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

Supporting Information

Output Enhanced Compact Multilayer Flexible Nanogenerator for Self-Powered Wireless Remote System

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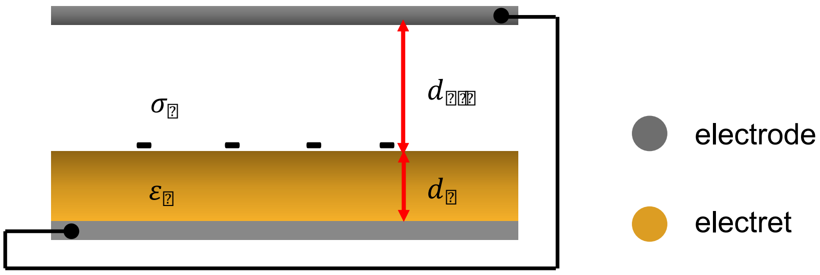
Note S1

Here we discuss the relation between, ε_e and d_e. As mentioned, d_e is the thickness of the electret, σ_e is maximum surface charge density of the electret and ε_e is the dielectric constant of the electret. We established a model as follow.



Schematic S1

In the model, the top electrode can be freely moved up or down, without touching the up surface of the electret. It's noticed there is voltage exists between the top electrode and the top surface of the electret. If the airgap between the top electrode and the top surface of the electret will not breakdown wherever the top electrode is, we define the maximum possible electret surface charge density as σ_e.

Paschen's Law perfectly describes the relationship between the breakdown voltage and airgap distance. The result shows the breakdown point of the air is 327 V at the airgap distance of 7.5 μm.

Thus the breakdown electric field intensity in the air and in the electret is:

$$E_{air} = \frac{327V}{7.5\mu m}, E_{electret} = \frac{327V}{d_e}$$

The maximum surface charge density of the electret σ_e is given by Gauss Law.

$$\sigma_e = \varepsilon_0 \varepsilon_{air} E_{air} + \varepsilon_0 \varepsilon_{air} E_{electret}$$

Table S1

Parameters for calculating the maximum power output of CMFN

Parameters	Value
V	0.005 m s^{-1}
ε_0	8.85×10^{23}
ε_r	2.3
d_{airmin}	$0.1 \times d_{air}$ (t=0)
$d_{electret}$	30 μm
$d_{substrate}$	30 μm
V_{min}	327 V

