Supporting Information for **"Fabrication of Soft and Wearable Electrostatic Generator Based on Streaming Electrification"**

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Figure S1

Experimental system: (A) overall view and (B) generator part.

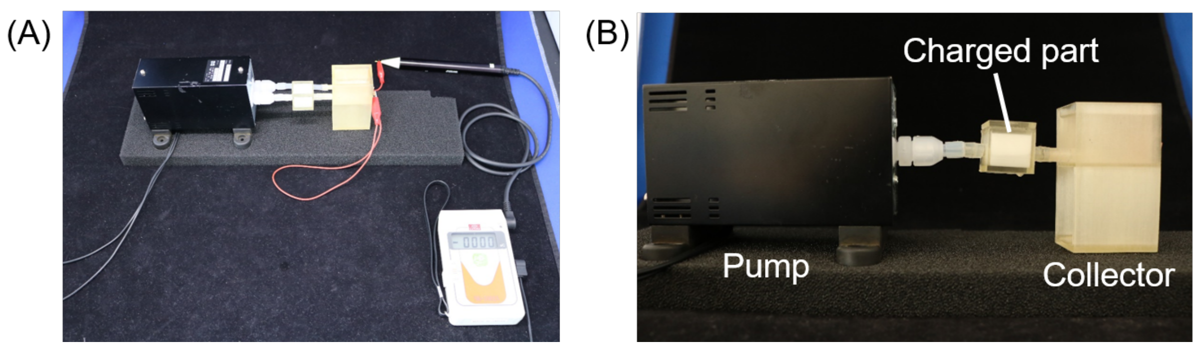


Figure S2

Photograph of charged part: (A) empty, (B) filled with melamine sponge, and (C) filled with urethane sponge.

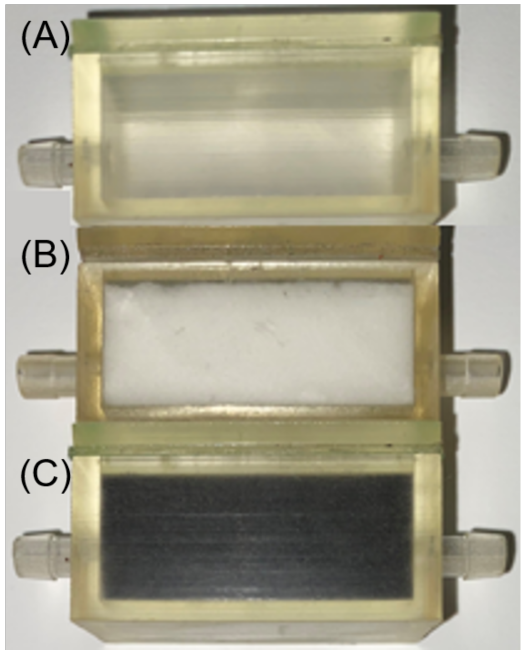


Figure S3

Design of sponge case: (A) lengths of 1, 2, and 4 cm, (B) 3D CAD model, and (C) 3D-printed parts.

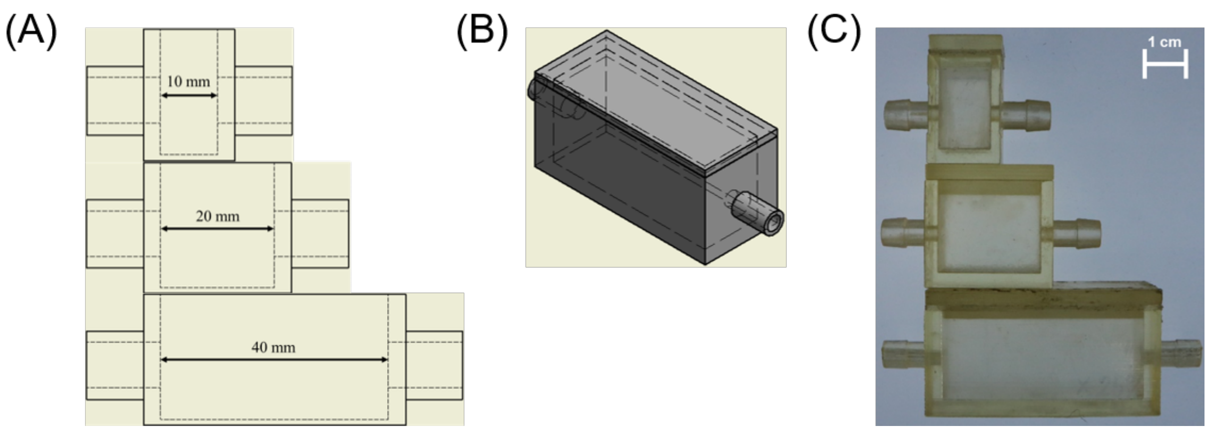


Table S1

Measurement conditions .

