

## Electret-based raindrops energy harvester

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### ABSTRACT

This paper reports a high-efficiency raindrops energy harvester using interdigital electrode. With the new electrode deployment and connection scheme, the raindrops energy harvester shows excellent energy conversion efficiency up to 2.5%, over 250 times higher than the conventional interdigital electrode-based triboelectric nanogenerator with efficiency of only 0.01%. Based on the new structure, we first proposed the concept of a raindrop-powered umbrella, which pushes forward a significant step of realizing raindrops energy harvesting in real-world application.

### INTRODUCTION

The reported raindrops energy harvester mainly consists of a fluorinated ethylene propylene film on an indium tin oxide substrate plus an interdigital Argentum nanowire electrode. Fig. 2 shows the mechanism of current flow in the proposed structure.

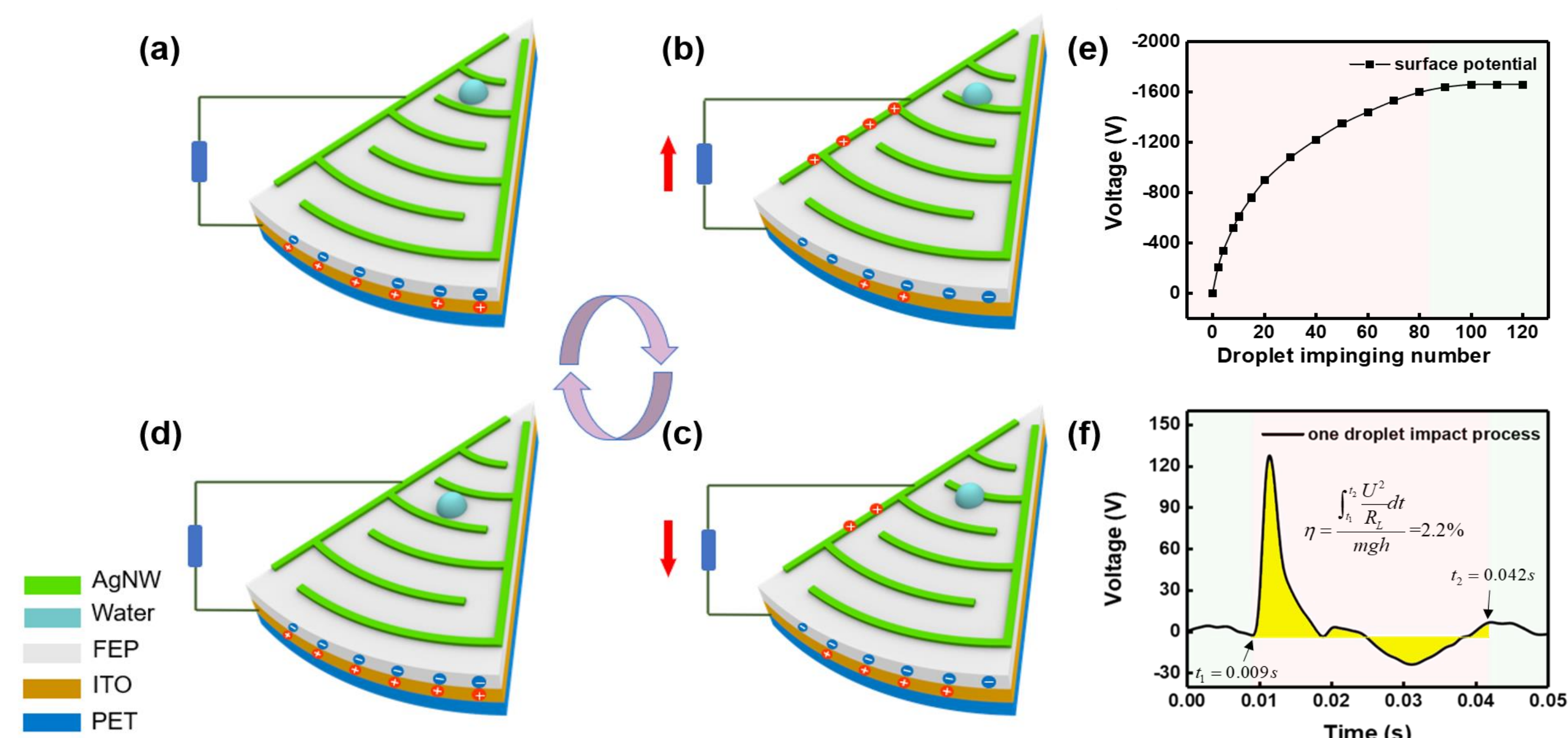


Figure 2: The mechanism of energy harvesting from raindrops: (a) Surface charging process of FEP; (b) Charge moves forward when the raindrop touches the AgNW; (c) Charge flows back when the raindrop detaches from AgNW; (d) The loop is disconnected and a new cycle starts; (e) The time-dependent variation of measured surface potential on the FEP film; (f) The output voltage of one raindrop impact process and its energy conversion calculation.

