Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.
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Supporting Information

Enhanced electroactive β-phase of sonication process derived PVDF-activated carbon composite film for efficient energy conversion and battery free acceleration sensor

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Flexible PVDF film using magnetic stirring process:

The PVDF transparent solution was prepared by dissolving 2 gm of commercially purchased PVDF powder in the mixture of 10 mL N,N-dimethylformamide (DMF), 6 mL of acetone and magnetically stirred at a temperature of 60 ^{0}C for 2 h. The obtained PVDF transparent solution was poured into a glass Petri dish and soaked at 70 ^{0}C overnight for the removal of residual solvents (DMF/acetone) and to form as a flexible PVDF film.

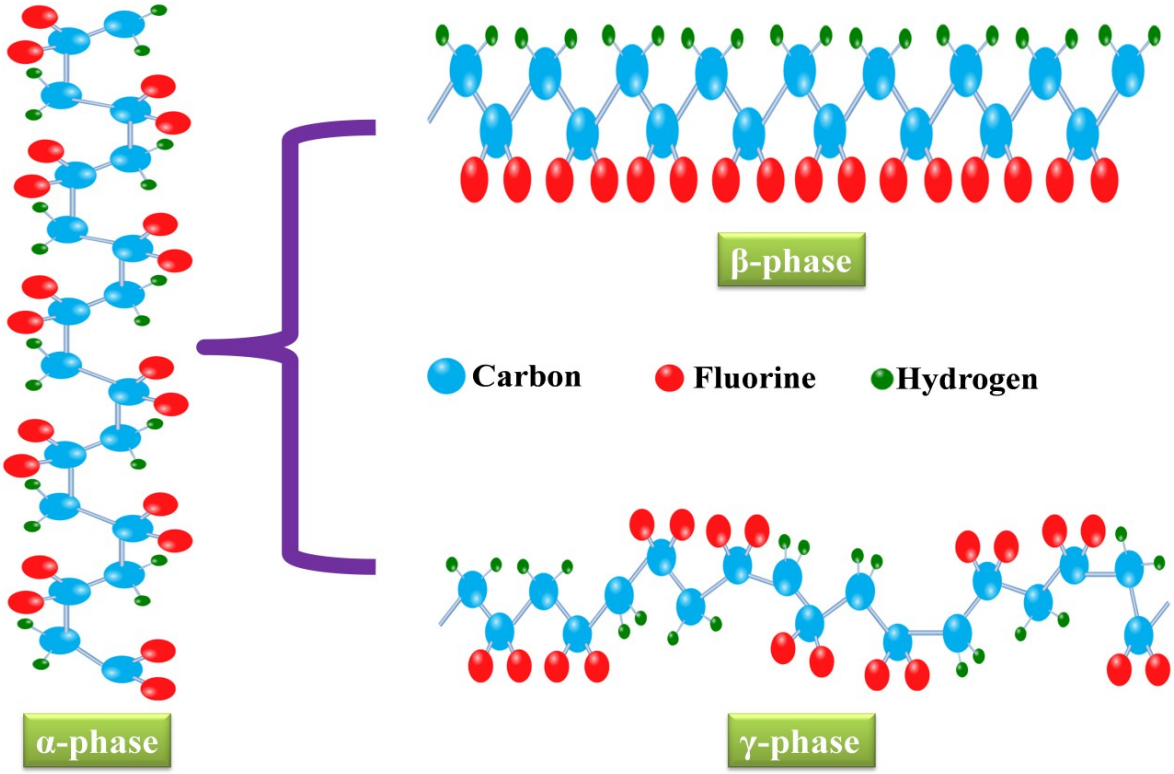

Figure S1 Schematic representation for the phase conversion of PVDF phases such as α-phase to β and γ phases.