Figure S4

Relaxation of electric charge. When Novec 7300 flows into a melamine sponge, the melamine sponge becomes positively charged and Novec 7300 becomes negatively charged. When Novec 7300 flows into the positively charged melamine sponge, the opposite sign charges recombine with each other and the amount of charge decreases. We guess that relaxation of charge due to recombination to be the reason for the decrease in charge generation when the contact time is long.

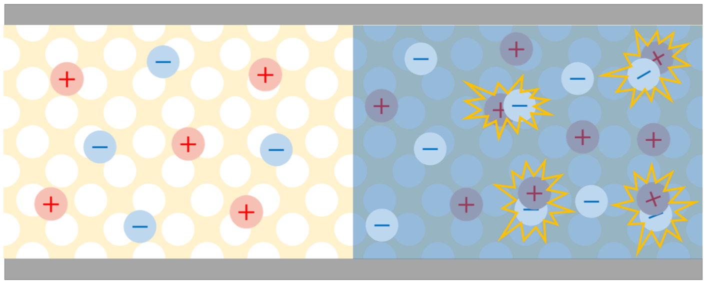
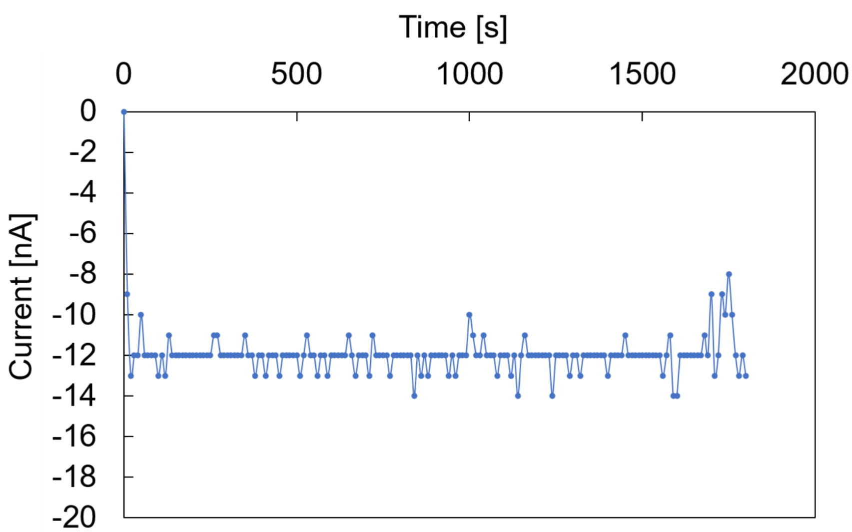


Figure S5

Durability experiment on the SEG. The SEG was directly connected to the digital multimeter to measure current and driven for 1800 seconds. The output current did not change much before the liquid volatilized.



Equation S1

From Gauss's law, we get

$$\int_S E \cdot dS = \frac{Q}{\varepsilon} \ .$$

From Coulomb's law, we get

$F = \frac{1}{4\pi\epsilon} \cdot \frac{Q_1 Q_2}{|r_1 - r_2|} \cdot \frac{r_1 - r_2}{|r_1 - r_2|^2} .(1)$

From the model in Figure 3F, we get

where the force experienced by the charge at position A from that at position B is

$F_{AB} = \frac{1}{4\pi\varepsilon} \cdot \frac{Q_1 Q_2}{|\overrightarrow{OA} - \overrightarrow{OB}|} \cdot \frac{\overrightarrow{OA} - \overrightarrow{OB}}{|\overrightarrow{OA} - \overrightarrow{OB}|^2}.(2)$

In addition, it is essential to note that the moment resulting from F_{AB} around O is

$\overrightarrow{\Delta N} = \overrightarrow{OA} \times \overrightarrow{F_{AB}}.(3)$

By setting the total moment around O=0, we get

$\overrightarrow{N} = \sum_a \sum_b \overrightarrow{OA} \times \overrightarrow{F_{AB}} = mg \cdot \frac{h}{2} \cdot \sin\theta.(4)$

On substituting this in Equation 4, we get , we get

Therefore, the relationship between the angle of the electroscope leaves and the charge density is as follows:

$\rho = \sqrt{\frac{\sin\theta}{\sum_a \sum_b \overrightarrow{OA} \times \frac{\overrightarrow{OA} - \overrightarrow{OB}}{|\overrightarrow{OA} - \overrightarrow{OB}|^3}} \cdot \frac{mgh}{2} \cdot \frac{4\pi\varepsilon}{\Delta r^2}}(5)$

where, ε is the permittivity of air, g is the acceleration due to gravity, m is the leaf mass, h is the leaf length, and O is the leaf junction point.

