Energy Materials

Supplementary Materials

Synergistic effect study of g-C_3N_4 composites for high-performance triboelectric nanogenerators

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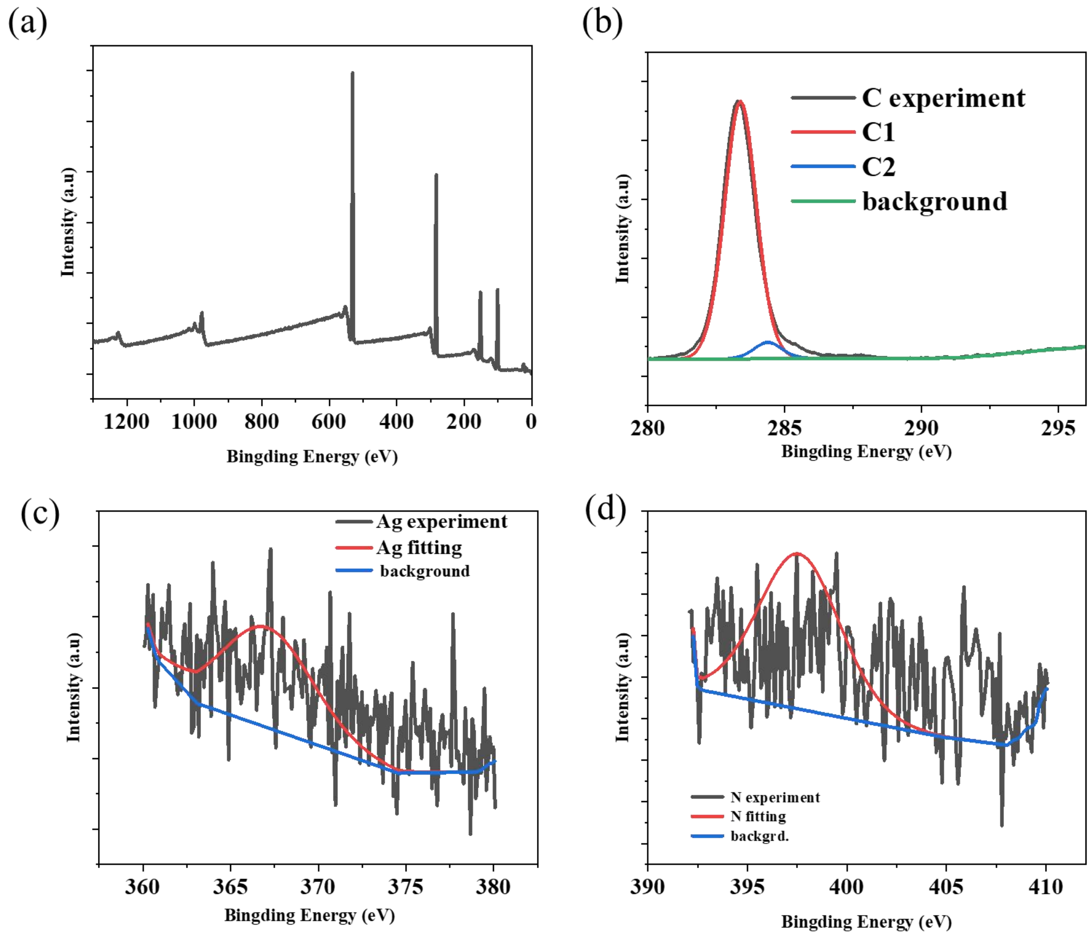

Figure S1. (a) XPS survey spectra of Ag/g-C_3N_4 PDMS composite. High-resolution XPS spectrum showing the binding energy of (b) C, (c) Ag, and (d) N electrons.

In Figure S2, doping nickel-coated CNTs with g-C_3N_4 at a 1:1 ratio in PDMS composite resulted in improved TENG performance, with *Voc, Isc*, and *Qsc* reaching 70 V, 3.5 µA, and 45 nC, respectively, doubling output compared to pure nickel-coated CNTs. Similarly, 1:1 ratio of multiwall CNTs and g-C_3N_4 yielded a twofold increase in electrical parameters, with *Voc, Isc,* and *Qsc* at 140 V, 6 µA, and 100 nC, respectively. For MXene/g-C_3N_4 PDMS composites, the optimal electrical performance was reached at a 1:1 ratio, with peak *Voc* of 20 V and *Isc* of 0.45 µA, while the highest *Qsc* of 8 nC was observed at a 4:1 ratio. The comparative investigation found that silver dopants outperformed silver oxide in all parameters, while hybrid dopants consistently surpassed the performance of individual dopants. Our experimented dopants were either conductive (metal particles, carbon nanotubes) or semiconductive ($g\text{-}C_3N_4$, MXene).

