

Enhanced output power of freestanding ball-based triboelectric generator through electrophorus effect

Tsz Hin Choy^{1†}, Ying Ying O^{1†}, Feichi Zhou¹, Wei Xu¹, Man Chung Wong¹, Tao Ye², Jianhua Hao¹, and Yang Chai^{1}*

¹ Department of Applied Physics, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China.

² Department of Electrical and Electronics Engineering, Southern University of Science and Technology

*Correspondence should be addressed to: ychai@polyu.edu.hk

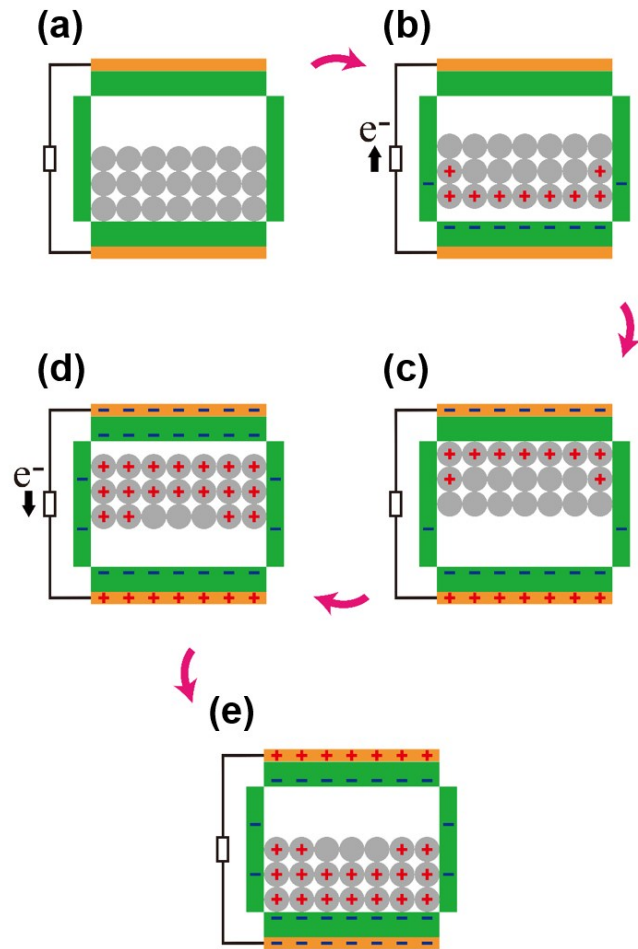


Figure S1. Working mechanism of ball based triboelectric generator (B-TEG) at 1st cycle. (a) Initial state: Al balls contact with bottom inner surface of PTFE cylinder. (b) First separation: Al balls move upwards and leave the bottom inner surface of PTFE cylinder. (c) First contact: Al balls contact with the top inner surface of PTFE cylinder. (d) Second separation: Al balls move downwards and leave the top inner surface of PTFE cylinder. (e) Contact to bottom surface: Al balls contact with bottom inner surface of PTFE cylinder.

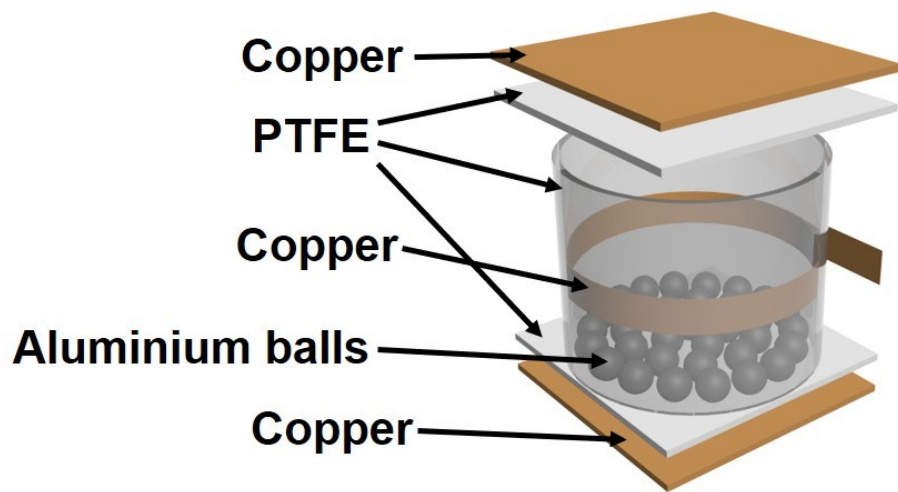


Figure S2. Illustration of the ball-based grounded-metal-freestanding-layer triboelectric generator (B-GTEG).