Figure S6

(A) Photograph of fluorescent lamp lit using SEG: (i) before being driven by SEG and (ii) after being driven by SEG. (B) Inside the fluorescent lamp: Electrons supplied by SEG are emitted from the electrodes of the lamp. The mercury vapor reflects the electrons that produce ultraviolet light, which is emitted by the luminescent material coated on the inner surface of the glass.

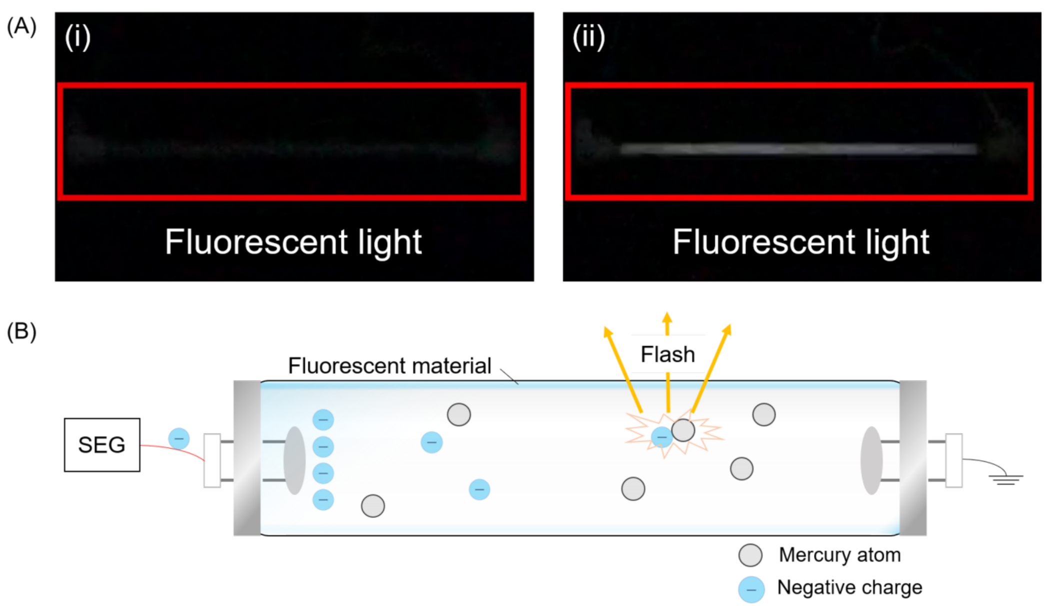
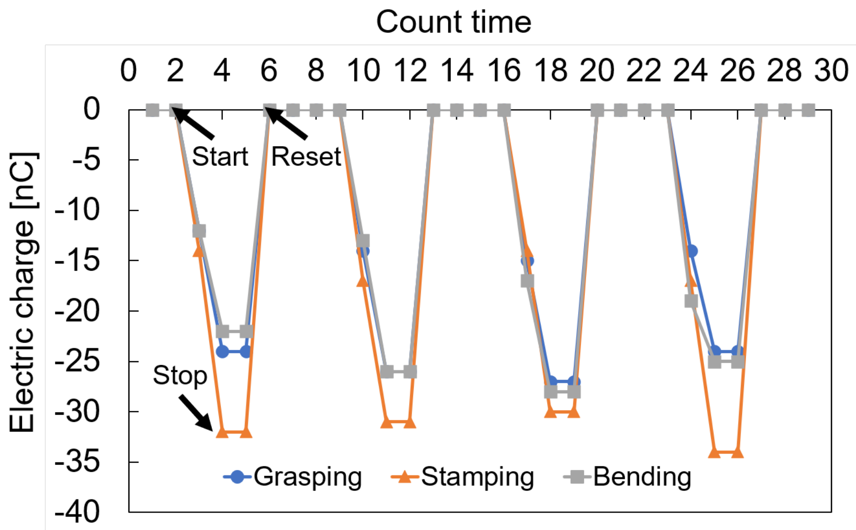


Figure S7

Amount of charge collected for each device (grasping, stamping, bending) fabricated using the SEG. “Start” is the point of the device activated. “Stop” is the point of the device deactivated. “Reset” is the point of the measurement system to be reset.



Supplementary Videos

Video S1

Rich media available at https://youtu.be/PS0l2riEGa0

Video S2

Rich media available at https://youtu.be/4eBQimxA1SU

Video S3

Rich media available at https://youtu.be/IbblsYSjFpY

Video S4

Rich media available at https://youtu.be/AG_vg6SeDUg

Video S5

Rich media available at https://youtu.be/sH1aWT8QWR8

Video S6

Rich media available at https://youtu.be/WX-fSDsUCJw