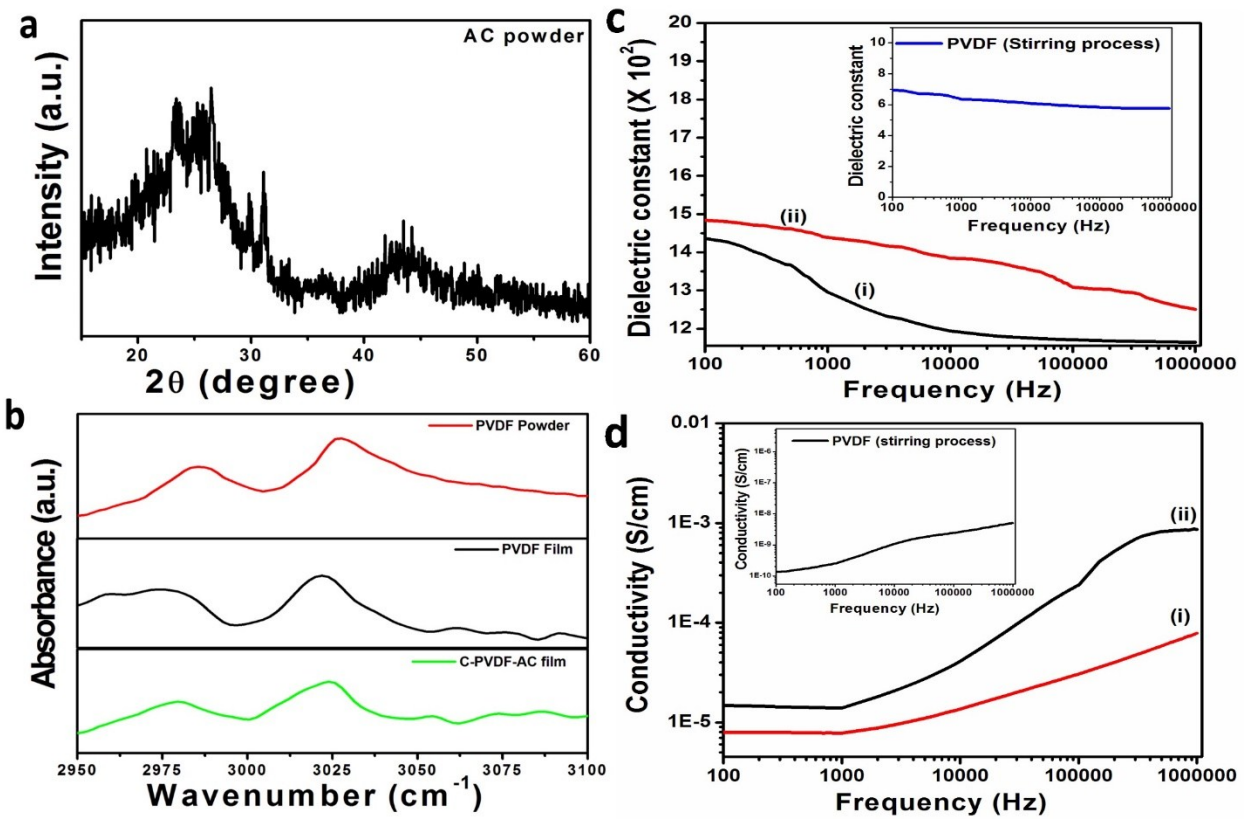

Figure S2 (a) XRD pattern of the commercial AC powder **(b)** FT-IR spectra of commercial PVDF powder and as-synthesized films such as pure PVDF film and C-PVDF-AC film (30 V/V %). **(c, d)** Frequency dependent dielectric constant and conductivity analysis at room temperature for sonication derived PVDF and C-PVDF-AC films (30 V/V %). The inset shows the frequency dependent dielectric constant and conductivity of the PVDF film (*via* stirring process).