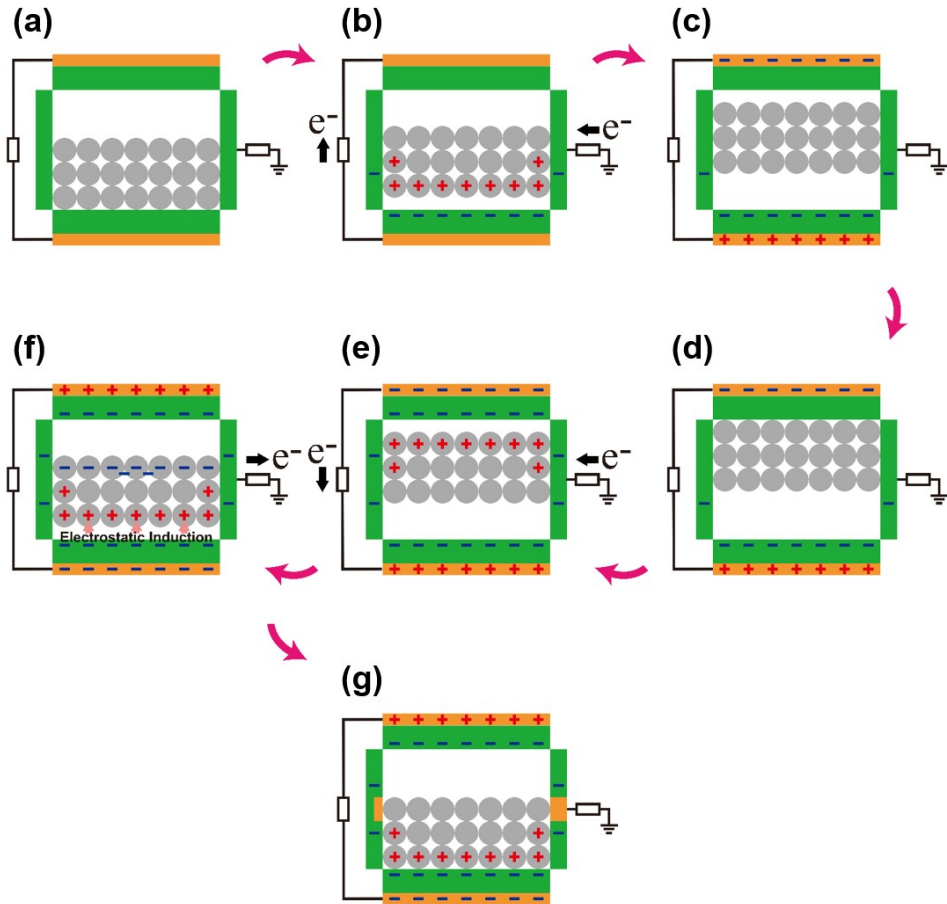


Figure S3. Working mechanism of ball-based grounded-metal-freestanding-layer triboelectric generator (B-GTEG) at 1st cycle. (a) Initial state: Al balls contact with bottom inner surface of PTFE cylinder. (b) First separation: Al balls move upwards and leave the bottom inner surface of PTFE cylinder. (c) Electrostatic induction (X): There is no electrostatic induction at the 1st cycle. (d) First contact: Al balls contact with the top inner surface of PTFE cylinder. (e) Second separation: Al balls move downwards and leave the top inner surface of PTFE cylinder. (f) Electrostatic induction: Electrophorus effect is occurred when Al balls is approaching the bottom inner surface of PTFE cylinder by electrostatic induction. (g) Contact to bottom surface: Al balls contact with bottom inner surface of PTFE cylinder.

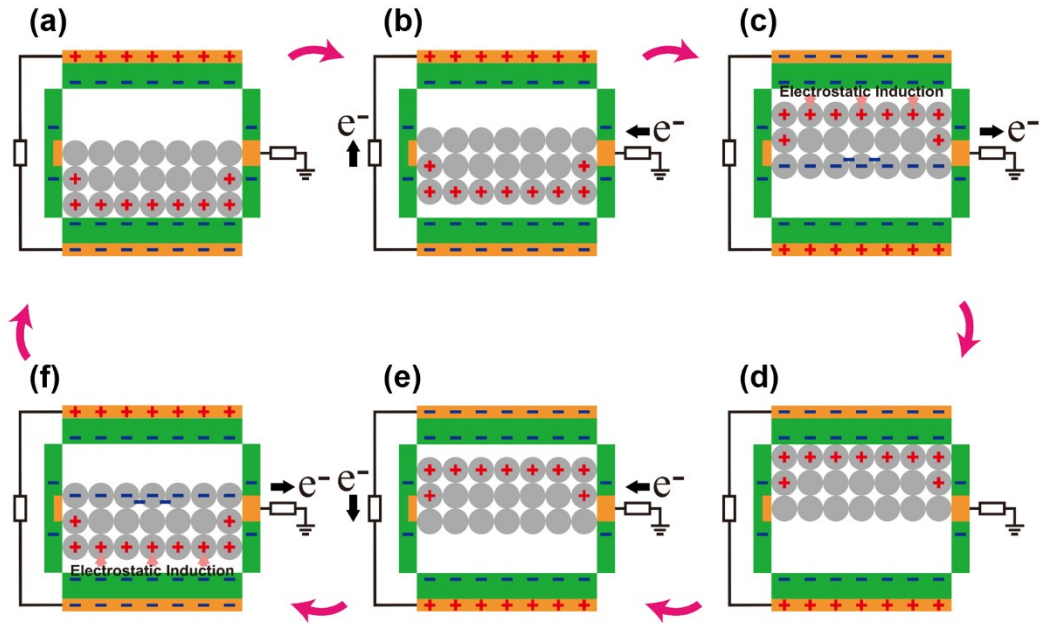


Figure S4. Working mechanism of ball based grounded-metal-freestanding-layer triboelectric generator (B-GTEG). (a) Contact to bottom surface: Al balls contact with bottom inner surface of PTFE cylinder. (b) Separation from bottom surface: Al balls move upwards and leave the bottom inner surface of PTFE cylinder. (c) Electrostatic induction: Electrophorus effect is occurred when Al balls is approaching the top inner surface of PTFE cylinder by electrostatic induction. (d) Contact to top surface: Al balls contact with the top inner surface of PTFE cylinder. (e) Separation from top surface: Al balls move downwards and leave the top inner surface of PTFE cylinder. (f) Electrostatic induction: Electrophorus effect is occurred when Al balls is approaching the bottom inner surface of PTFE cylinder by electrostatic induction.