Supporting Information

Robust triboelectric nanogenerator based on rolling electrification and electrostatic induction at an instantaneous energy conversion efficiency of ~55%

Long Lin[†,#], Yannan Xie[†,#], Simiao Niu[†], Sihong Wang[†], Po-Kang Yang[†], Zhong Lin Wang[*,†,‡]

[†]School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, Georgia 30332-0245, United States

[‡]Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences, Beijing, 100083, China

[*]Address correspondence to: zlwang@gatech.edu

[#]These authors contributed equally to this work.

Video S1. A live demonstration of the rolling triboelectric nanogenerator for harvesting energy from finger movement to drive series of light-emitting diodes.

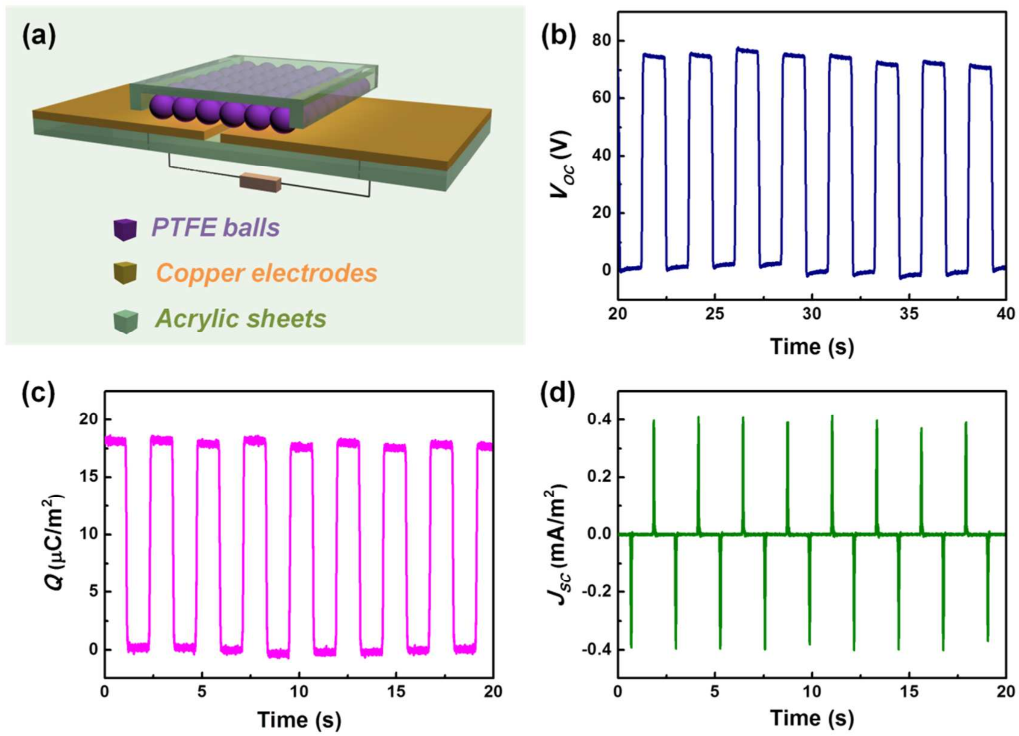

Figure S1. Device structure and output performance of the RTENG based on the rolling electrification between PTFE balls and a pair of copper electrodes. (a) The schematic structure of the RTENG that is composed of PTFE rolling balls and a pair of copper electrodes, both of which are confined or supported by the acrylic sheets, respectively. (b-d) The measurement result of the (b) open-circuit voltage, (c) transferred charge density, and (d) short-circuit current density of this type of RTENG, respectively.