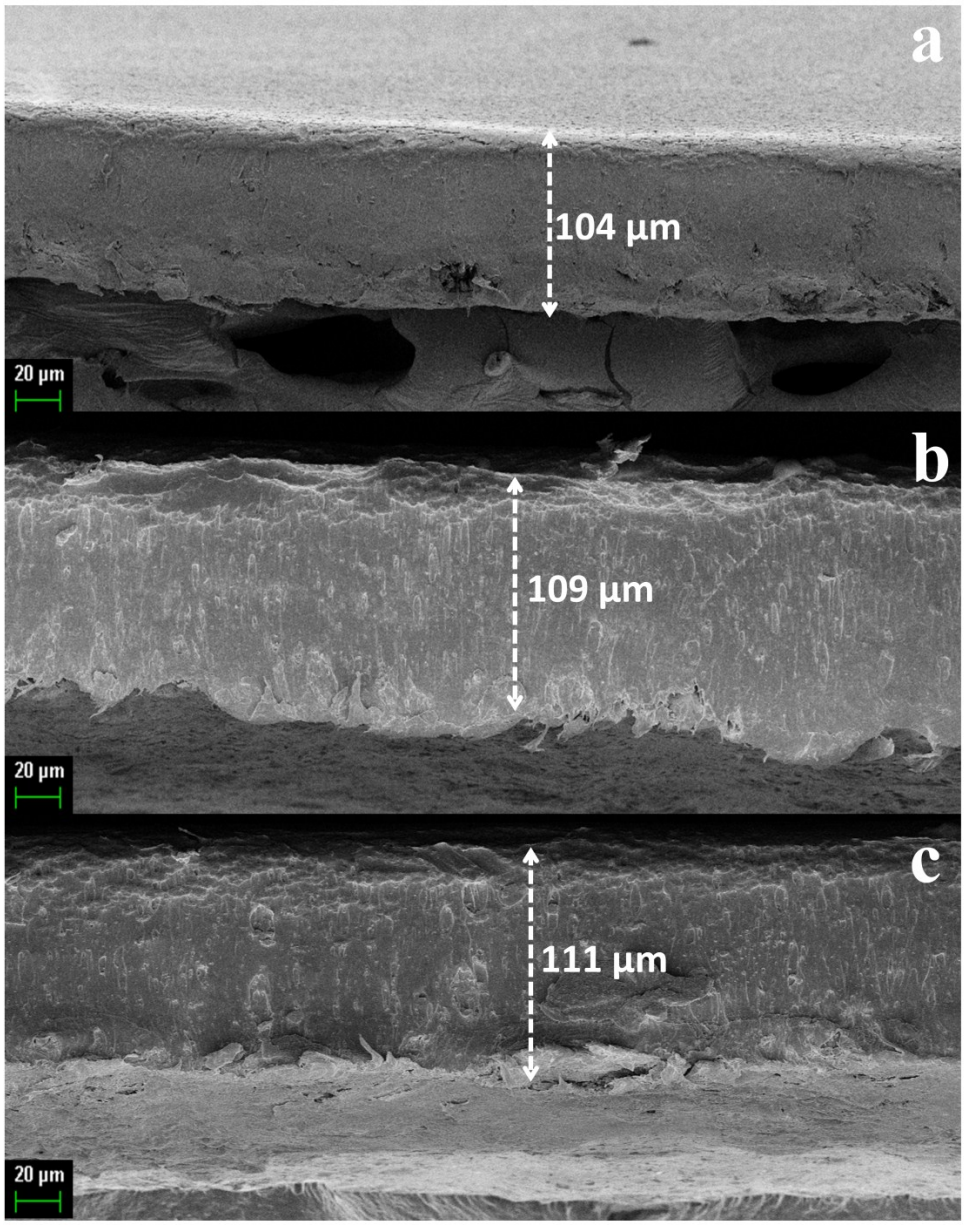

Figure S3 Cross-sectional FE-SEM image of the C-PVDF-AC films with different volume concentrations at 20 µm scale **(a)** 10 V/V % **(b)** 20 V/V % and **(c)** 30 V/V %.

