Electronic Supplementary Information for

Piezo-Pyro-Photoelectric Effects Induced Coupling Enhancement of Charge Quantity in $BaTiO_3$ Materials for Simultaneously Scavenging Light and Vibration Energies†

Yun Ji,[ab] Kewei Zhang,[ab] Zhong Lin Wang*[abc] and Ya Yang*[abd]

Received (in XXX, XXX) XthXXXXXXXXX 20XX, Accepted Xth XXXXXXXXX 20XX
DOI: 10.1039/c000000x

[a]CAS Center for Excellence in Nanoscience, Beijing Key Laboratory of Micro-nano Energy and Sensor, Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences, Beijing 100083, P. R. China. E-mail: yayang@binn.cas.cn (Y. Yang)

[b]School of Nanoscience and Technology, University of Chinese Academy of Sciences, Beijing, 100049, P. R. China

[c]School of Material Science and Engineering, Georgia Institute of Technology, Atlanta, GA 30332-0245, USA. E-mail: zhong.wang@mse.gatech.edu (Z. L. Wang)

[d]Center on Nanoenergy Research, School of Physical Science and Technology, Guangxi University, Nanning 530004, PR China.

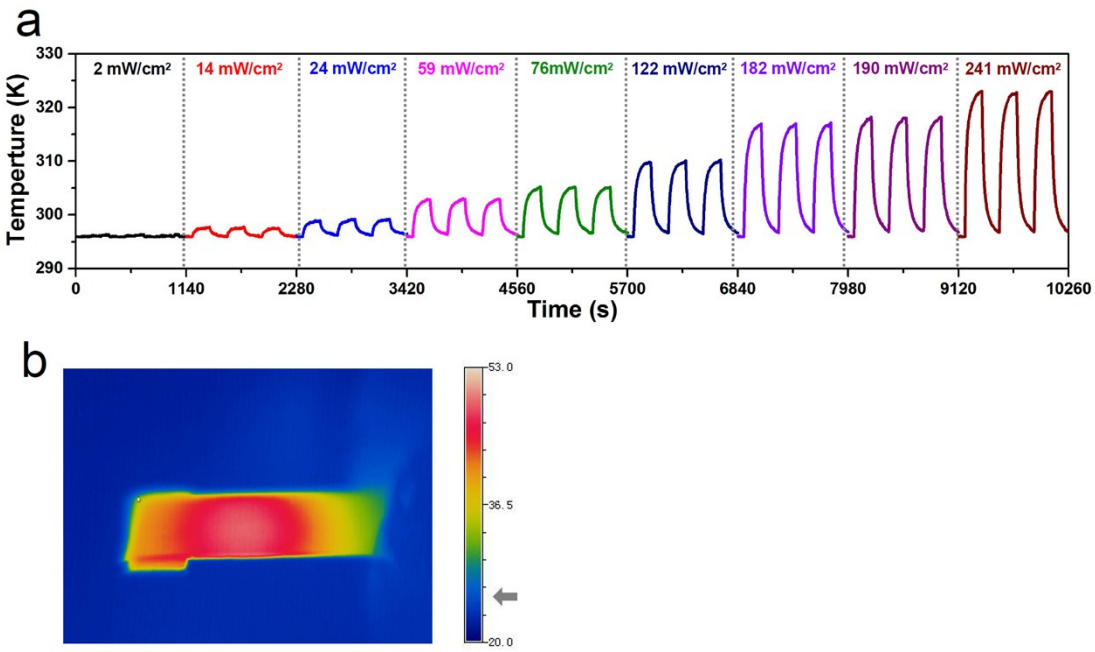

Fig. S1| Temperature variation and example IR image of the device under light illumination.

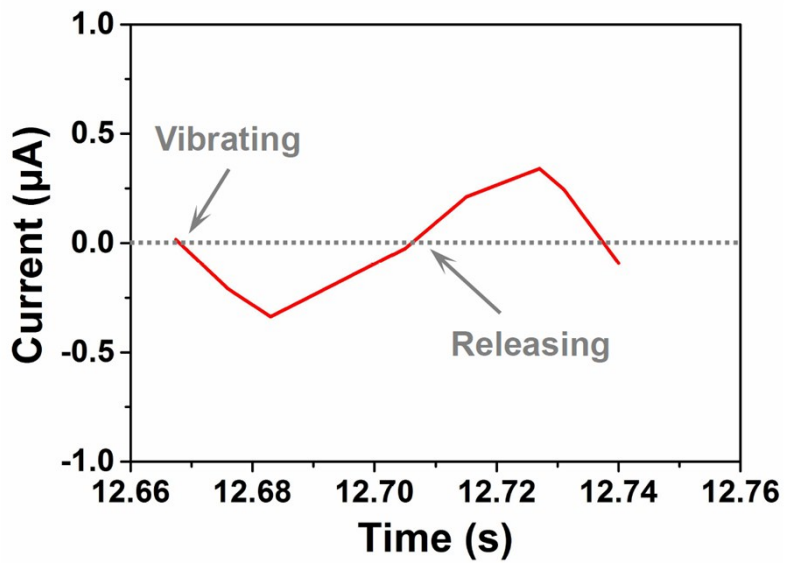

Fig. S2| A single cycle of vibration.