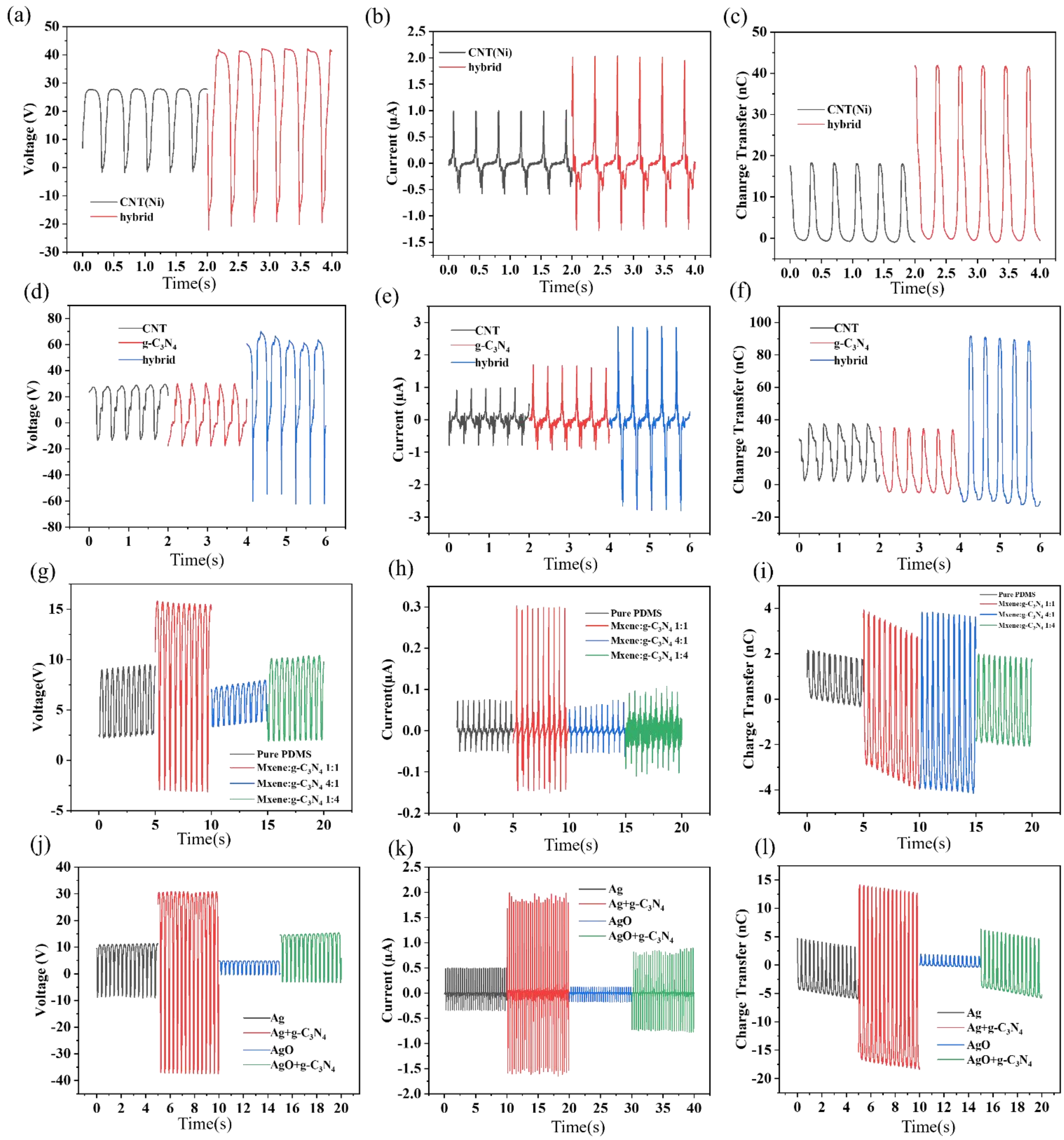

Figure S2. (a) Open circuit voltage, (b) Short circuit current, and (c) Charge Transfer of TENG with nickel-coated carbon nanotubes and nickel-coated carbon nanotubes together with $g\text{-}C_3N_4$. (d) Open circuit voltage, (e) Short circuit current, and (f) Charge Transfer of TENG with pure multiwall carbon nanotubes, pure $g\text{-}C_3N_4$, hybrid multiwall carbon nanotubes with $g\text{-}C_3N_4$. (g) Open circuit voltage, (h) Short circuit current, and (i) Charge Transfer of PDMS TENG doped with different ratios of MXene and $g\text{-}C_3N_4$. (j) Open circuit voltage, (k) Short circuit current, and (l) Charge Transfer of PDMS TENG doped with Ag, Ag and $g\text{-}C_3N_4$, AgO, AgO and $g\text{-}C_3N_4$.