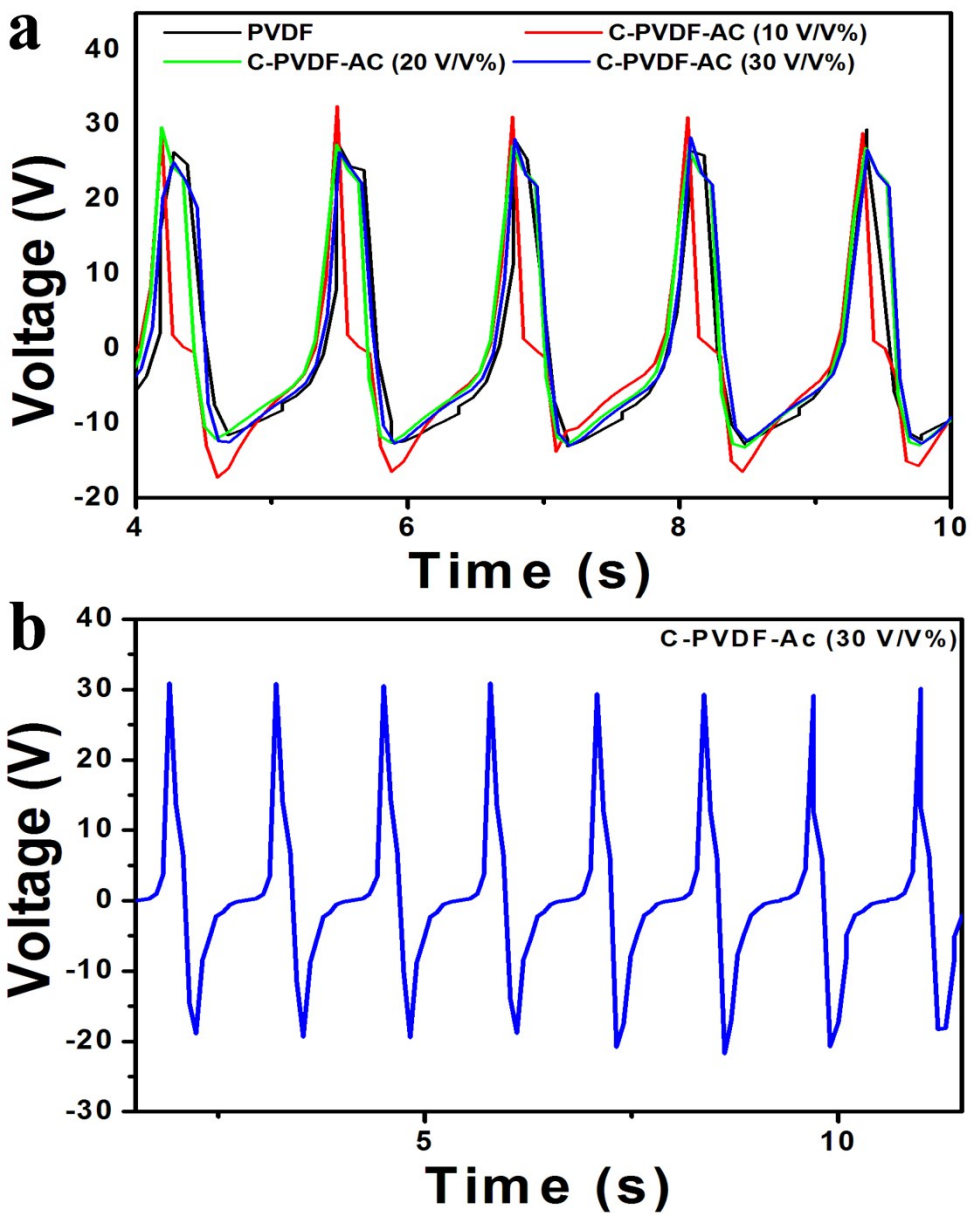

Figure S4 (a) Comparative voltage response of various un-poled C-NG devices upon the mechanical force (2 N). (b) Open circuit voltage of poled C-NG device (30 V/V %) upon constant mechanical force (2 N).