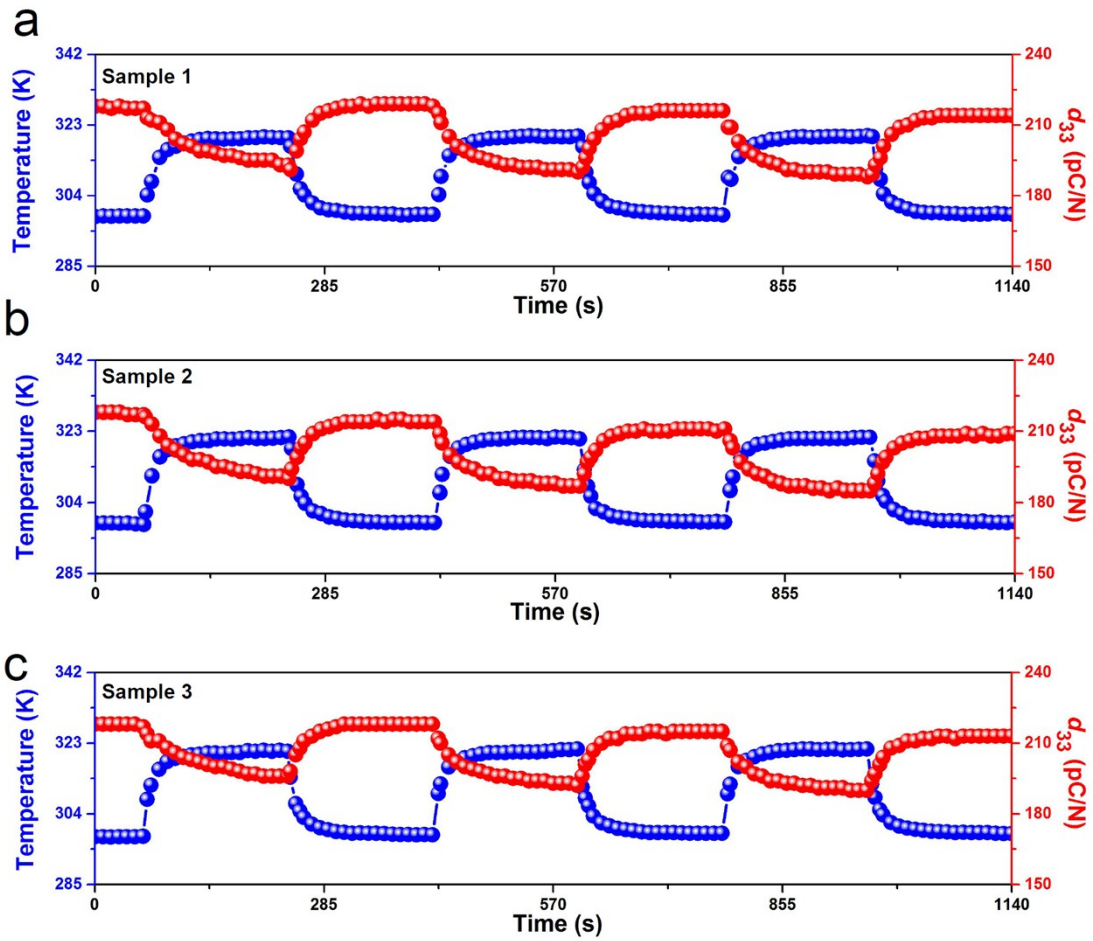

Fig. S3 | Temperature and piezoelectric constant of the device under light illumination..

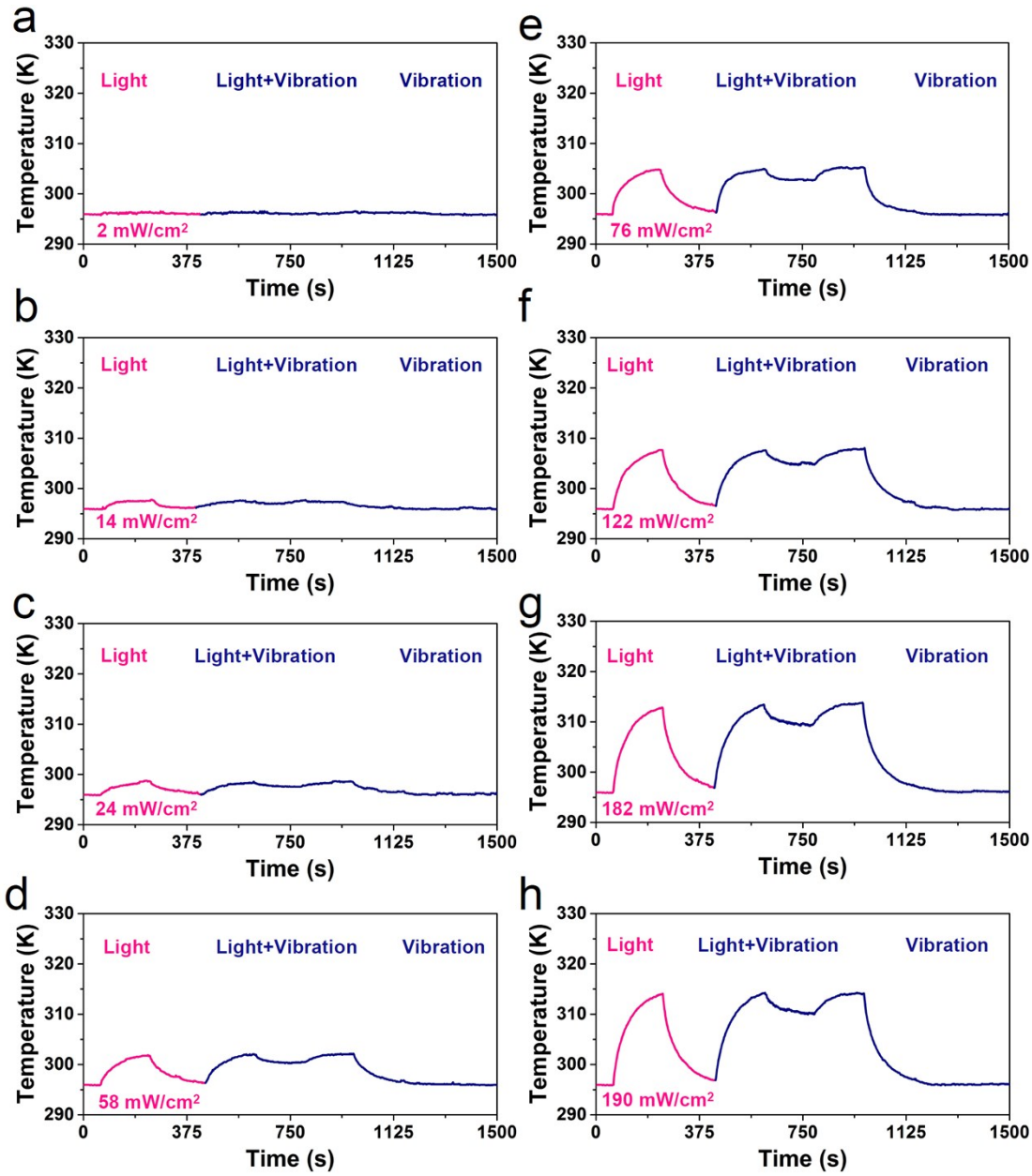

Fig. S4 | (a-h) Light illumination, vibration, and light illumination followed by vibration effect (asynchronous) on temperature change of the nanogenerator under different light intensities (2 to 190 mW/cm^2).