### TESTING RESULTS

The fabricated raindrops energy harvester could also be utilized in detecting the raindrops speed. Note that the first electrode of the interdigital electrode is designed for the energy harvesting and the rest are utilized to detect the raindrops speed.

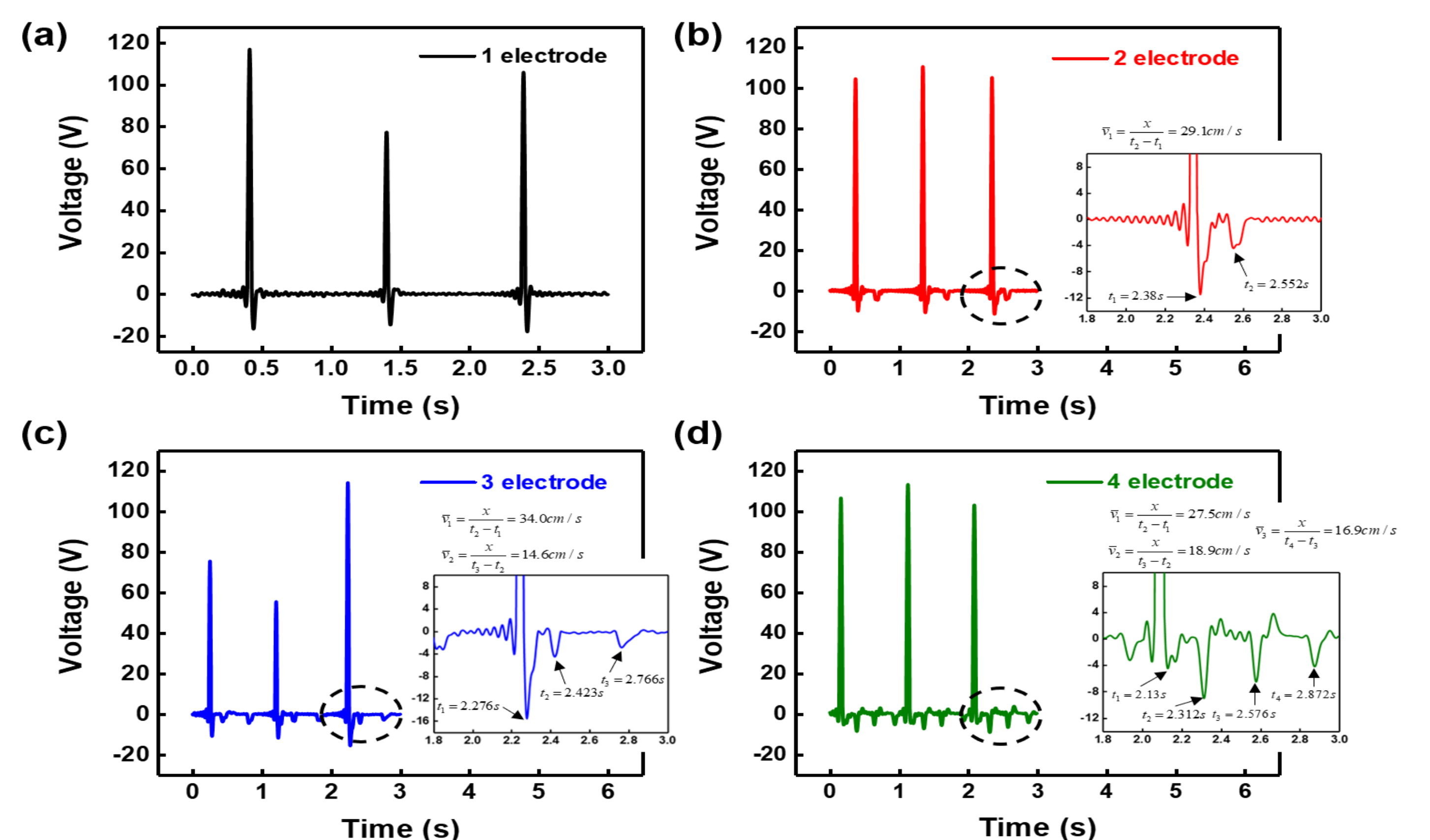


Figure 3: The output open-circuit voltage for (a) one-, (b) two-, (c) three-, (d) four-electrode device.

### CONCLUSION

In this paper, a high-efficiency raindrops energy harvester using the interdigital electrode has been successfully developed. The use of the interdigital electrode enables it to realize the power generation from water and the raindrops speed detection at the same time. A fabricated raindrops energy harvesting umbrella is demonstrated to light up the commercial LEDs in the simulated rainy environment.