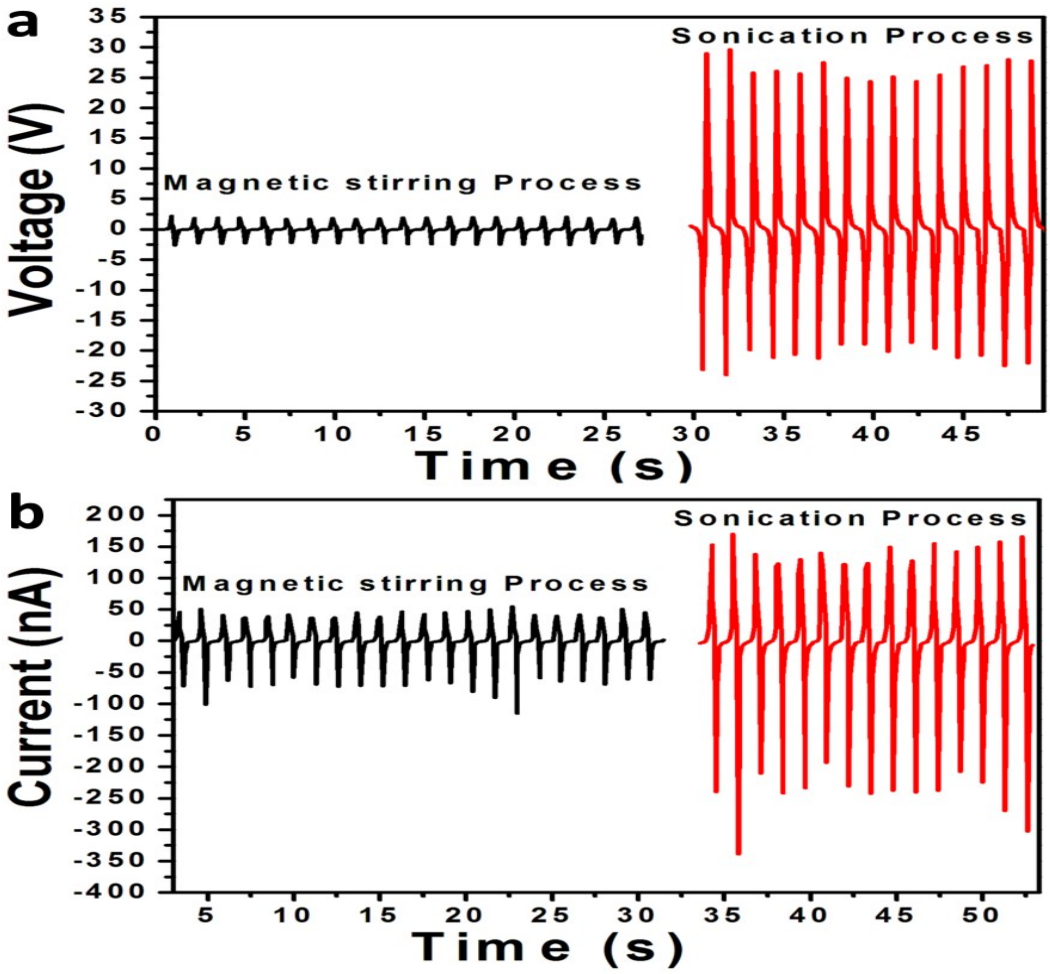

Figure S5 (a, b) Comparative electrical responses of PVDF film based devices upon constant mechanical force (≈2 N). Here the PVDF films were prepared under two different methods such as magnetic stirring process and sonication process.

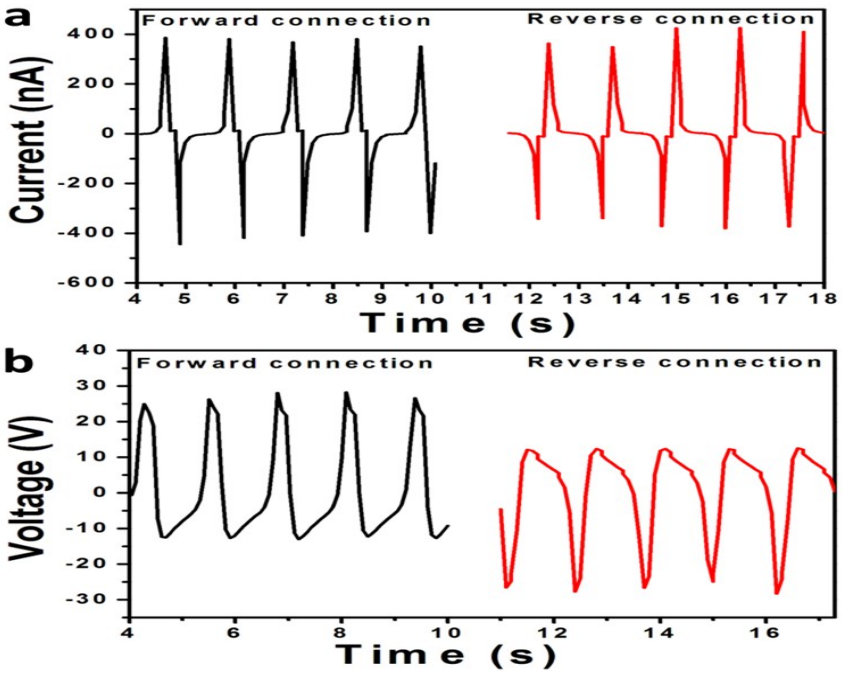

Figure S6 Switching-polarity test of un-poled C-NG device up on mechanical force 2 N. (a) Current response and (b) Voltage response.

