Self-powered graphene-based composites for rain energy harvesting

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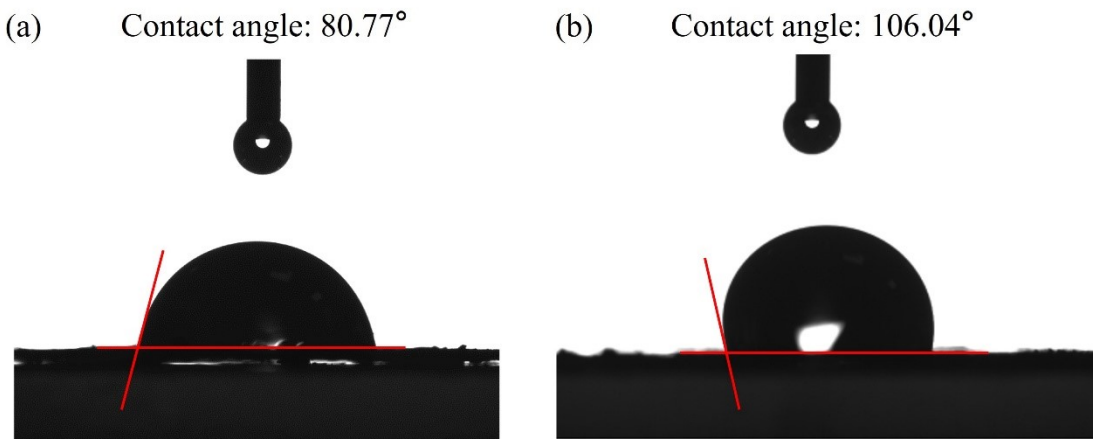

Fig. S1 The contact angles of 94 wt% G-CB/PVC films by dropping (a) 0.6 M NaCl droplet and (b) pure water, respectively.

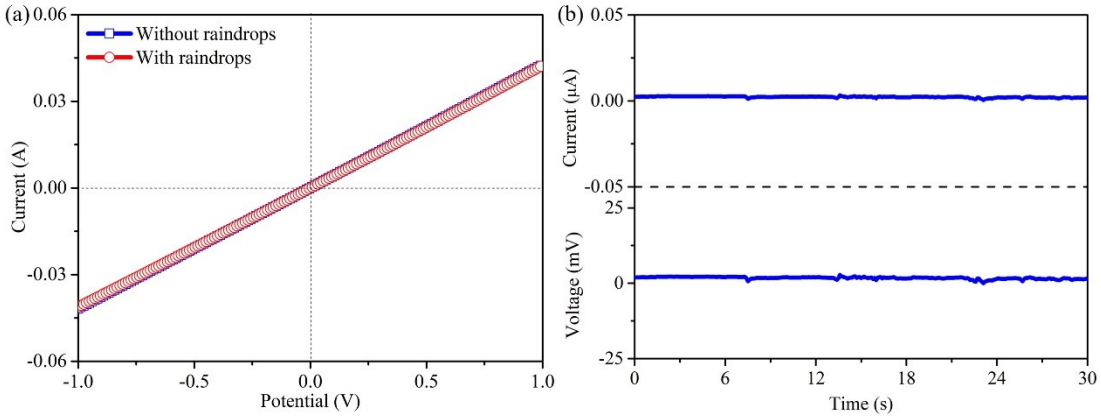

Fig. S2 (a) Linear plots of the current as a function of the voltage for 94 wt% G-CB/PVC films with and without 0.6 M NaCl solution. (b) The curve of deionized water instead of 0.6 M NaCl aqueous solution.