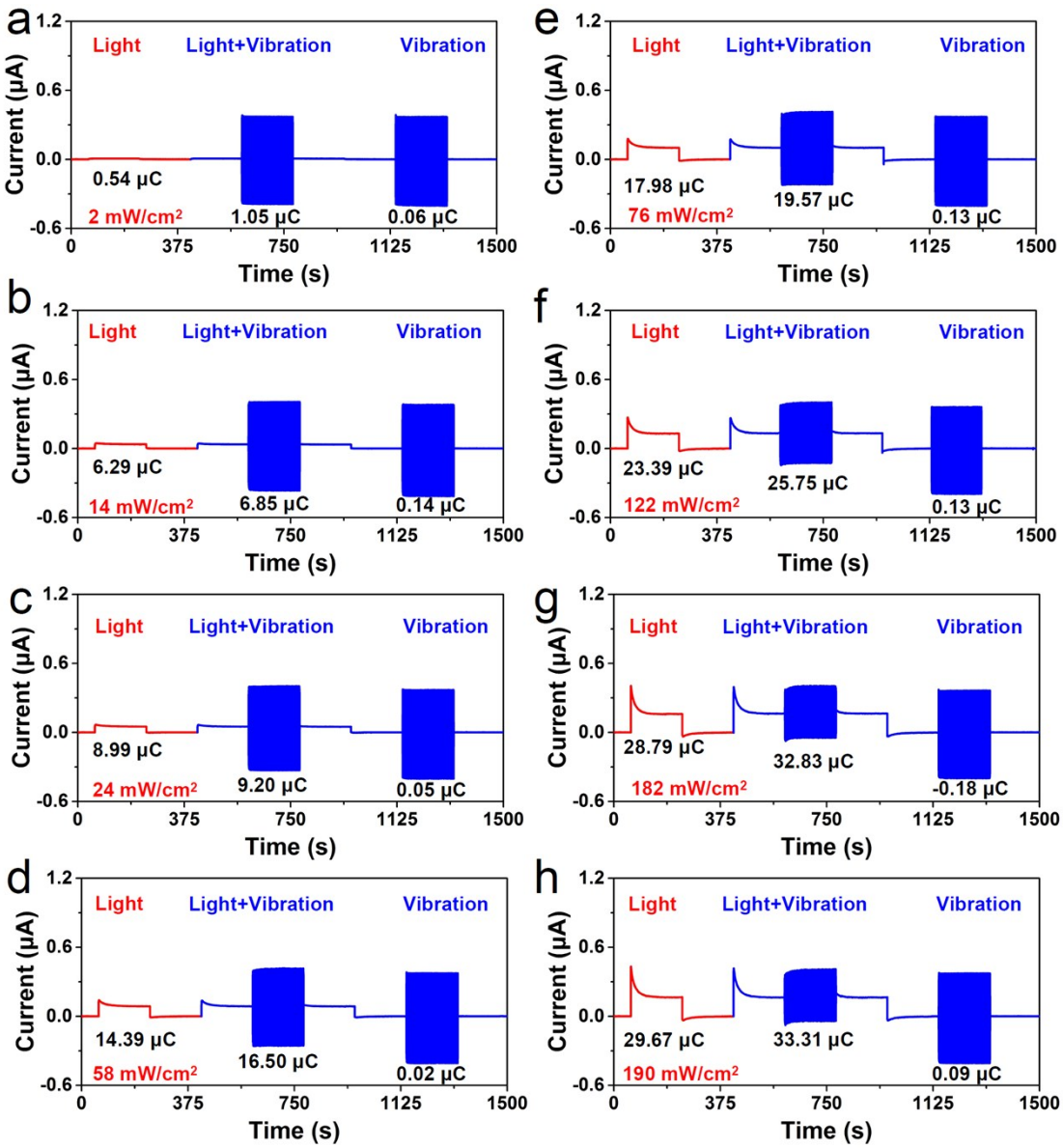

Fig. S5 | (a-h) Light illumination, vibration, and light illumination followed by vibration effect (asynchronous) on output current of the nanogenerator under different light intensities (2 to 190 mW/cm^2).

Table S1. Mean transferred charge quantities and standard deviations over the three sequential photogenerated platform current for each light intensity.

Light Intensity (mW/cm^2)	Mean Transferred Charge Quantity (μC)	Standard Deviations (μC)
2	1.01	0.04
14	6.64	0.05
24	9.78	0.05
58	17.43	0.03
76	20.49	0.05
122	25.54	0.06
182	30.11	0.12
190	30.63	0.1
241	33.07	0.15

Table S2. Mean transferred charge quantities and standard deviations over the three sequential photogenerated total current for each light intensity.

Light Intensity (mW/cm^2)	Mean Transferred Charge Quantity (μC)	Standard Deviations (μC)
2	1.05	0.01
14	6.89	0.03
24	10.25	0.05
58	18.78	0.06
76	22.42	0.11
122	28.66	0.12
182	34.89	0.04
190	35.57	0.12
241	38.79	0.07

