

Electronic Supplementary Information

A high-output flexible triboelectric nanogenerator based on polydimethylsiloxane/three-dimensional bilayer graphene/carbon cloth composites

Yongteng Qian,^a Minkyun Sohn,^a Wen He,^a Hyunje Park,^a K. R. V. Subramanian,^b and Dae Joon Kang^{*,a}

^aDepartment of Physics and Interdisciplinary Course of Physics and Chemistry, Sungkyunkwan University, 2066, Seobu-ro, Jangan-gu, Suwon-si, Gyeonggi-do 16419, Republic of Korea

^bDepartment of Mechanical Engineering, Ramaiah Institute of Technology, MSR Nagar, MSRIT Post, Bangalore 560054, India

*Author to whom correspondence should be addressed: djkang@skku.edu (Tel.: +82-31-290-5906)

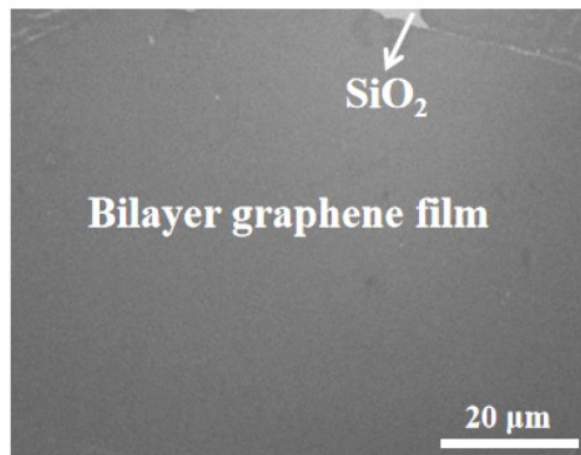


Figure S1. SEM image of BLG film on SiO₂ substrate

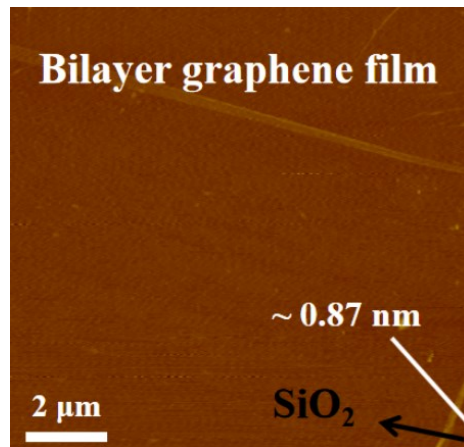


Figure S2. AFM image of BLG film on SiO_2 substrate

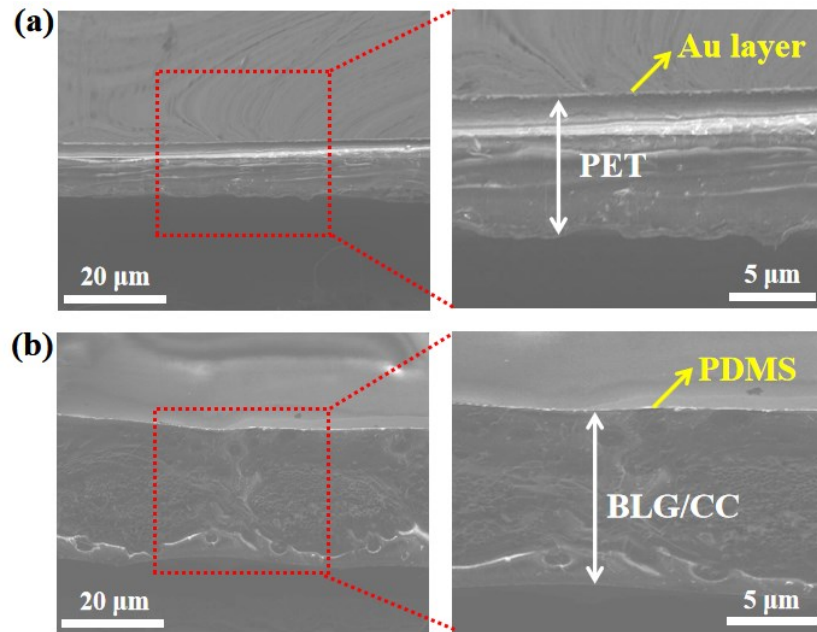


Figure S3. Cross-sectional SEM images of (a) top and (b) bottom electrodes of FTENG

