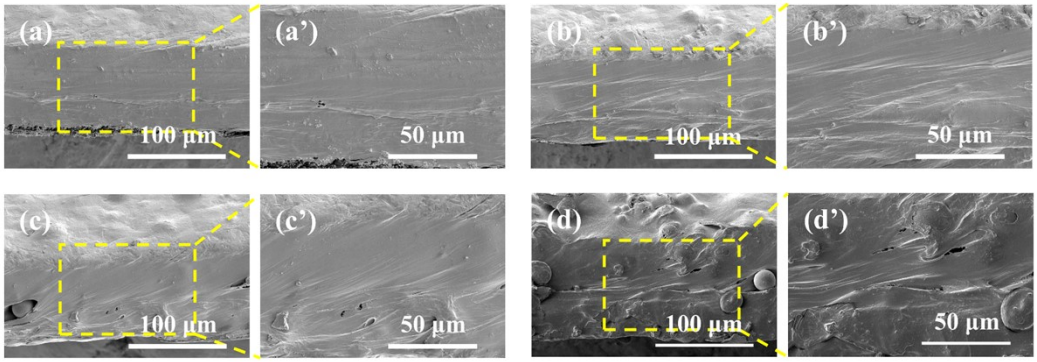

Fig. S2 The SEM images of the cross-section of (a) the PEO film and the Ag@SiO_2/PEO films with different content of the Ag@SiO_2 particles with different magnifications: (b) 17 wt%, (c) 33 wt% and (d) 50 wt %.

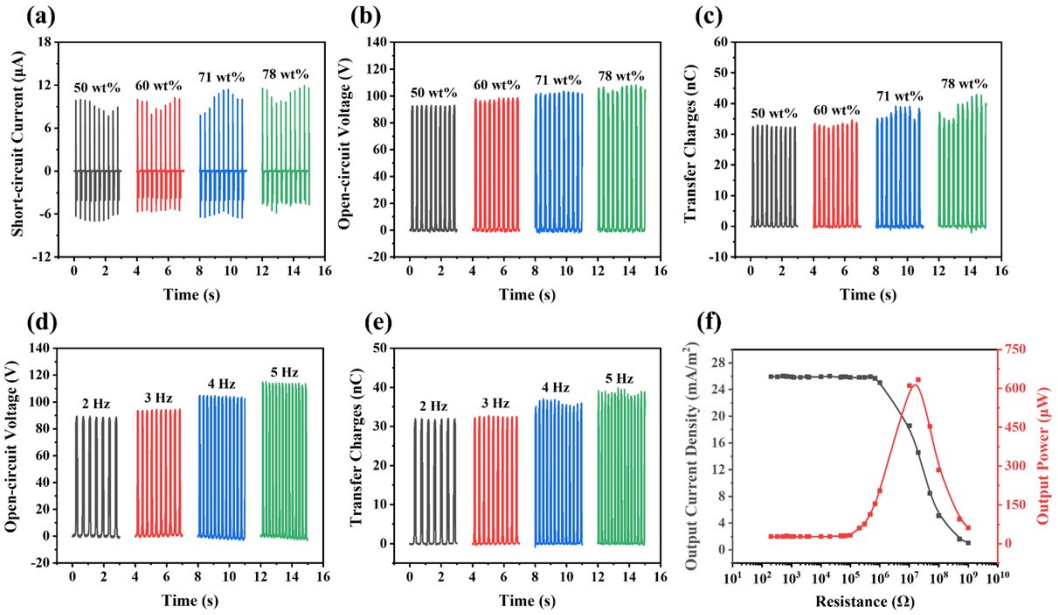

Fig. S3 The output performance of the Ag@SiO_2-PEO/Ecoflex TENGs: (a) the short-circuit current, (b) the open-circuit voltage and (c) the transfer charges of the Ag@SiO_2/PEO films based TENGs with further increasing the Ag@SiO_2 particles content. (d) The open-circuit voltage and (e) the transfer charges of the Ag@SiO_2-PEO-50 wt% film based TENG under different test frequency. (f)

The instantaneous peak value of the output current density and the instantaneous power density of the Ag@SiO_2-PEO-50 wt% film based TENG dependence of different load resistances.

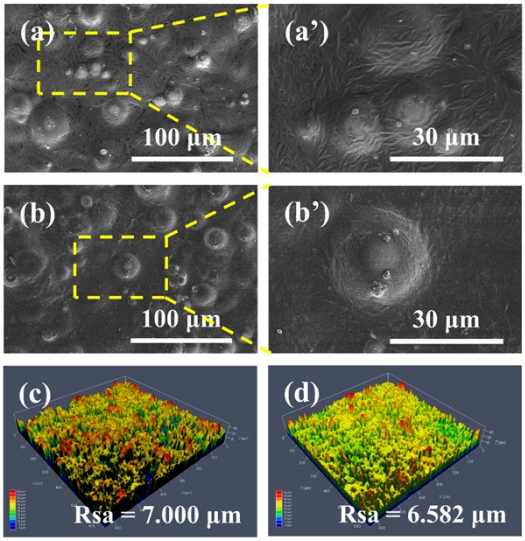

Fig. S4 The SEM images of the surface of the Ag@SiO_2-PEO-50 wt% films with different magnifications: (a) before and (b) after the cycling measurement. The LSCM images of the Ag@SiO_2-PEO-50 wt% films with the scanning dimension of 600 μm × 600 μm: (c) before and (d) after the cycling measurement.