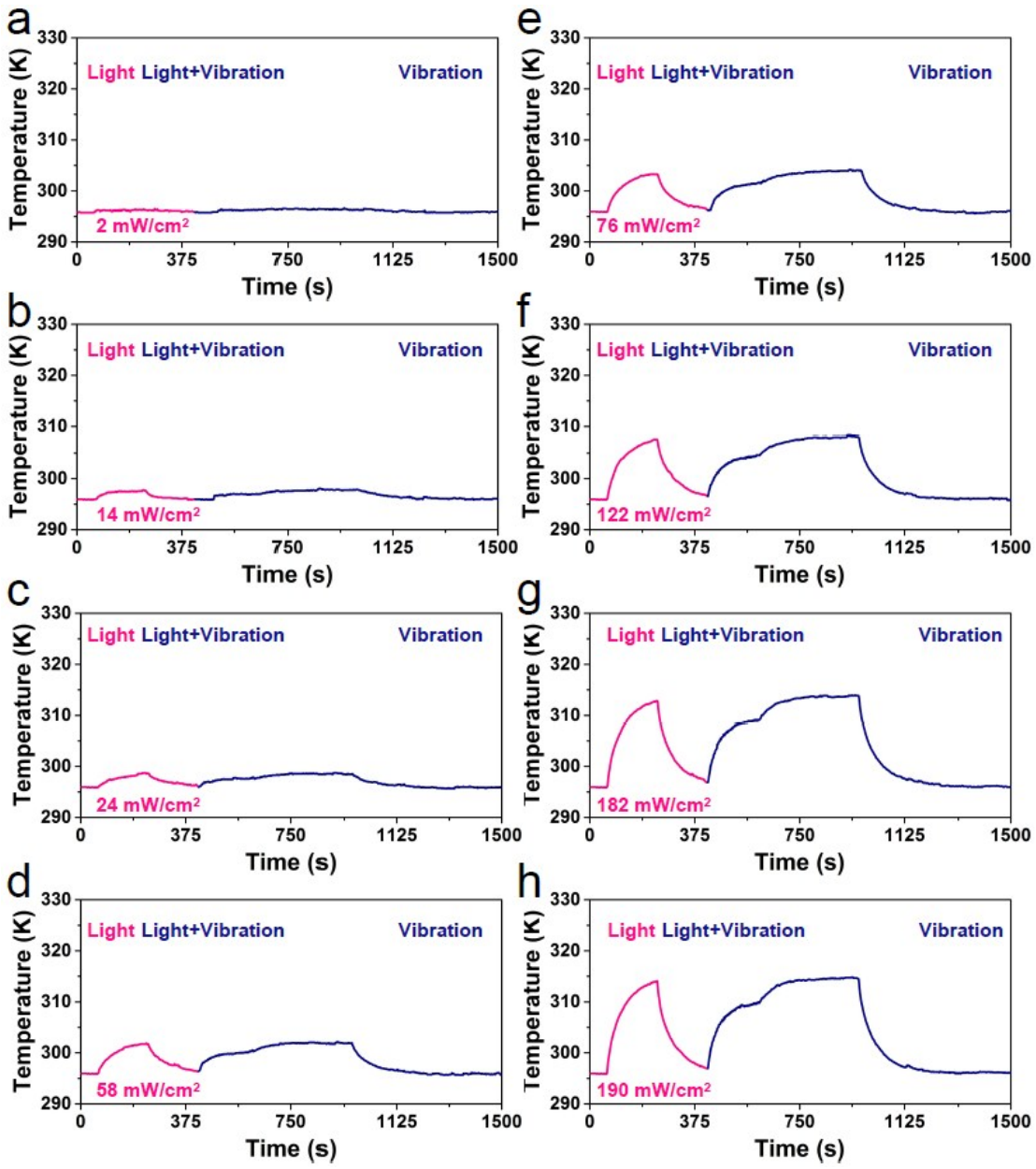

Fig. S6 | (a-h) Light illumination, vibration, and light illumination followed by vibration effect (synchronous) on temperature change of the nanogenerator under different light intensities (2 to 190 mW/cm^2).

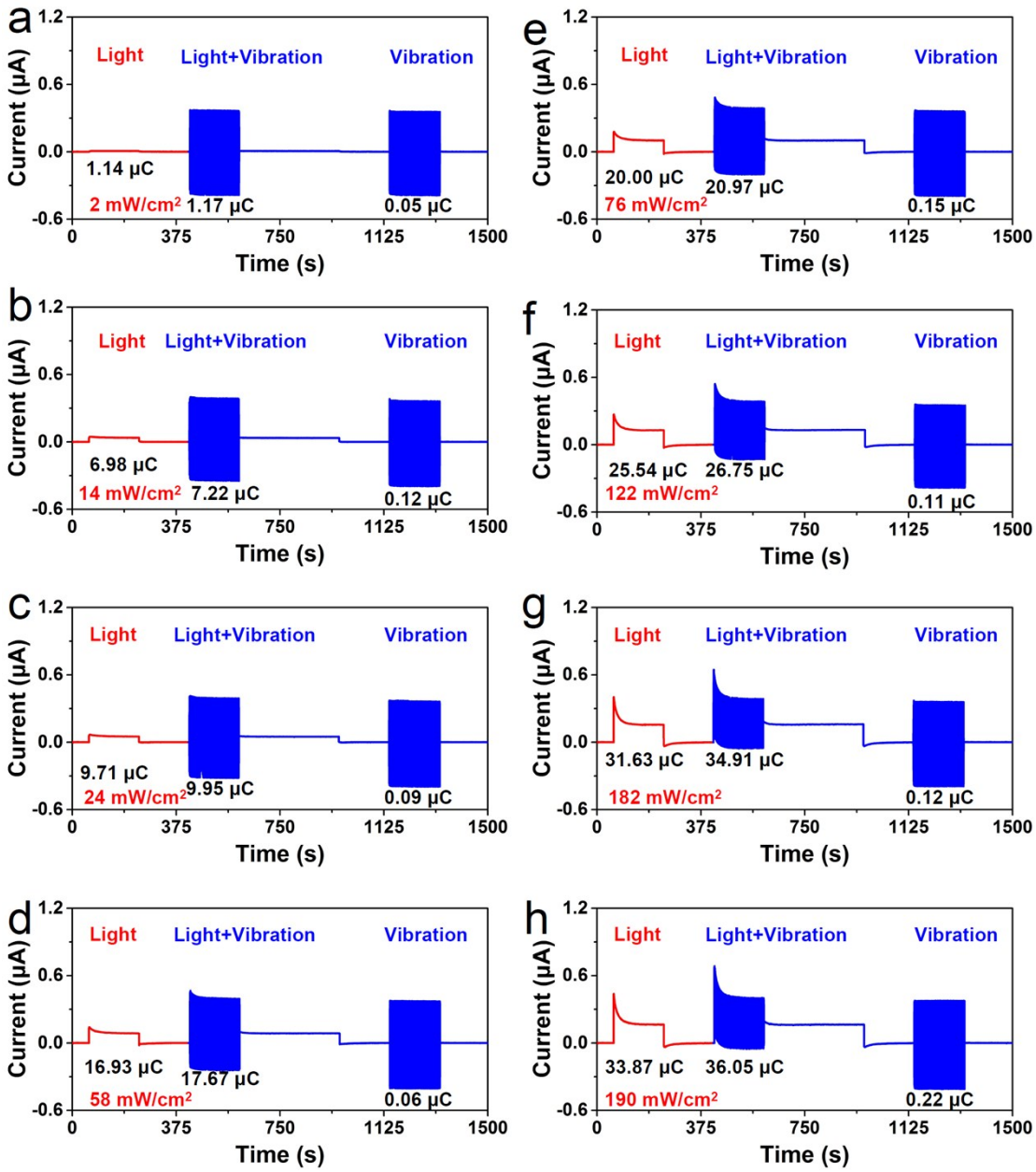

Fig. S7 | (a-h) Light illumination, vibration, and light illumination followed by vibration effect (synchronous) on output current of the nanogenerator under different light intensities (2 to 190 mW/cm²).

