Hard coating films of fluorine-containing ladder-like structured polysilsesquioxane as negative triboelectric materials for high-performance triboelectric generators

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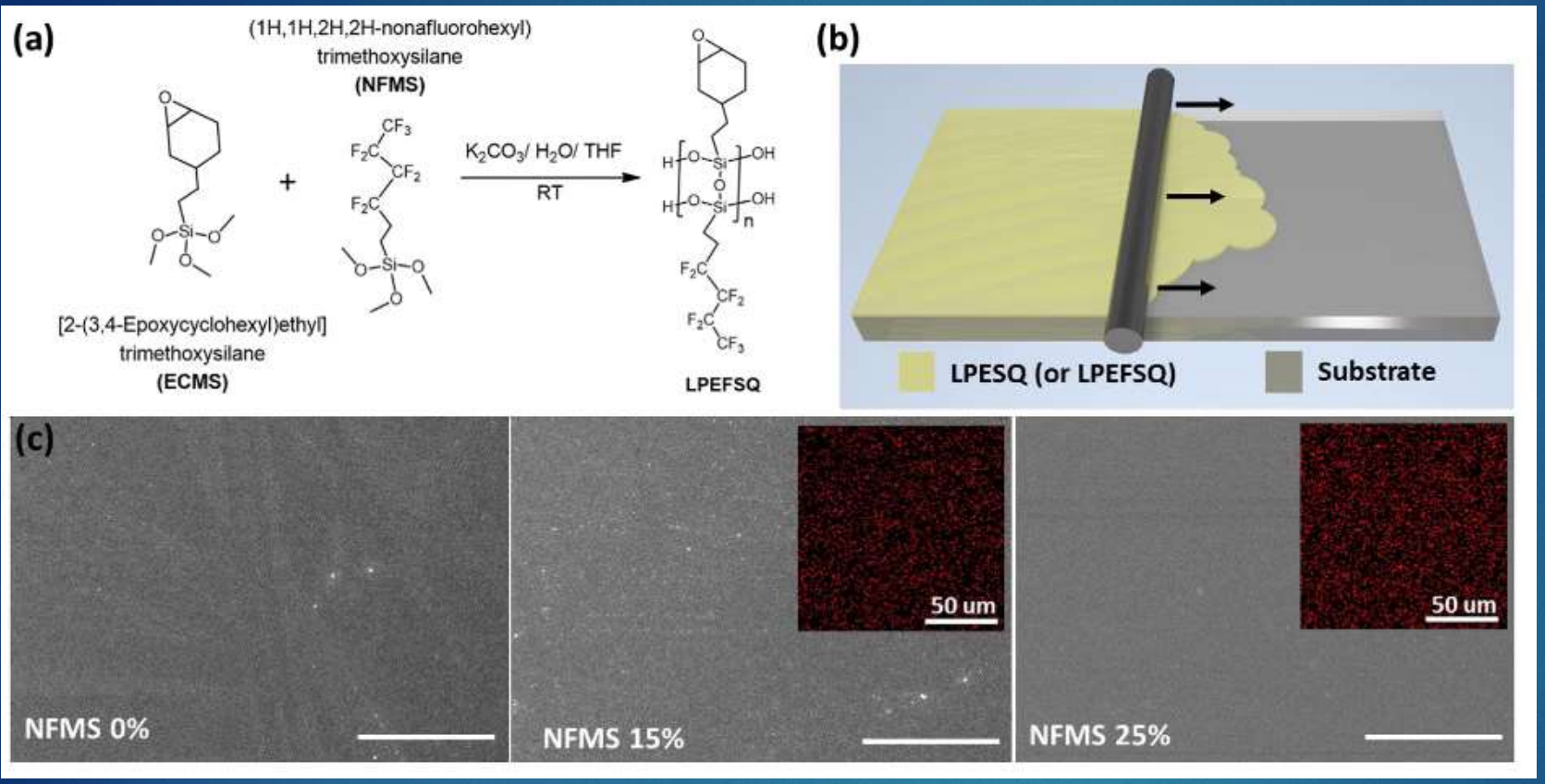
Fabrication and Characterization of LPEFSQ Films.



