Triboelectric Nanogenerator

2600 years ago, contact electrification (triboelectrification) was first documented, but because triboelectrification can cause electrical discharge, it has been considered as a harmful effect for a quite a long time.[1] For thousands of years, people tried many methods to eliminate it, because triboelectrification can be harmful to human health, hamper production of electronics, and even cause fire or explosion. In 2012, triboelectric nanogenerator (TENG) based on the coupling of triboelectrification effect and electrostatic induction were put forward and fabricated.[2] Originating from Maxwell's displacement current, TENG produces outputs through the varying polarization field induced by surface polarization charges, which can harvest many kinds of mechanic energy sources, especially at low frequency.[3] Due to benefits such as being light-weight, low-cost, and easily fabricated, TENGs have attracted worldwide attentions since its birth and becomes an ideal energy harvester to be integrated with some other energy converting components.

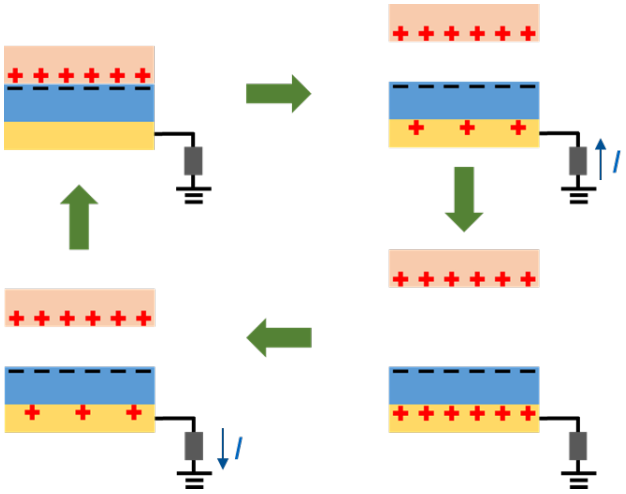

Figure 1: Working principle of the single-electrode mode TENG

In our group, a flexible hybrid energy harvester is designed and fabricated integrated with a conventional single-electrode mode TENG component and a solar cell component. The hybrid device can harness both, solar and mechanical energy from ambient environment to generate electricity. In order to optimize the output performance and characterize the bending stability of the device, grazing incidence small-angle X-ray scattering (GISAXS) is utilized to measure morphology changes of the mesoscale structure.[4] This work may have exciting applications in smart home systems and soft robots.

References

[1] Z. L. Wang, A. C. Wang: *On the origin of contact-electrification*; Mater. Today **30**, 34-51 (2019)
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[4] P. Müller-Buschbaum: *The active layer morphology of organic solar cells probed with grazing incidence scattering techniques*; Adv. Mater. **26**, 7692-7709 (2014)