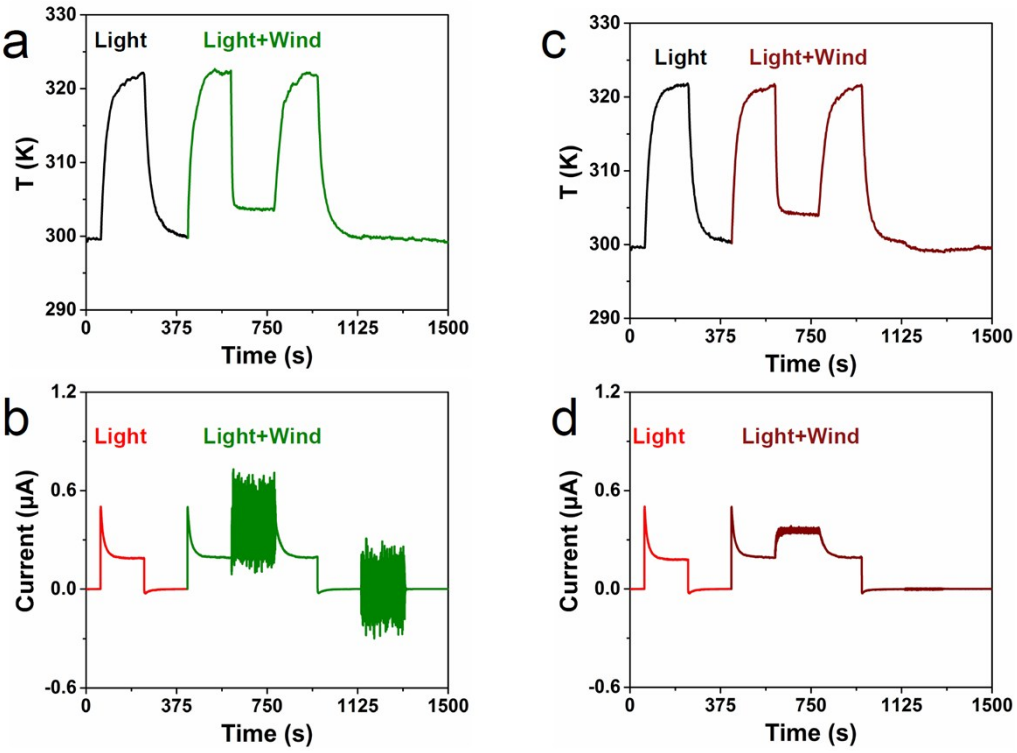

Fig. S8 | Temperature variation (a) and corresponding output current (b) of the device under light and wind conditions without shielded. Temperature variation (c) and corresponding output current (d) of the device with shielded.