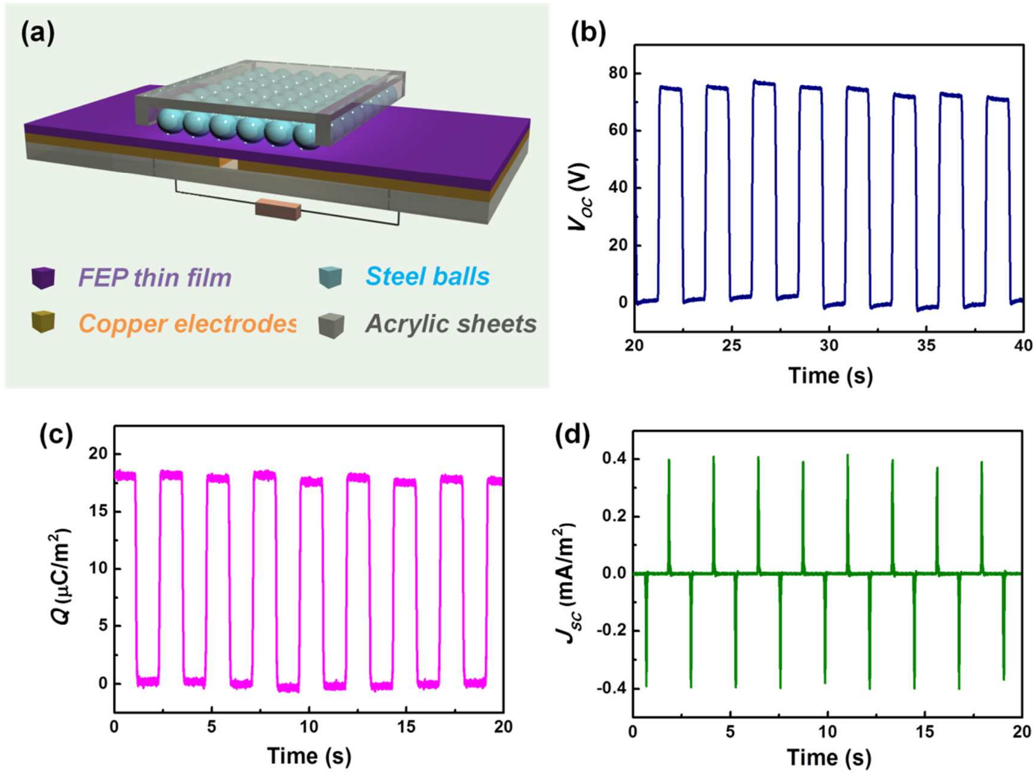

Figure S2. Device structure and output performance of the RTENG based on the rolling electrification between steel balls and FEP thin film. (a) The schematic structure of the RTENG that is composed of steel rolling balls and FEP thin film deposited with a pair of copper electrodes. Both parts are confined or supported by the acrylic sheets, respectively. (b-d) The measurement result of the (b) open-circuit voltage, (c) transferred charge density, and (d) short-circuit current density of this configuration of RTENG, respectively.

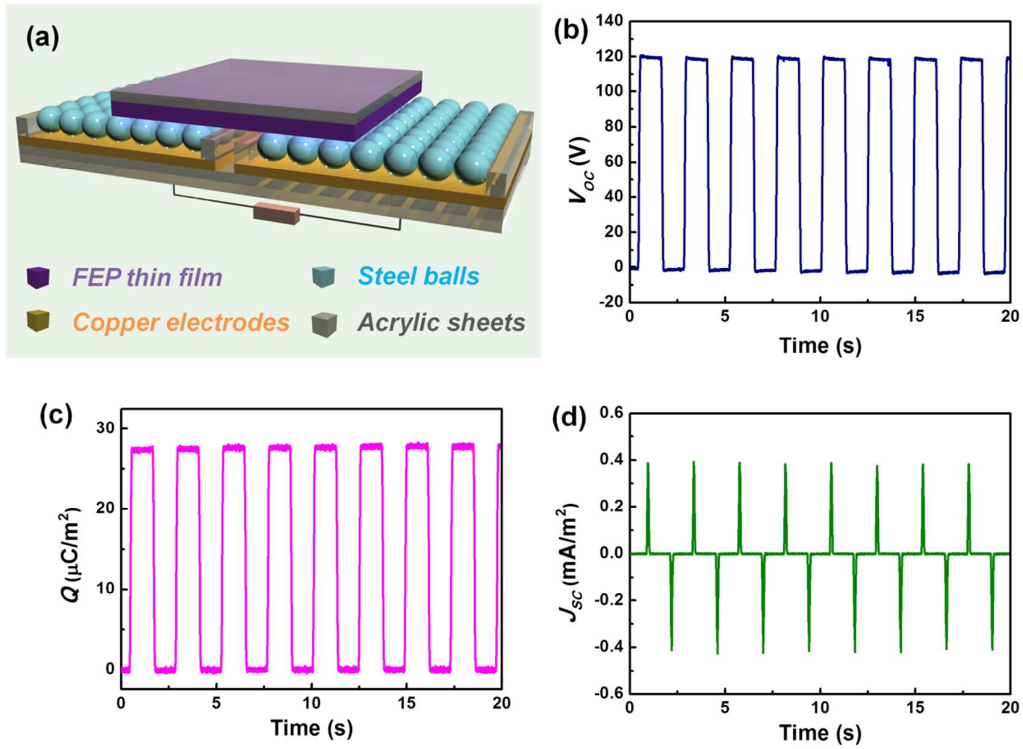

Figure S3. Device structure and output performance of the RTENG based on the rolling electrification between two sets of steel balls and freestanding FEP thin film. (a) The schematic structure of the RTENG that is composed of two sets of steel rolling balls connected with copper electrodes, and a piece of freestanding FEP thin film without electrode deposition. Both parts are confined or supported by the acrylic sheets, respectively. (b-d) The measurement result of the (b) open-circuit voltage, (c) transferred charge density, and (d) short-circuit current density of this prototype of RTENG, respectively.