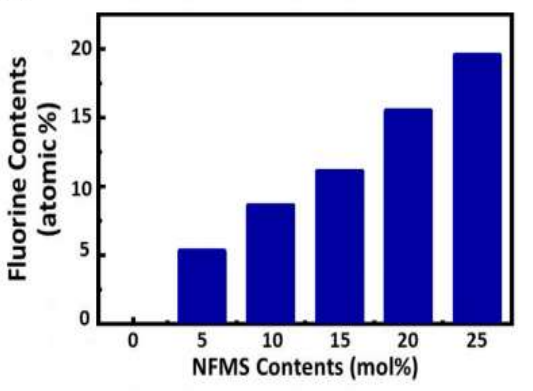
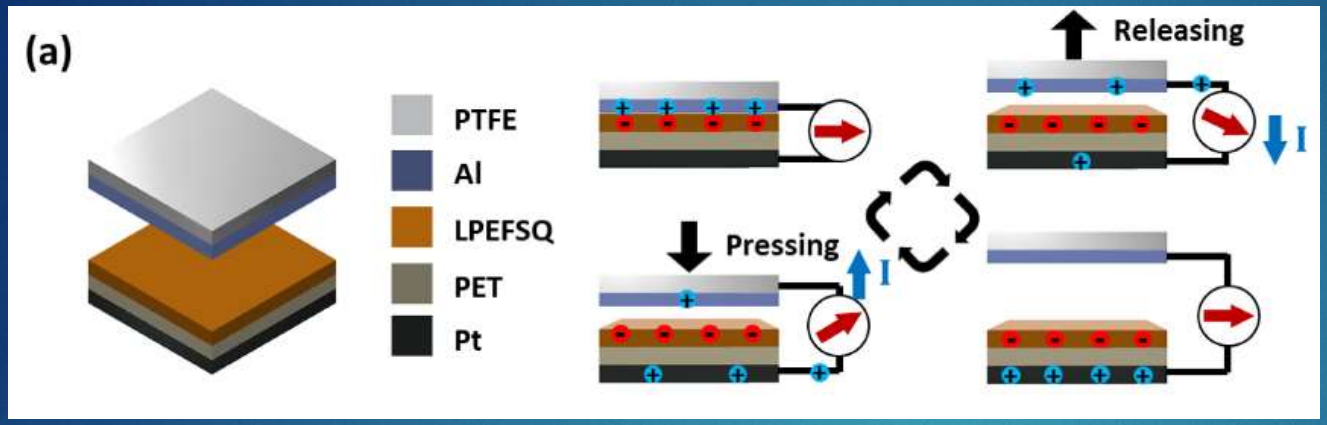


Fig. 1. Fabrication and characterization of LPEFSQ films. (a) Synthetic scheme of LPEFSQs. (b) Schematic illustration of LPEFSQ film fabrication with bar-coatingmethod. (c) Scanning tunneling microscope images of LPEFSQ films with various NFMS mol%. Insets show EDX mapping data representing fluorine contents withred-colored dot