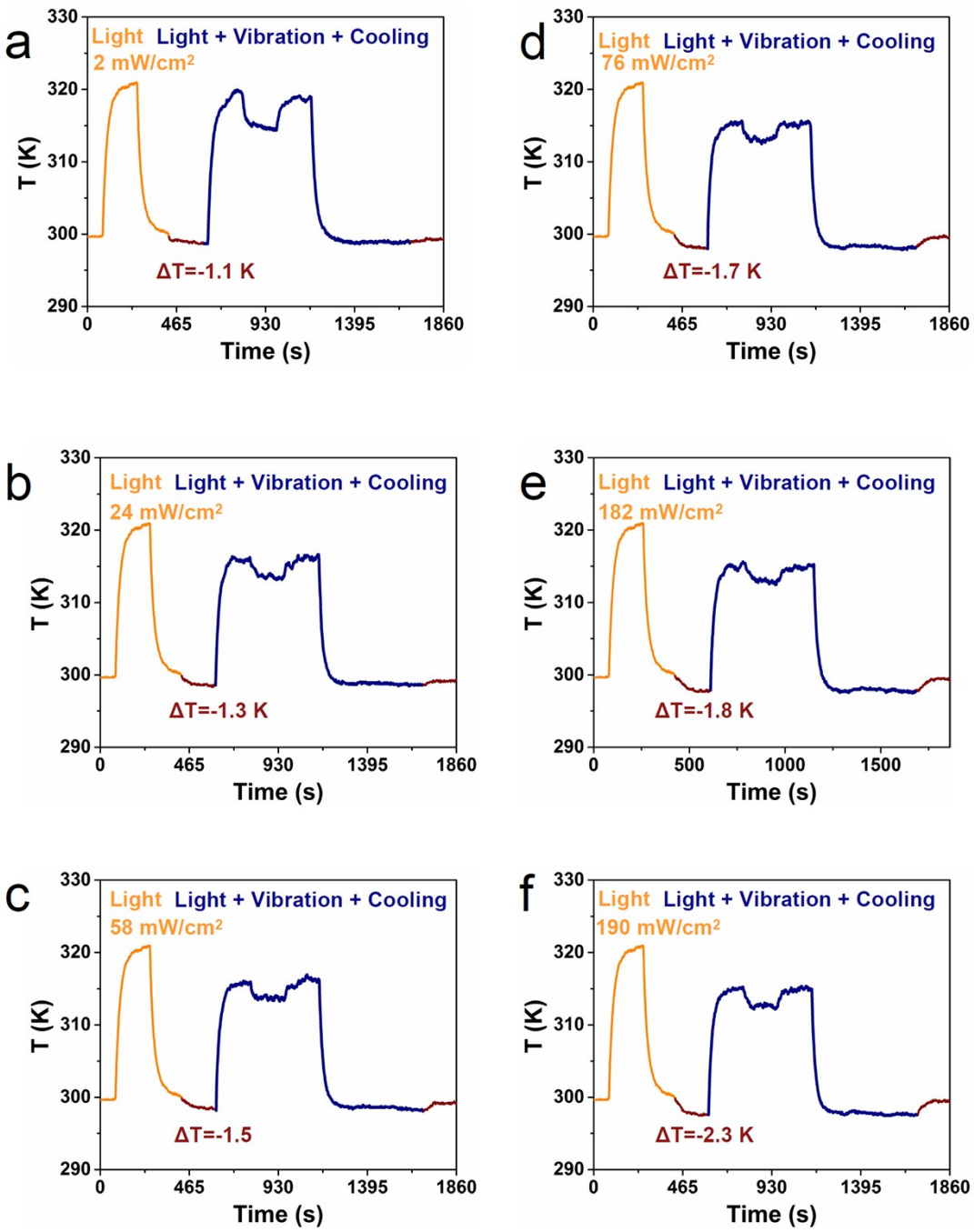

Fig. S9 | (a-f) Light illumination, cooling-vibration, and light illumination followed by vibration effect (asynchronous) on temperature of the nanogenerator under different light intensities (2 to 190 mW/cm^2).

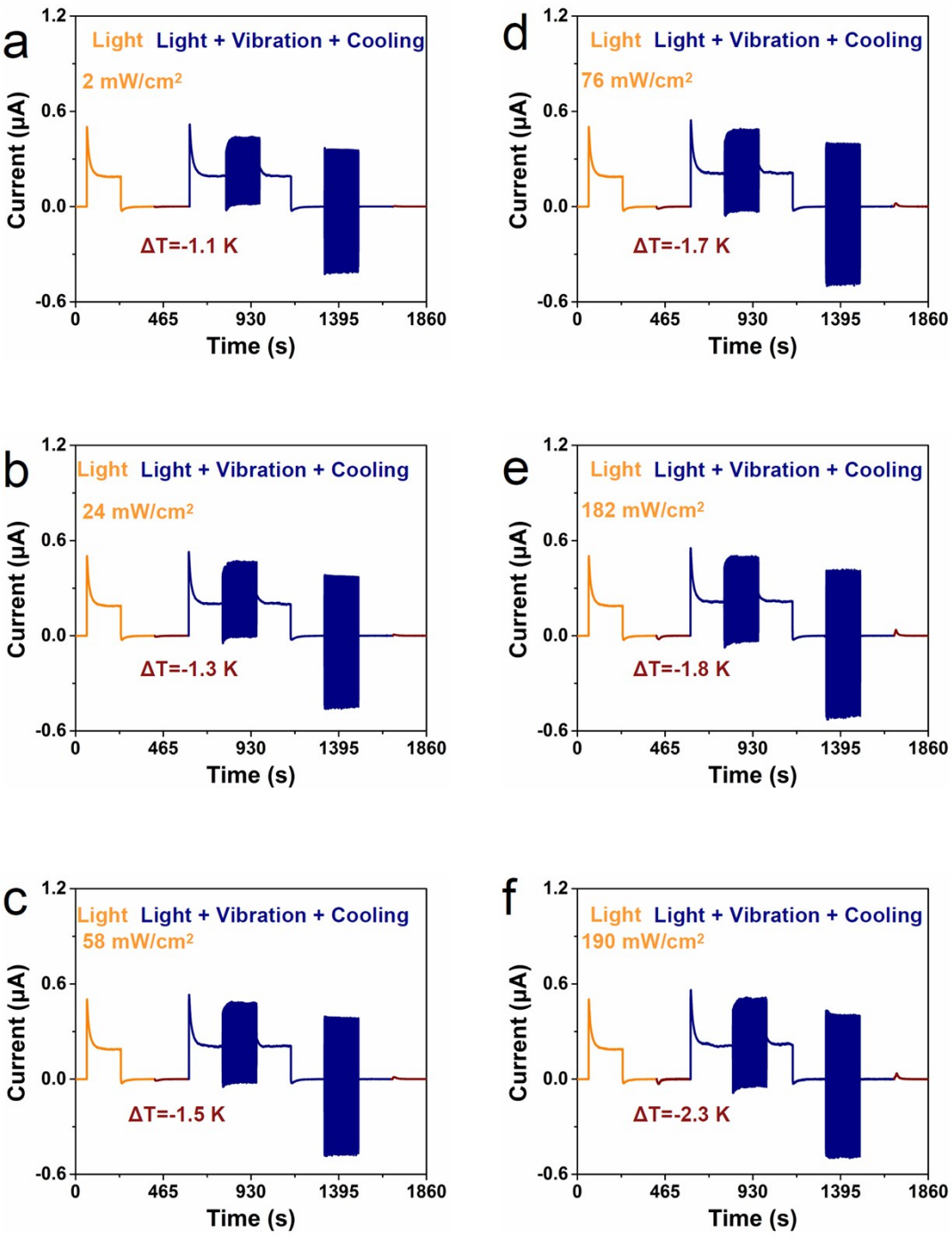

Fig. S10 | (a-f) Light illumination, cooling-vibration, and light illumination followed by vibration effect (asynchronously) on output current of the nanogenerator under different light intensities (2 to 190 mW/cm^2).