Figure S3 demonstrated one application as TENG adhered to the elbow generating different levels of voltage with different movements, 1.5 V from total stretching (Figure S2a) to bending angle 45°, 0.3 V from stretching to 100° fold (Figure S2b), and 0.5V from100° to 45° bending (Figure S2c).

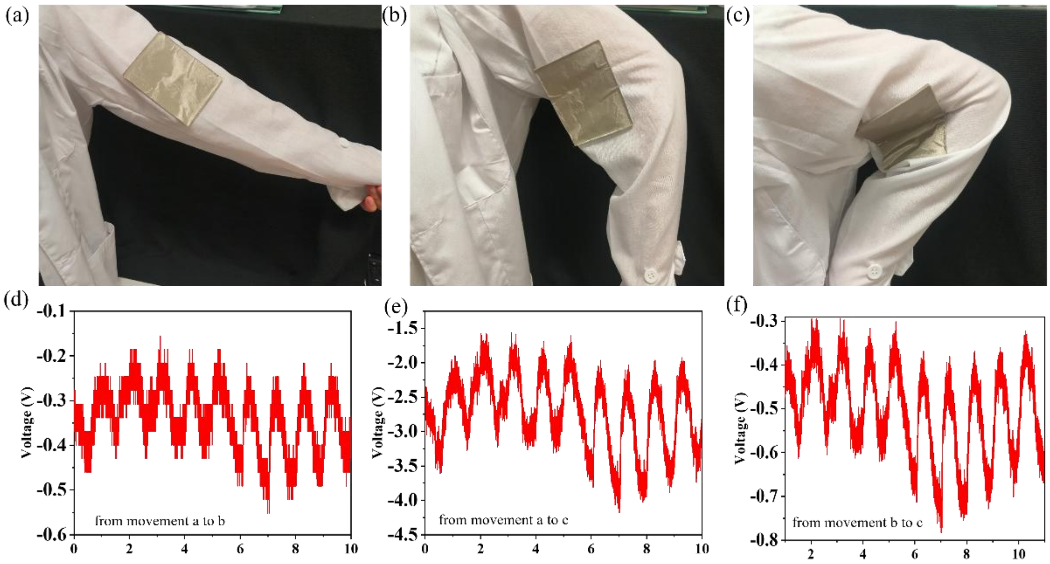

Figure S3. Monitoring elbow bending angles by pasting hybrid dopant/PDMS TENG on the elbow (a) stretching, (b) moving to 100°, and (c) bending to 45°. Voc generated while moving (d) between a to b, (e) between a to c, and (f) between b to c.

Table S1. Comparison with other similar works

Dopants	**Substrate**	**Size (cm²)**	**V (V)**	**I (μA)**	**Power density (mW/m²)**	**Ref.**
CNT on surface	PDMS/steel	12×10	1.7	-	-	[1]
Aligned Li	ZnO nanowire	-	1.6	-	-	[2]
Ag	ZnO nanowire	10	2	0.5	-	[3]

TiO_2	PVDF	9×7.5	8.8	-	16	4
MAPbBr	PVDF	9.5×8.5	5	-	2.8	5
Vitamin B_2	PVDF	-	0.27	-	-	6
ZnO	PVDF	3×3	1.7	-	2	7
ZnS	PVDF	8×8	6	-	1.5	8
Cu nanowire	PDMS	2×2	45	-	134	9
FCB	PDMS	5×5	50	4	12	10
Ag+ g-C_3N_4	PDMS	2×2	92	4.2	1,450	This work
CNT+ g-C_3N_4	PDMS	2×2	122	5.8	1,502	This work

Video S1: Hybrid dopant/PDMS TENG lighting up 40 LEDs connected in series by gentle hand slapping

Video S2: Real-time intelligent system of hybrid dopant/PDMS TENG, wireless Bluetooth module and mobile software application transferring signal wirelessly

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