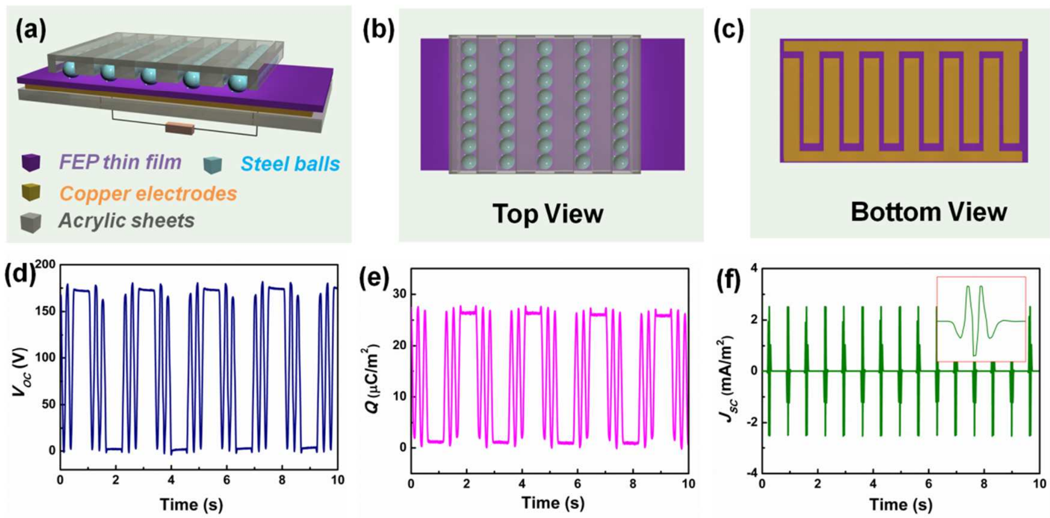

Figure S4. Device structure and output performance of the RTENG based on the rolling electrification between steel balls and FEP thin film complementary deposited with grated copper electrodes. (a) The schematic structure of the RTENG that is composed of the steel rolling balls, the FEP thin film, and the copper electrodes. Here, steel rolling balls are separated into several strips by an acrylic bracket fabricated by laser cutting. (b-c) The top view and bottom view of the device structure showing the grated structure of both the rolling ball array and the complementary copper electrodes. (d-f) The measurement result of the (d) open-circuit voltage, (e) transferred charge density, and (f) short-circuit current density of this prototype of RTENG, respectively.

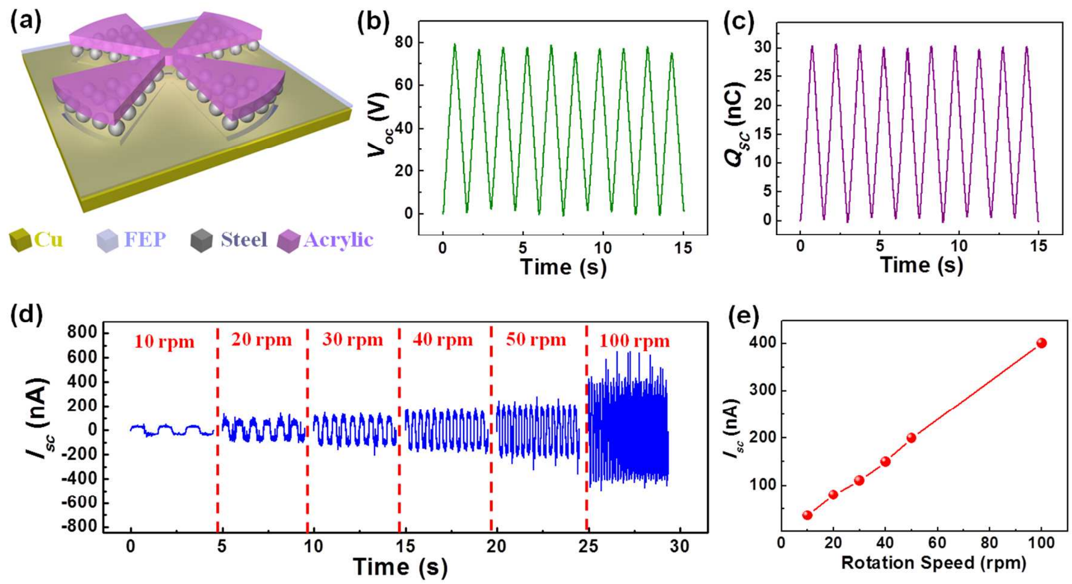

Figure S5. Device structure and output performance of the RTENG based on the rotary rolling electrification between steel balls and FEP thin film. (a) The schematic structure of the RTENG that is composed of steel rolling balls, the FEP thin film, and complementary disk-patterned electrodes. Both parts are confined and supported by the acrylic sheets, respectively. (b-c) The measurement result of the (b) open-circuit voltage, (c) transferred charge density of the rotary RTENG. (d) The measured short-circuit current of the rotary RTENG with variable rotation speeds. (e) The summarized measurement result of the short-circuit current with variable rotation speeds.