A sliding-mode triboelectric nanogenerator with chemical group grated structure by shadow mask reactive ion etching

With the support by the National Natural Science Foundation of China, a collaboration by the research groups led by Prof. Cheng Gang (**程纲**) from Henan University and Prof. Wang Zhonglin (**王中林**) from Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences, invents "a sliding-mode triboelectric nanogenerator with chemical group grated structure by shadow mask reactive ion etching", which was published in *ACS Nano* (2017, 11(9): 8796−8803).

Based on the conjunction of contact electrification and electrostatic induction effect, the triboelectric nanogenerator (TENG) has drawn much attention recently. TENG is a clean and sustainable power provider that can harvest energies often ignored by us from environments such as human walking energy, wind flowing energy, and water/ocean wave energy. Compared with the electromagnetic induction generator, TENG has significant advantages of high efficiency, low cost, reliable robustness, and being environmental friendly.

However, the concavo-convex structure in TENG with grated structure leads to large frictional resistance and abrasion. Cheng's and Wang's group developed a sliding-mode triboelectric nanogenerator with chemical group grated structure (S-TENG-CGG) based on a triboelectric layer with triboelectric potential positive-negative alternating structure. The tribo-electric layer was fabricated through the RIE process with the help of a metal mask with grated structure. After the RIE etching process, the nylon film, originally positively charged as in friction with stainless steel, gained opposite triboelectric potential with a grated structure on its surface because of the change of surface functional groups. The output signals of the S-TENG-CGG are alternating, and the frequency is determined by both the segment numbers and the moving speed. In the S-TENG-CGG, there is no concavo-convex structure, and the frictional resistance and abrasion are largely reduced.

These findings provide a new method and strategy to fabricate high performance grated TENG with better stability and longer working lifetime.

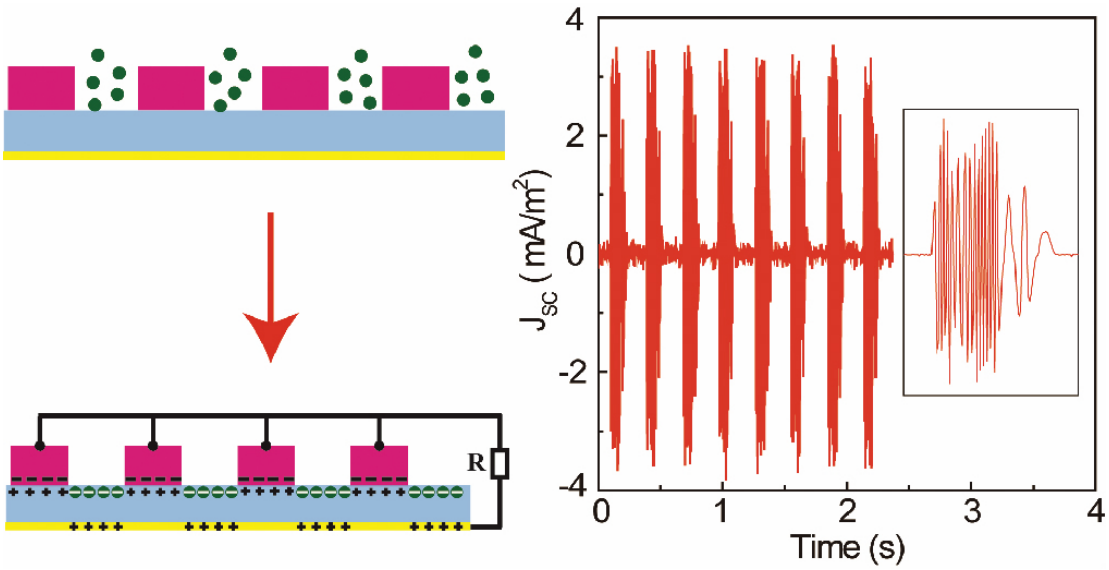

Figure Schematic image of the reactive ion etching processes and the current density (J_{SC}) of the S-TENG-CGG.