Supplementary Figures

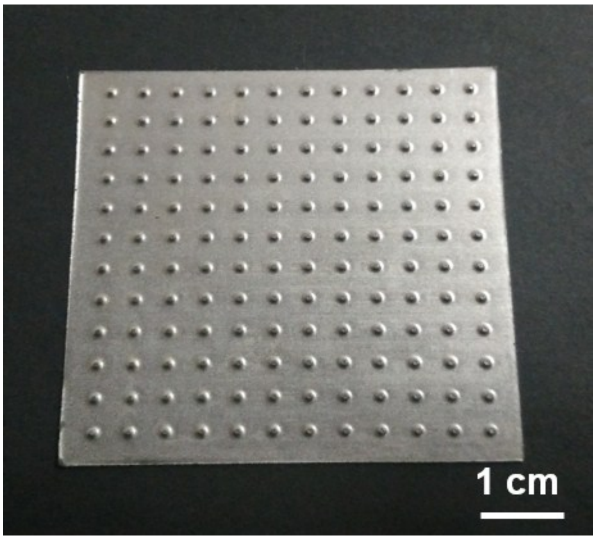


Figure S1 The digital picture of the template in the hot press process

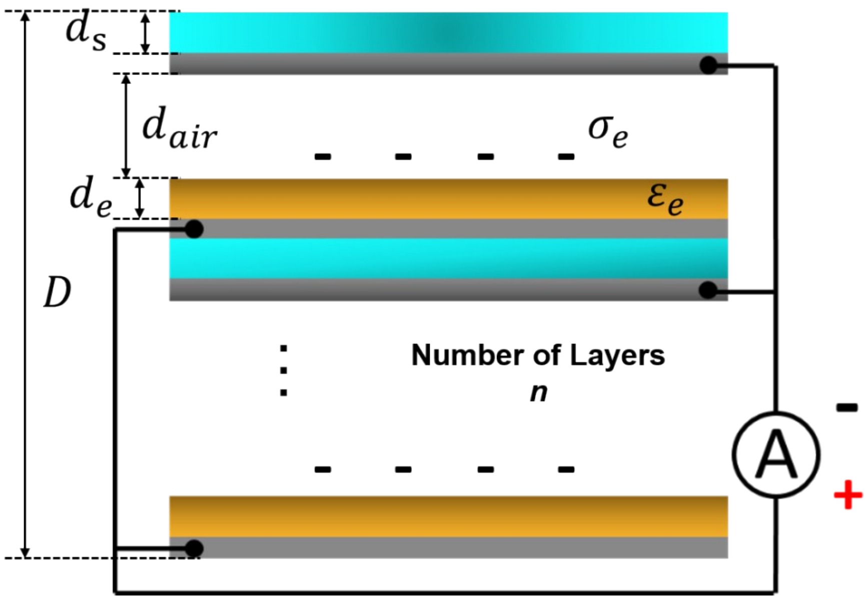


Figure S2 The enlarged schematic diagram for a CMFN.

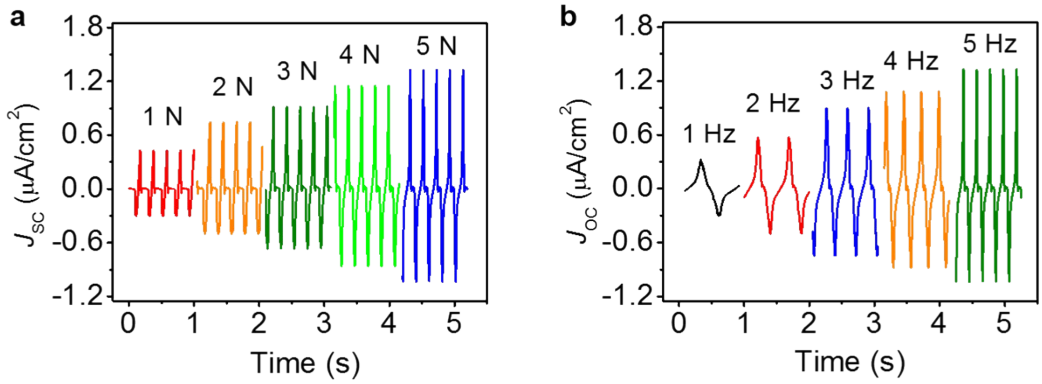


Figure S3 Output current density curve for (a) different force under a stimulation of 5 Hz and (b) different frequency under a stimulation of 5 N.

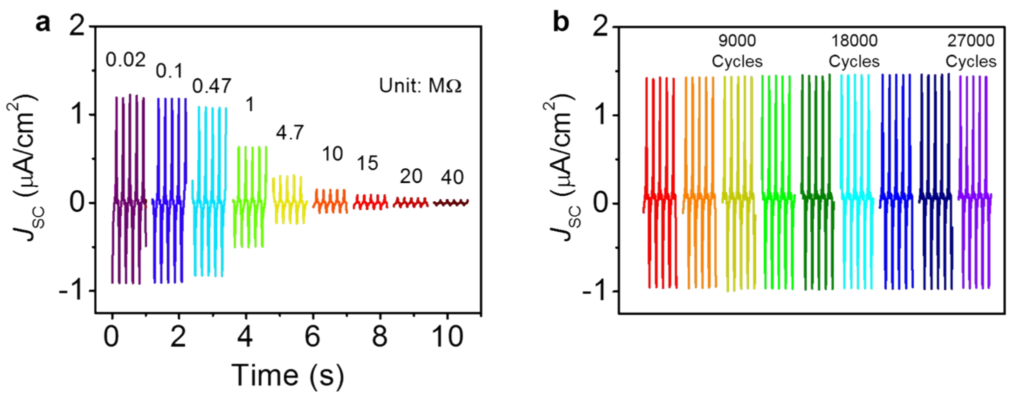


Figure S4 Output current density curve for (a) different load resistance under a stimulation of 5 Hz and 5 N. (b) 27000 cycles repeating power generation.

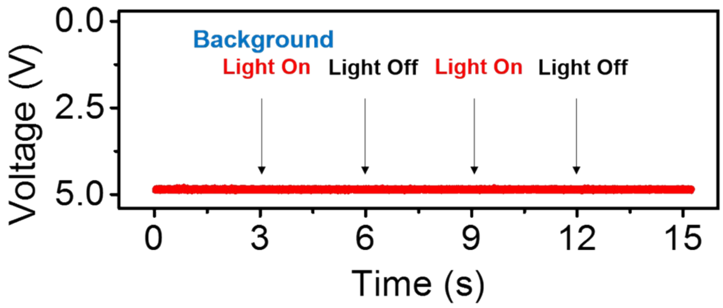


Figure S5 The control voltage signal in the receiving system when turn on/off the background light.