Tab. S1 The mechanical performance of the friction materials.

Sample	Elastic Modulus (MPa)	Tensile Strength (MPa)	Elongation at Break (%)
PEO	465.95	10.82	446.08
Ag@SiO_2-PEO-17 wt%	585.61	9.56	316.22
Ag@SiO_2-PEO-33 wt%	619.89	6.72	278.14
Ag@SiO_2-PEO-50 wt%	563.13	4.79	175.3
Ecoflex	0.12	0.67	983.24

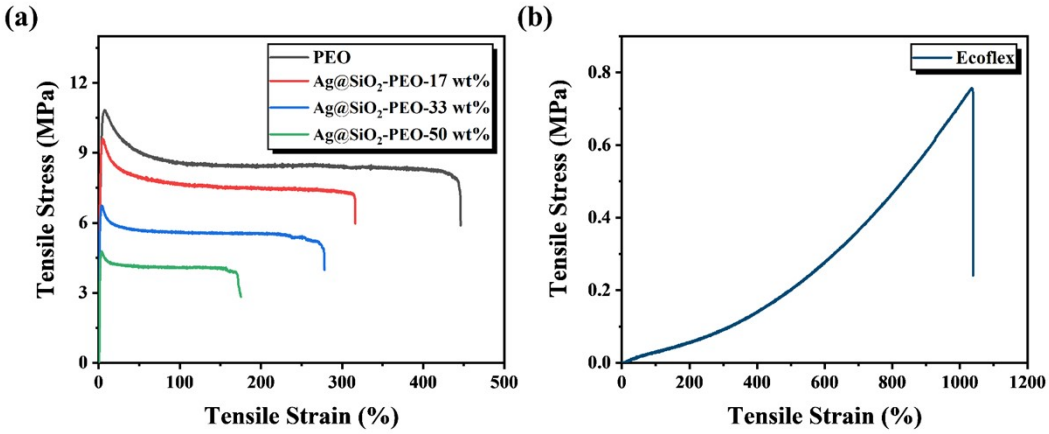

Fig. S5 The tensile stress-strain curves of (a) the Ag@SiO_2/PEO films with different Ag@SiO_2. particles content and (b) the negative materials.

$$P_D = J_s \times V = \frac{I}{s} \times V \quad (1)$$

where P_D is the power density of friction material, J_s is the output current density of friction material, I is the output current of friction material, V is the output voltage of friction material and S is the effective area of friction material.

Tab. S2 The instantaneous peak value of the output current, the output voltage, the output current density, the transfer charges and the instantaneous power density of the Ag@SiO_2-PEO-50 wt% film based TENG dependence of different load resistances.

Resistance (Ω)	Output Current (μA)	Output Voltage (V)	Output Current Density (mA/m^2)	Transfer Charges (nC)	Power Density (W/m^2)
200	10.3805	2.6813	25.95125	35.3263	0.06958
330	10.3611	2.7136	25.90275	35.3128	0.07029
510	10.416	2.6813	26.04	35.3244	0.06982
680	10.3902	2.81052	25.9755	35.3048	0.073
1×10^3	10.3676	2.6813	25.919	35.2895	0.0695
1.2×10^3	10.3355	2.74591	25.83875	35.2995	0.07095

2×10^{3}	10.3325	2.6813	25.83125	35.2899	0.06926
3.3×10^{3}	10.3809	2.6813	25.95225	35.2694	0.06959
3.9×10^{3}	10.3452	2.74591	25.863	35.196	0.07102
1×10^{4}	10.3711	2.7136	25.92775	35.1774	0.07036
2×10^{4}	10.3999	2.64899	25.99975	35.216	0.06887
4.7×10^{4}	10.3325	3.00435	25.83125	35.1714	0.07761
5.1×10^{4}	10.368	2.81052	25.92	35.2399	0.07285
6.8×10^{4}	10.3649	3.00435	25.91225	35.2385	0.07785
1×10^{5}	10.3256	3.23048	25.814	35.2212	0.08339
2×10^{5}	10.3226	5.84717	25.8065	35.1867	0.15089
3×10^{5}	10.3354	7.3655	25.8385	35.1714	0.19031
4.7×10^{5}	10.374	10.91902	25.935	35.1681	0.28318
6.8×10^{5}	10.2739	14.98943	25.68475	35.2295	0.385
1×10^{6}	10.0154	20.41664	25.0385	35.2038	0.5112
1×10^{7}	7.43428	82.07092	18.5857	34.4337	1.52535
2×10^{7}	5.8352	108.6245	14.588	33.3934	1.58461
5×10^{7}	3.38649	133.9467	8.466225	31.317	1.13402
1×10^{8}	2.04261	139.1149	5.106525	28.9941	0.71039
5×10^{8}	0.64704	146.8267	1.6176	22.1082	0.23751
1×10^{9}	0.41122	149.2634	1.02805	17.531	0.15345