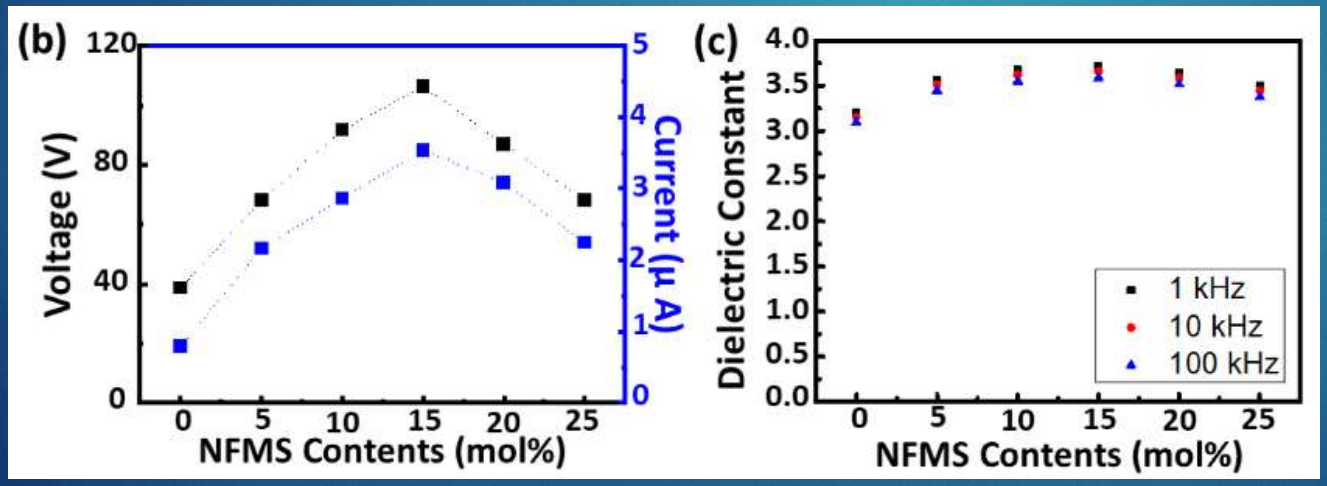
Electrical characteristics of TENGs based on hard coated LPEFSQ Films.