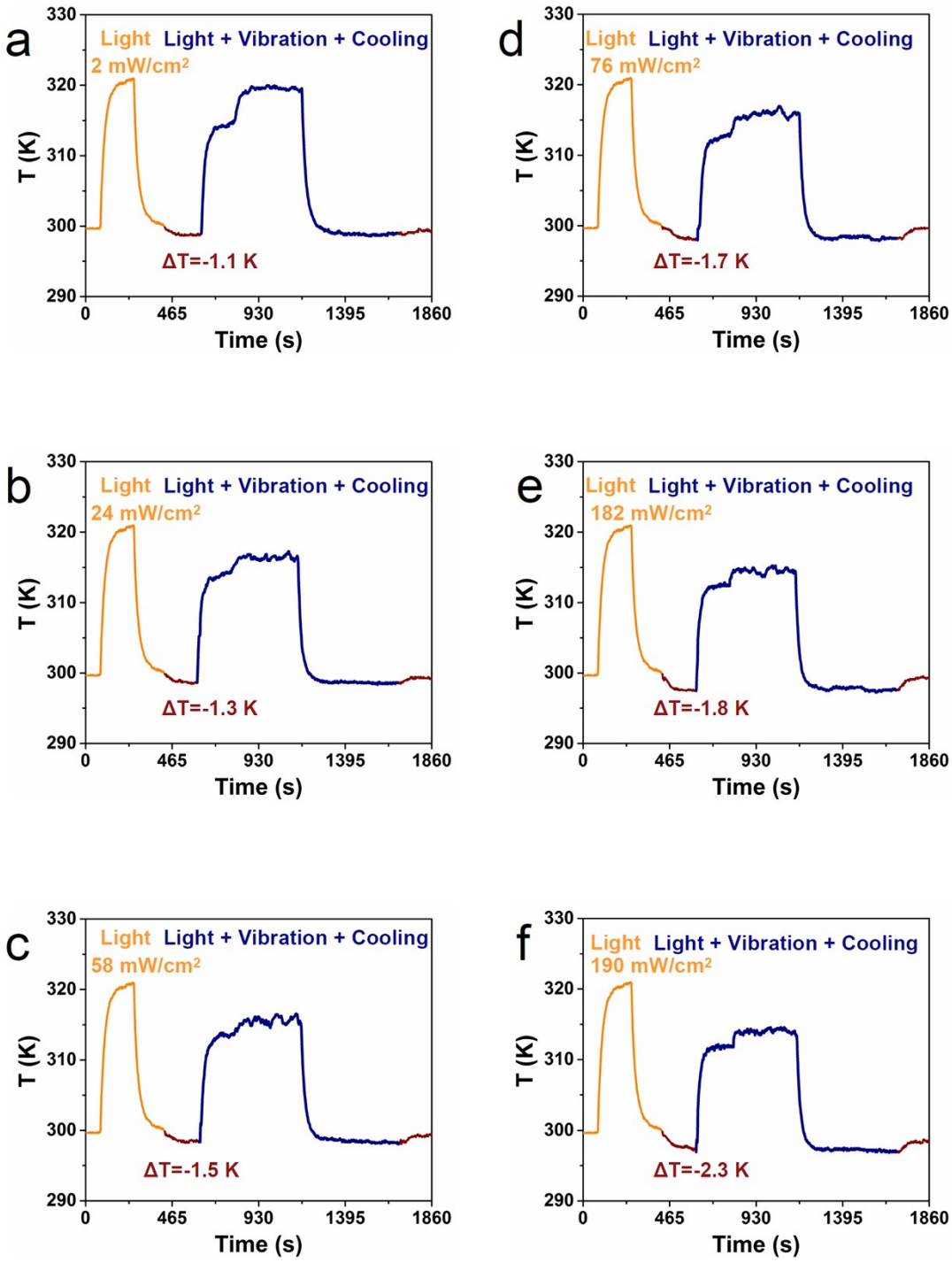

Fig. S11 | (a-f) Light illumination, cooling-vibration, and light illumination followed by vibration effect (synchronous) temperature of the nanogenerator under different light intensities (2 to 190 mW/cm^2).

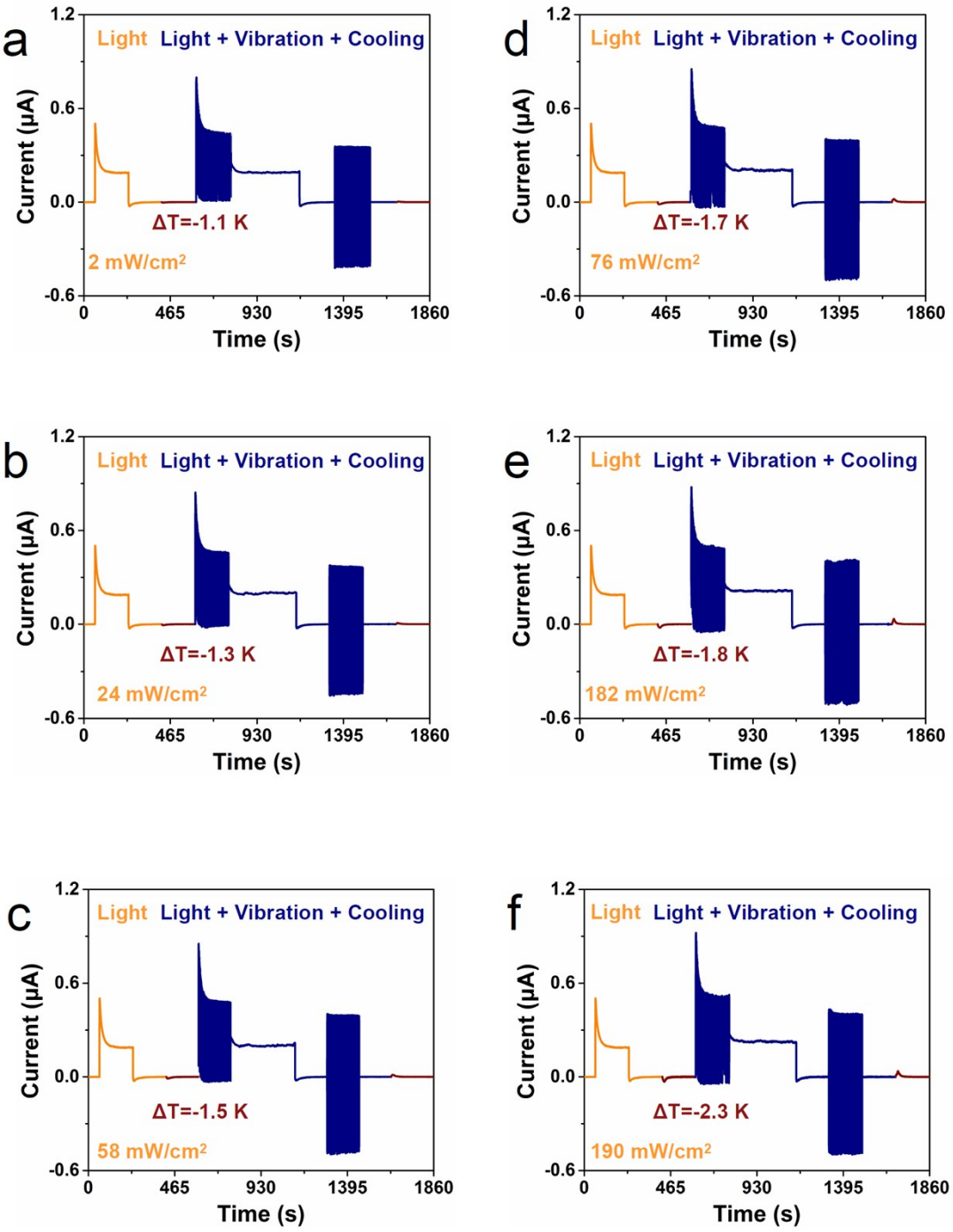

Fig. S12 | (a-f) Light illumination, cooling-vibration, and light illumination followed by vibration effect (synchronous) on output current of the nanogenerator under different light intensities (2 to 190 mW/cm²).