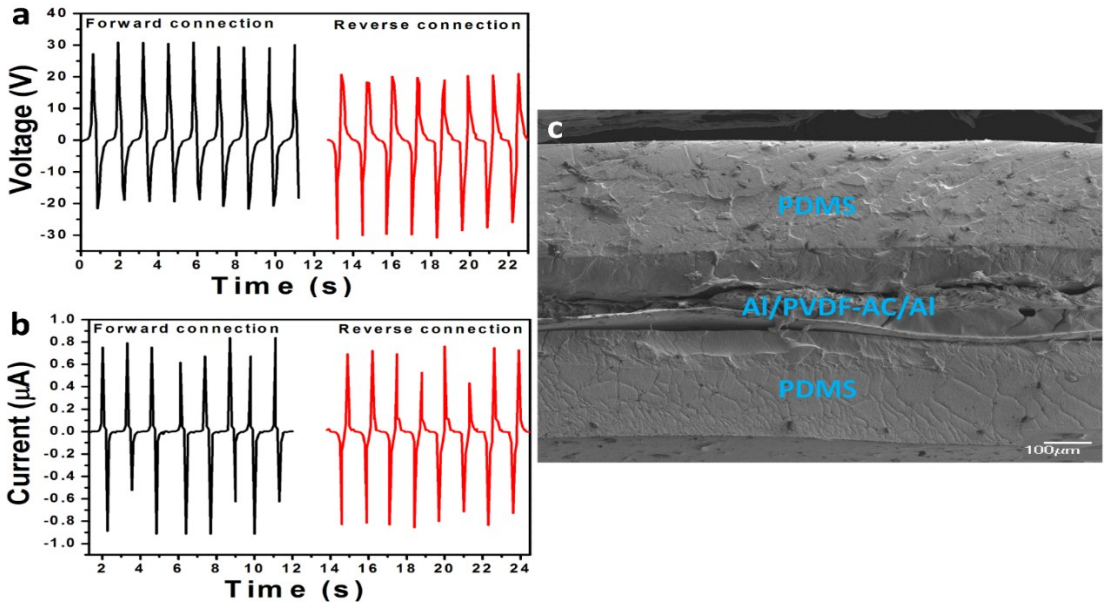

Figure S7 Switching-polarity test of poled C-NG device (8 kV/24 h at RT) up on mechanical force 2 N. (a) Voltage response, (b) Current response and (c) Cross-sectional FE-SEM image of C-NG device (30 V/V %) at 100 μm scale.