Frequency = 1.3 Hz

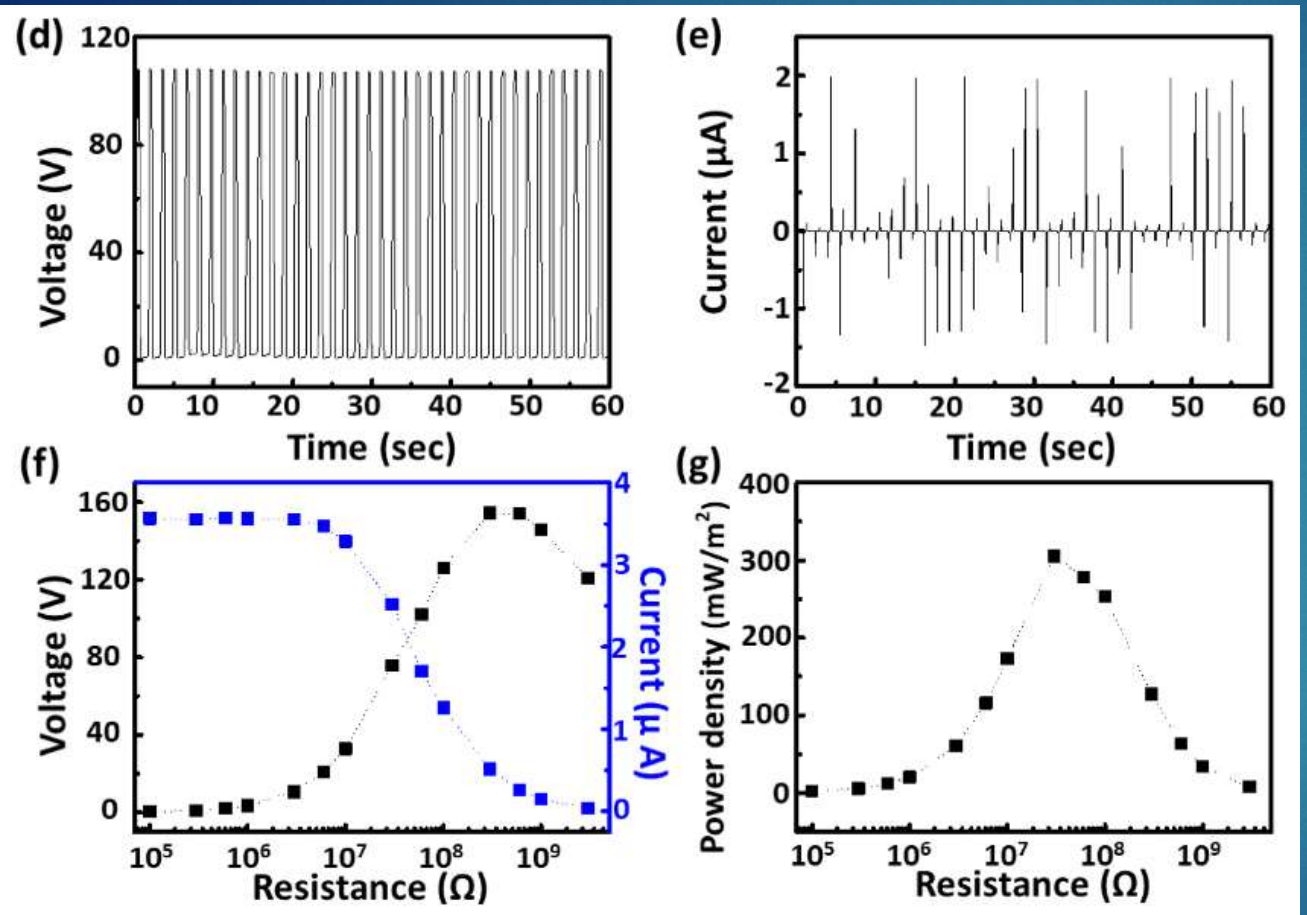
Sample Size : 2.5 cm X 2.5 cm

(a) Schematic illustration of a structure of the TENG and its energy conversionprocess.



(a) Schematic illustration of a structure of the TENG and its energy conversion process. (b) Voltage and current outputs of TENGs depending on NFMS mol%. (c) Dielectric constant of LPEFSQ films depending on NFMS mol%

Voltage and Current output of TENGs based on hard coated LPEFSQ Films.