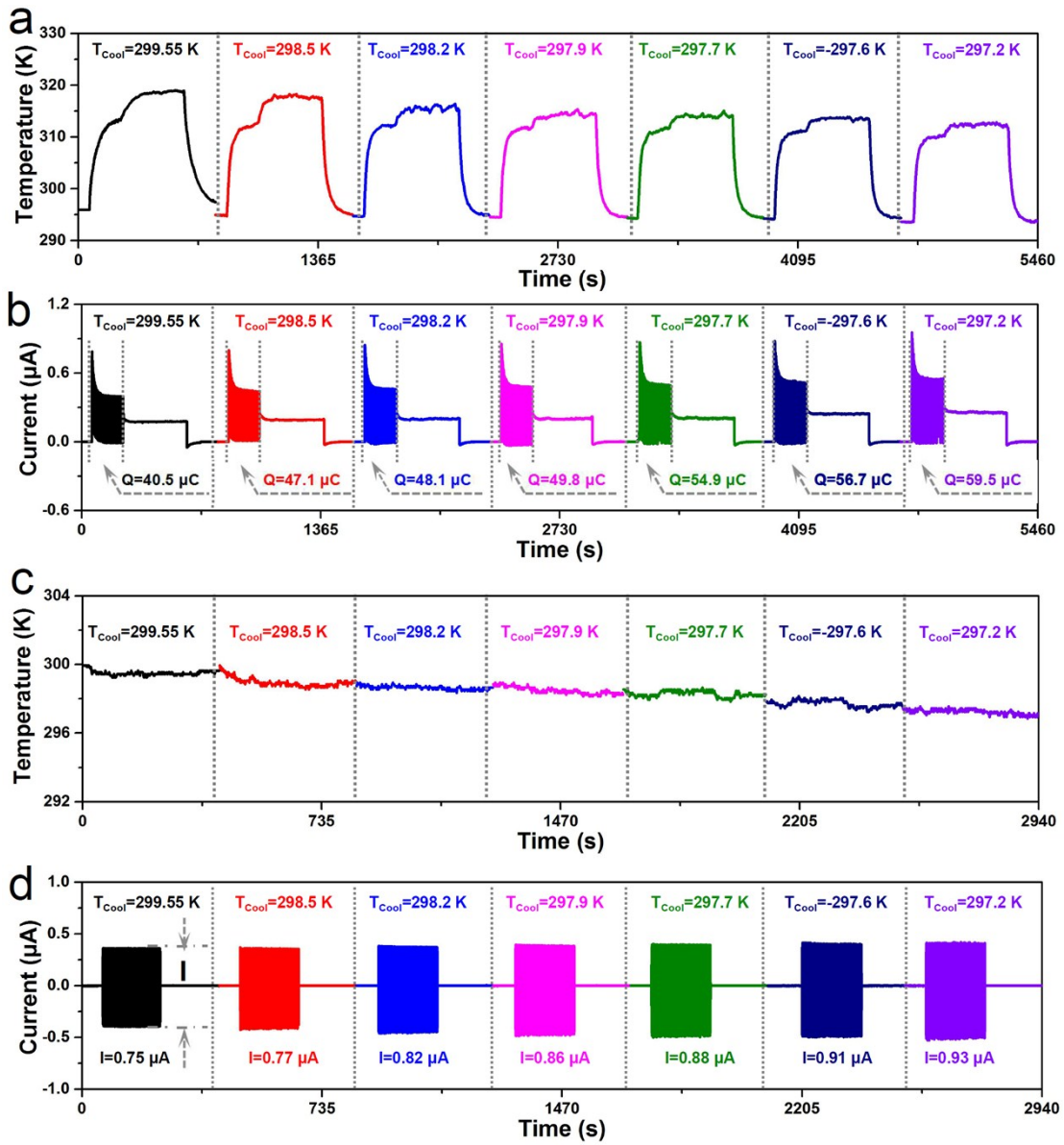

Fig. S13 | (a, b) Cooling-light-vibration coupled effect on temperature change and corresponding output current for the nanogenerator under different cooling temperatures. (c, d) Cooling-vibration coupled effect on temperature change and corresponding output current for the nanogenerator under different cooling temperatures.

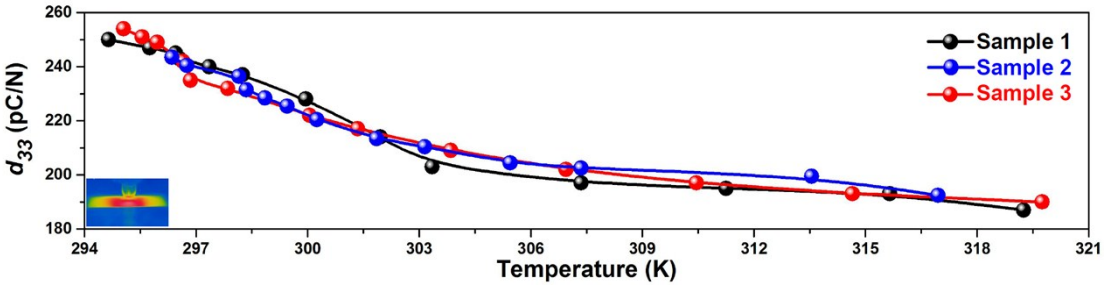

Fig. S14 | Dependence of piezoelectric constant (d_{33}) for ITO/BTO/Ag devices on temperature change. The insert is IR image obtained during the measurements.