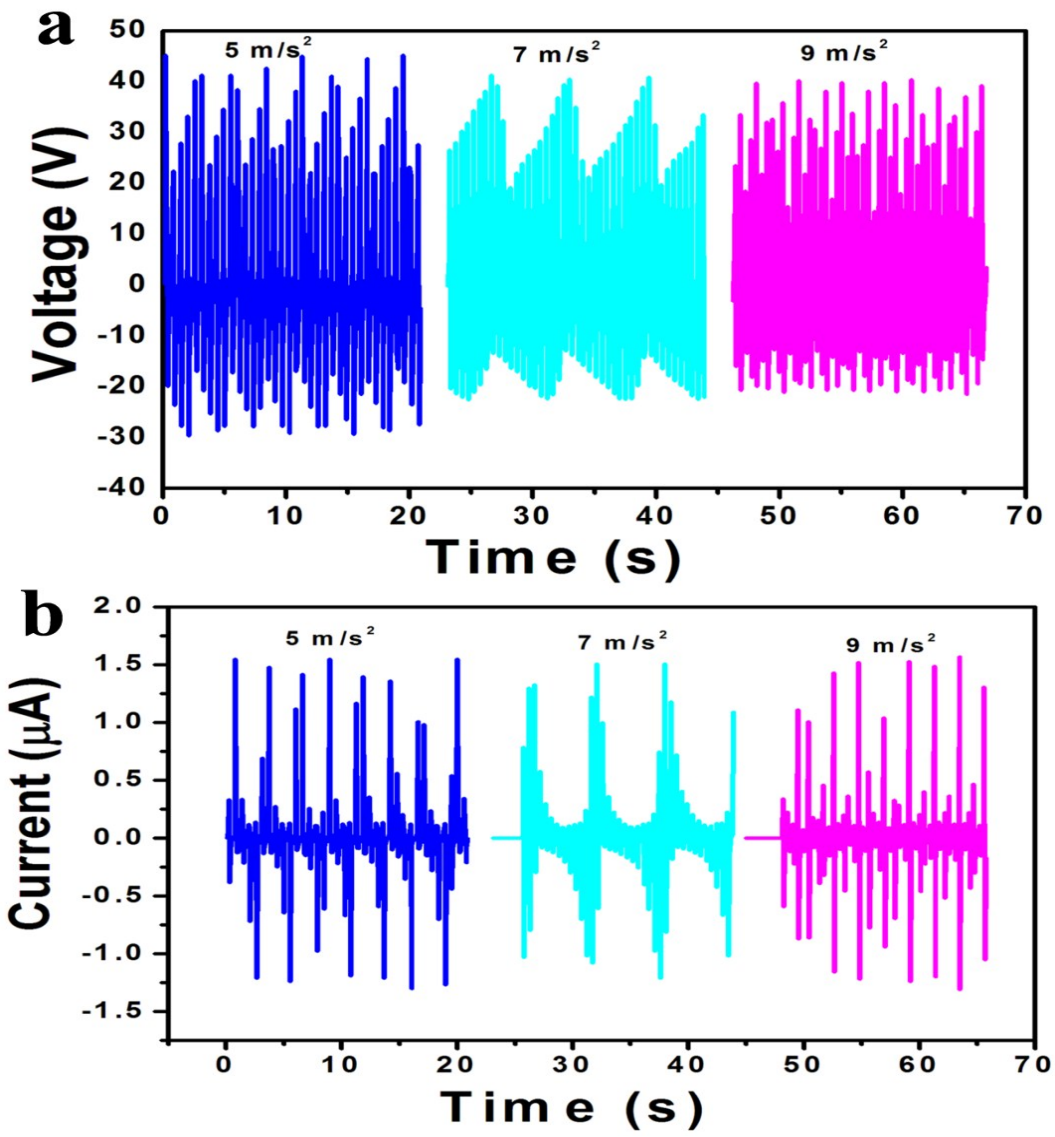

Figure S8 (a, b) Open circuit voltage and short circuit current of S-AS upon various accelerations (5, 7 and 9 m/s^2) of shaft load (2 Kg) act on it.