Frequency = 1.3 Hz

Sample Size : 2.5 cm X 2.5 cm

$V_{peak-to-peak} = 108\ V$

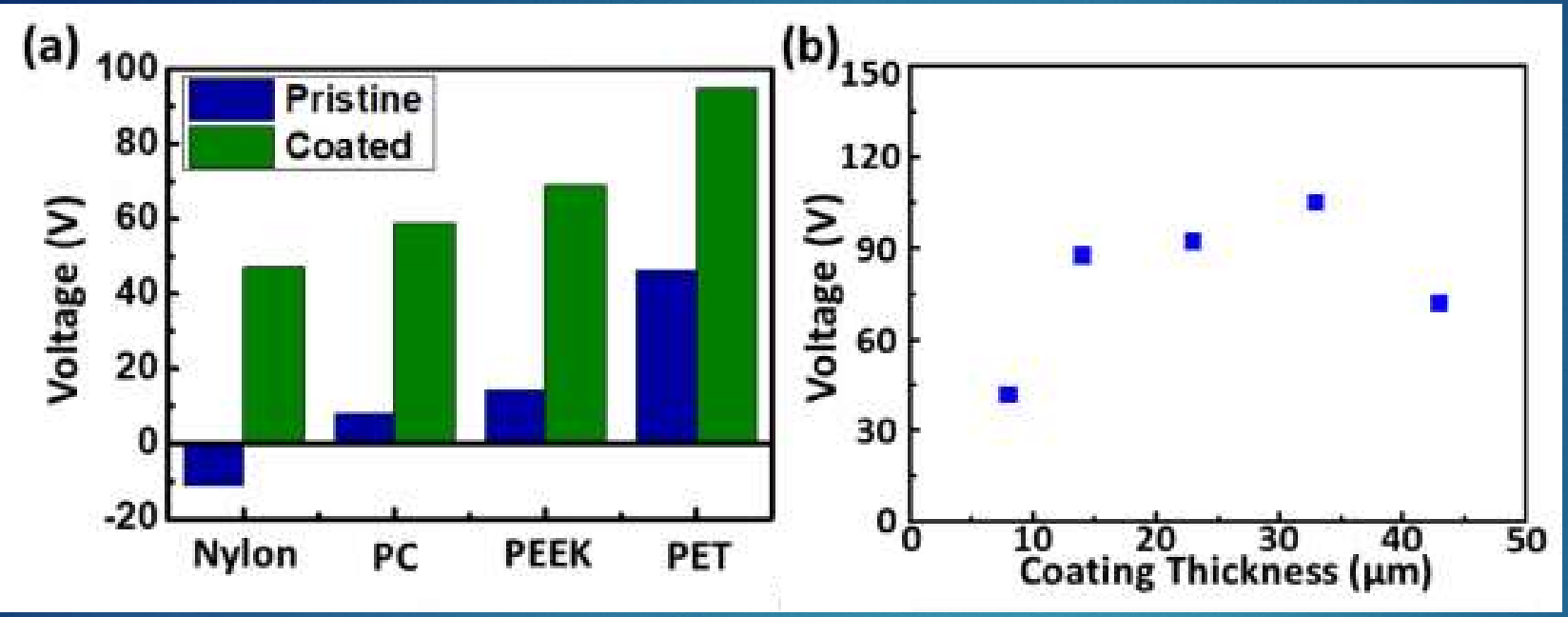
$I_{peak-to-peak} = 3.37 \mu A$

PTFE-Al V = 15 ~ 20 V

The maximum power density was 305 mW/m^2 at a load resistance of ~60 MΩ

(d) Open-circuitvoltage Voc and (e) short-circuit current Isc outputs of a TENG based on a LPEFSQ-15 film. (f) Summary of peak-to-peak Voc , Isc outputs of a LPEFSQ-15-TENG in the function of a load resistance. (g) Summary of power outputs of a LPEFSQ-15-TENG in the function of a load resistance.

Effects of supporting substrates and coating thickness of LPEFSQ-15 film in TENG outputs.

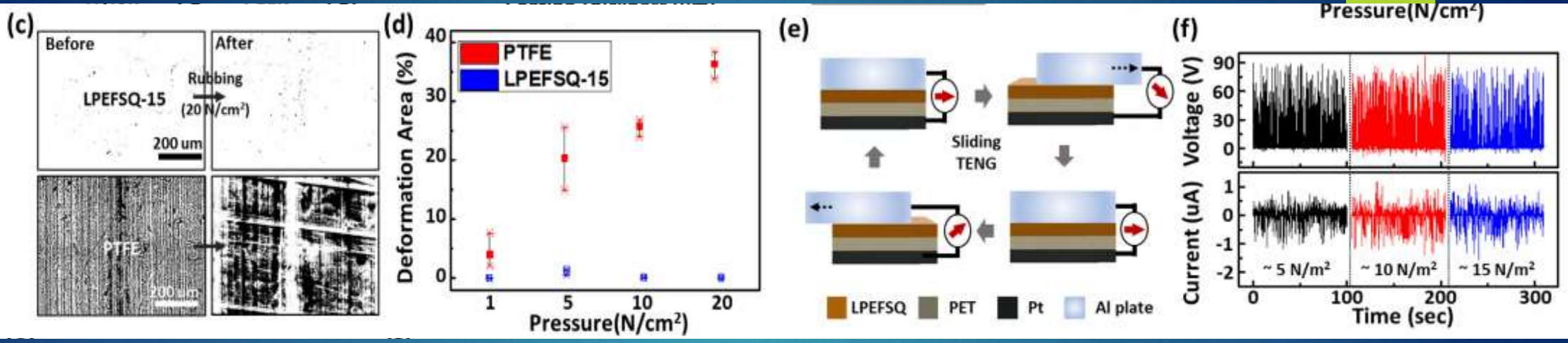


Sample Size : 2.5 cm X 2.5 cm

Frequency = 1.3 Hz

(a) Open-circuit voltage (Voc) outputs of TENGs based on various polymeric substrates with LPEFSQ-15 coating. (b) Voc outputs of TENGs with different thickness of LPEFSQ-15 films on a PET substrate.