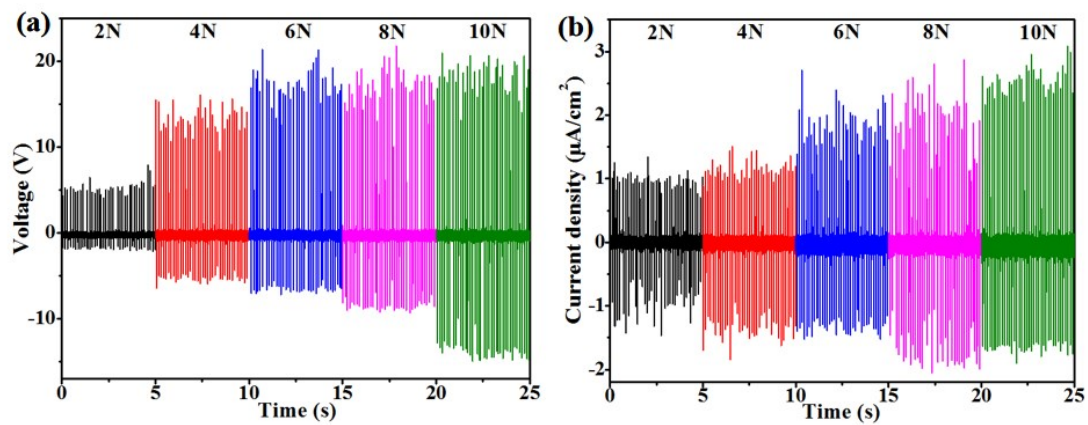


Figure S4. (a) The output voltage and (b) current density of PDMS/CC-based FTENG at driving frequency of 3 Hz under various compressive forces

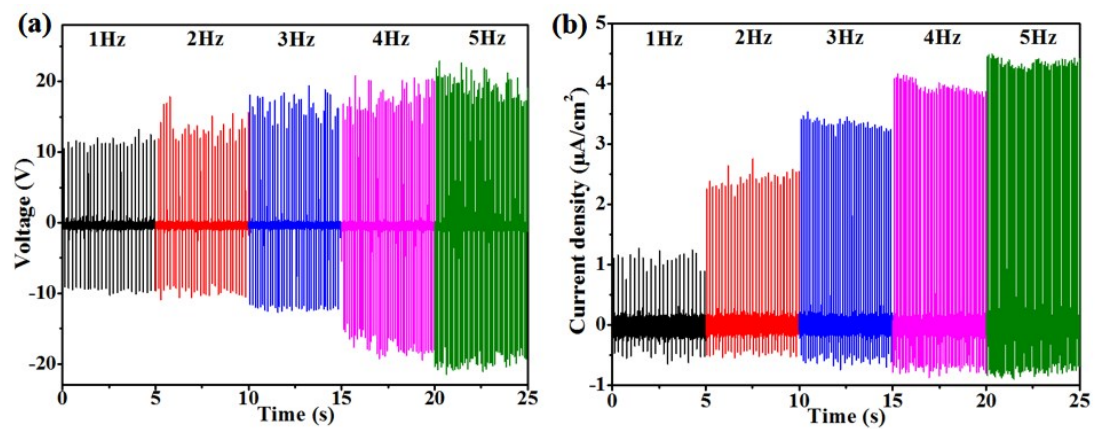


Figure S5. (a) The output voltage and (b) current density of PDMS/CC-based FTENG under driving compressive force of 6 N at various frequencies

Table S1. Output performance of FTENG under different vertical forces

PDMS/3D BLG/CC-based FTENG (1.0 cm×1.0 cm)				
Vertical force was varied (2, 4, 6, 8 and 10 N) at the same frequency (3 Hz).				
Force (N)	Output voltage (V)	Current density ($\mu\text{A cm}^{-2}$)	Power (mW)	Power density (mW cm^{-2})
2	13.5	3	0.041	0.041
4	18	4.3	0.077	0.077
6	40	6.3	0.252	0.252
8	49	7.8	0.382	0.382
10	57	8.6	0.490	0.490

PDMS/CC-based FTENG (1.0 cm × 1.0 cm)				
Vertical force was varied (2, 4, 6, 8 and 10 N) at the same frequency (3 Hz).				
Force (N)	Output voltage (V)	Current density ($\mu\text{A cm}^{-2}$)	Power (mW)	Power density (mW cm^{-2})
2	10.1	1.82	0.018	0.018
4	15.2	2.5	0.058	0.058
6	24.5	3.1	0.076	0.076
8	26.3	3.8	0.099	0.099
10	33.5	4.2	0.140	0.140

Table S2. Output performance of FTENG at different vertical frequencies

PDMS/3D BLG/CC-based FTENG (1.0 cm×1.0 cm)
Driving frequency was varied (1, 2, 3, 4, and 5 Hz) under the same vertical force (6 N).

Frequency (Hz)	Output voltage (V)	Current density ($\mu\text{A cm}^{-2}$)	Power (mW)	Power density (mW cm^{-2})
1	38	3.7	0.141	0.141
2	48.5	4.5	0.218	0.218
3	53	6.3	0.334	0.334
4	61	7.8	0.476	0.476
5	70	9.3	0.651	0.651

PDMS/CC-based FTENG (1.0 cm × 1.0 cm)
Driving frequency was varied (1, 2, 3, 4, and 5 Hz) under the same vertical force (6 N).

Frequency (Hz)	Output voltage (V)	Current density ($\mu\text{A cm}^{-2}$)	Power (mW)	Power density (mW cm^{-2})
1	20	1.6	0.032	0.032
2	21.9	2.8	0.061	0.061
3	29	3.9	0.113	0.113
4	35.5	4.6	0.163	0.163
5	39	5.1	0.199	0.199