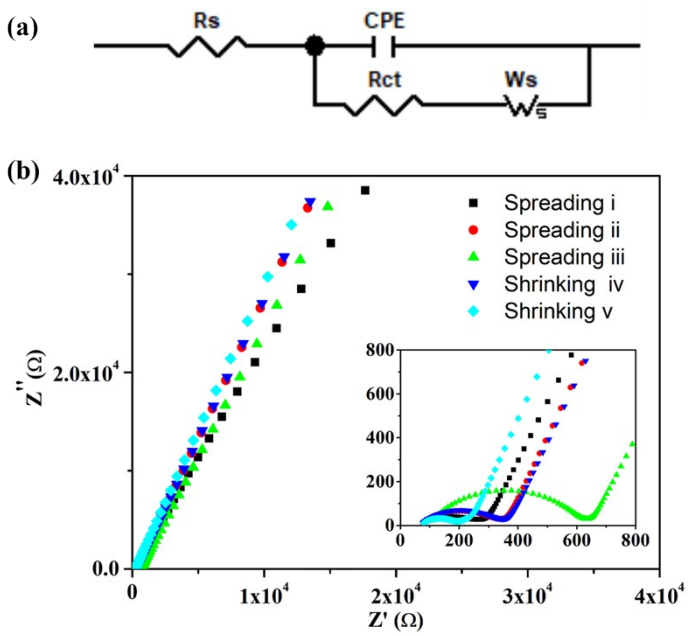

Fig. S3 EIS curve generated when raindrops spread and shrink on 94 wt% G-CB/PVC composite films.

Rs increases and subsequently decreases during the spreading/shrinking processes of raindrops, representing the adsorption/desorption behaviors between cations and electrons at the rainwater/film interface. Meanwhile, the positive charges move during raindrop spreading/shrinking processes, producing charge-transfer resistance (Rct) and charge-diffusion resistance (W). In this fashion, W has a peak value under the maximum spreading condition, leading to a similar evolution in electron migration for Rct.

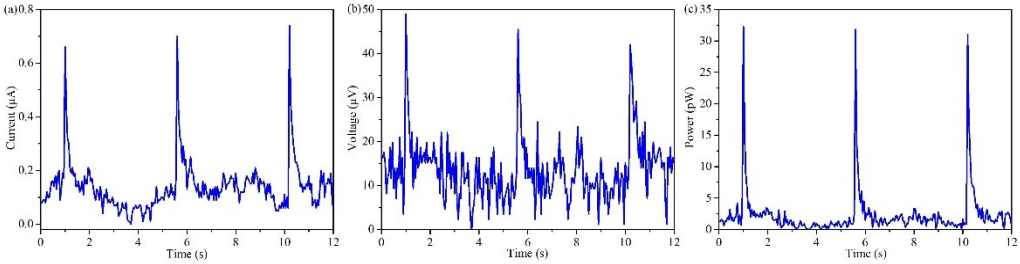

Fig. S4 The (a) current, (b) voltage and (c) power yielded by dropping real rainwater on the surface of 94wt% G-CB/PVC composite films at an injection velocity of 40 mL h^{-1}.

Table S1 The electrochemical parameters extracted from CV and EIS characterizations.

Processes	Area (cm^2)	Rs (ohm)	Rct (ohm)	W (ohm)	C (mF)
Before spreading	0	0	0	0	0
Spreading i	6	68.5	276.5	139.6	0.397
Spreading ii	12	70.6	332.8	164.5	0.921
Spreading iii	35	108.5	620.2	240.5	2.612
Shrinking iv	20	78.4	352.7	167	1.383
Shrinking v	2	62.7	183.1	93.8	0.249
Final state	0	0	0	0	0

Table S2 Electrical data produced by dropping NaCl aqueous solutions with different concentrations on 94 wt% G-CB/PVC film at an injection velocity of 60 mL h^{-1}.

Concentration (M)	Current (μA)	Voltage (mV)	Power (nW)
0.2	0.64 ± 0.07	0.05 ± 0.008	0.03 ± 0.01
0.4	1.27 ± 0.51	0.09 ± 0.011	0.11 ± 0.06
0.6	1.36 ± 0.18	0.21 ± 0.02	0.28 ± 0.03
1	4.62 ± 1.62	0.63 ± 0.05	2.91 ± 0.45
2	7.90 ± 1.50	1.08 ± 0.18	8.46 ± 0.86

Table S3 Electrical signals yielded by dropping real rain collecting from QingDao of China on the surface of G-CB/PVC film.

	Average current (μA)	Average voltage (μV)	Average power (pW)
Real rain	0.23 ± 0.04	29.90 ± 8.90	13.36 ± 3.50