Effects of supporting substrates and coating thickness of LPEFSQ-15 film in TENG outputs.



Frequency = 0.6 ~ 2.0 Hz

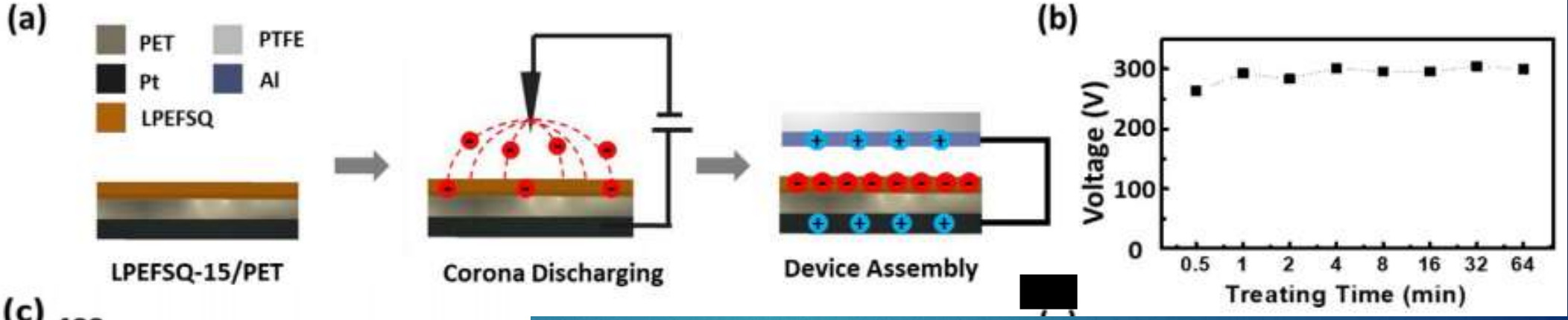
Sample Size : 2.5 cm X 2.5 cm

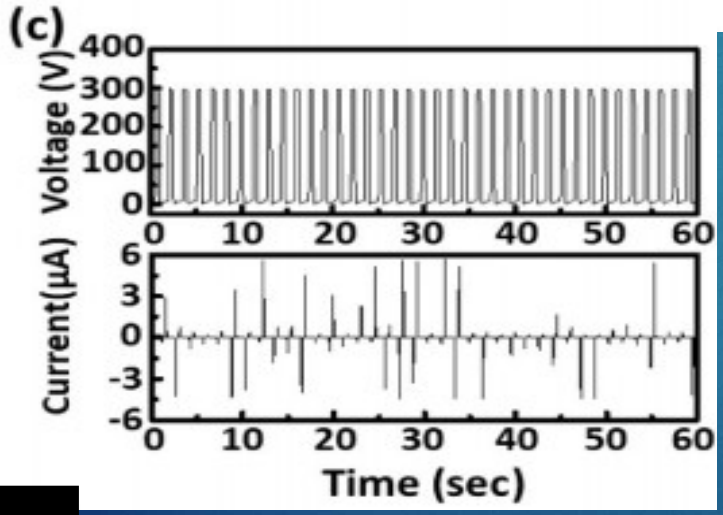
$$V_{peak-to-peak} = 90\ V$$

$$I_{peak-to-peak} = 2\mu A$$

(c) Falsely-colored optical micrograph images of LPEFSQ-15 and PTFE films before and after contact rubbing process. (d) Analysis of deformation area depending on contact pressure in rubbing process. (e) Sliding-mode TENG applications with a LPEFSQ-15 film and Al plate. (f) Open-circuit voltage (Voc) and short-circuit current (Isc) outputs of a sliding-mode TENG. The outputs were found to be stable in a pressure of ~15 N/m2 , which was a maximum value in a combination of a LPEFSQ-15 film and Al based TENG (see also Figure S9-S10).