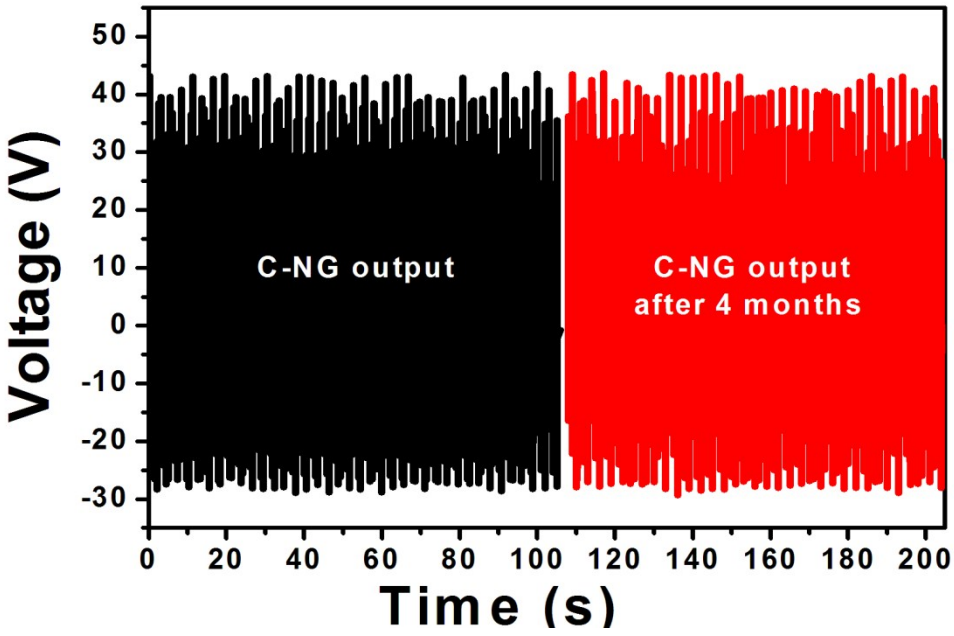

Figure S9 Open circuit voltage of C-NG device (or S-AS) up on the periodic acceleration of 5 m/s^2 of shaft mass 2 kg (i.e. 10 N).

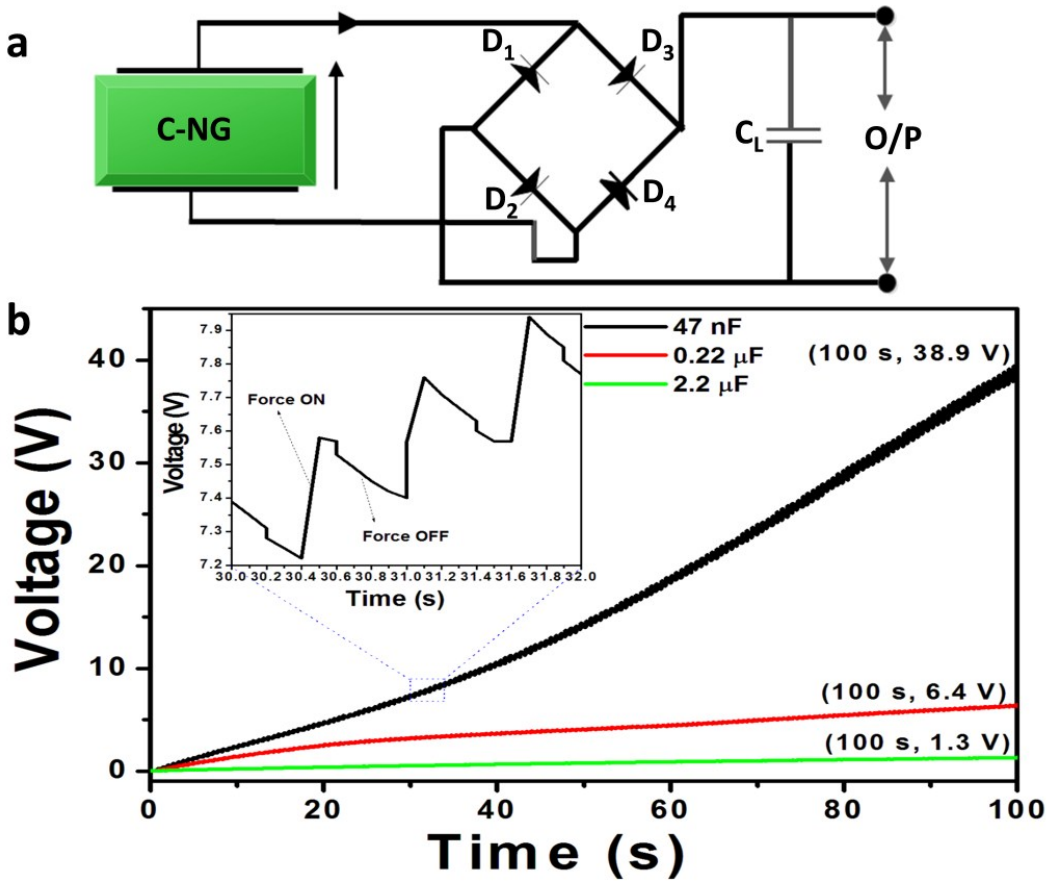

Figure S10 (a) Schematic diagram for the charging experiment using C-NG device (b) Charging behavior of various load capacitors (47 nF, 0.22 μF and 2.2 μF) across the C-NG device output up on the acceleration ≈5 m/s^2 of shaft mass 2 Kg.