Surface treatments on a LPEFSQ-15 film for the high performance TENG application.





Sample Size : 2.5 cm X 2.5 cm Frequency = 1.3 Hz

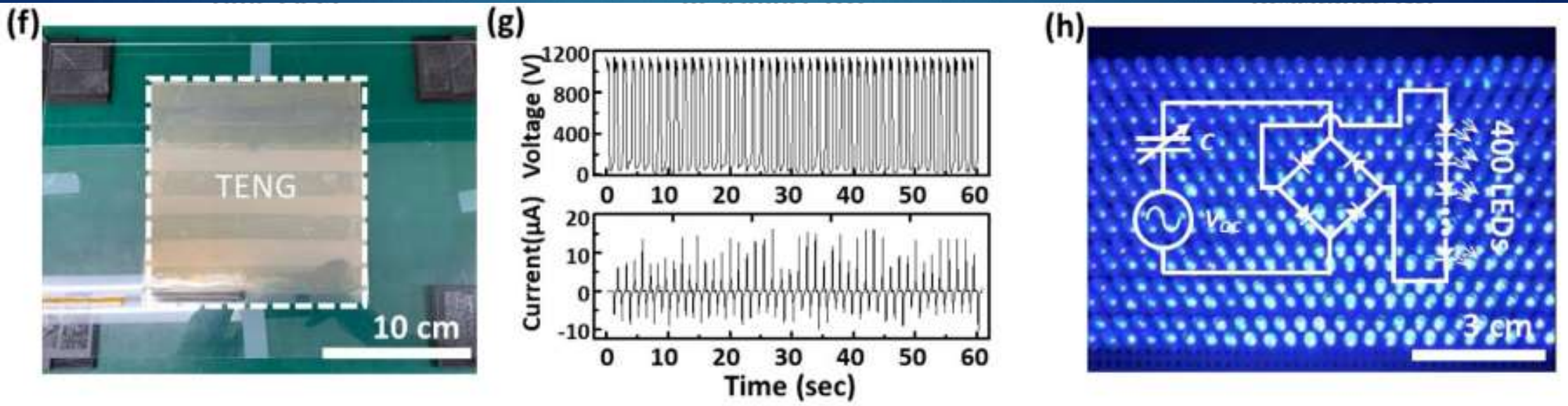
$V_{peak-to-peak} = 298\ V$ ~ 2.75 배

$I_{peak-to-peak} = 10\mu A$ ~ 3 배

The maximum power density was 2 W/m^2 at a load resistance of ~60 MΩ ~ 6 배

(a) Schematic illustration of corona discharge process. (b) Open-circuit voltage Voc (upper) and short-circuit current Isc (bottom) outputs of a LPEFSQ-TENG after corona treatment. (c) Open-circuit voltage Voc (upper) and short-circuit current Isc (bottom) outputs of a LPEFSQ-TENG after corona treatment.

Surface treatments on a LPEFSQ-15 film for the high performance TENG application.



Frequency = 1.3 Hz

Sample Size : 15 cm X 15 cm

$$V_{peak-to-peak} = 1140\ V$$

$$I_{peak-to-peak} = 23\mu A$$

(f) A photograph image of a large-scale TENG. (g) Voc and Isc outputs of a large-scale TENG after corona treatments. (h) The demonstration of lighting up 400 LEDs by a large-scale TENG.

THANK YOU

Q & A