Fabricating Self-powered E-paper on paper substrates and driven by triboelectric nanogenerator module

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Abstract

With the development of Inter of Things (IoT), paper-based substrate has gained extensive attention in recent years. Paper with the advantage of cost effective, biodegradable, disposable and even foldable shows great potential in printing electronic application.[2] So far, more and more electronic devices have been constructed on paper-based substrate such as circuit boards, touch panels, sensors, heaters, memories, supercapacitors etc.[3,4,5] Displays as the core of human-computer interaction are increasing prominent. Electrophoretic display (EPD) as a reflective display provides a paper-like experience. EPD technology processes several advantages including low power consumption, good flexibility, and excellent sunlight visibility.[1] It relies on electrostatic motion of color particles in a liquid suspension under an applied electric field. Electrophoretic microcapsule ink contains negatively charged white particles and positively charged black particles. When a positive voltage is applied, the negatively charged particles move toward the electrode on the viewer side and thus the viewer observed the white state of the electronic paper. At the same time, the positively charged black particles move to the opposite electrode. However, most EPD studies focuses on the common substrates Indium Tin Oxide (ITO) instead of paper-based substrate.

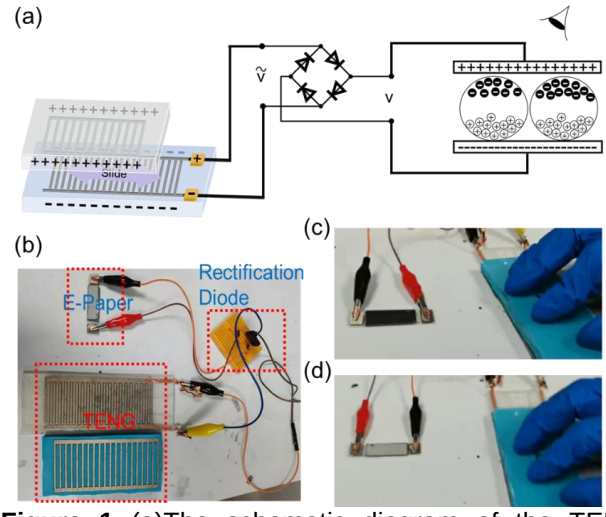

Figure 1 (a)The schematic diagram of the TENG device. (b)The image of the TENG devices driving E-paper. (c)(d) TENG devices driving E-Paper to black and white states.

Herein, we first introduce our previous works, as the foldable paper-based E-paper, and the self-powered E-paper (SPEP) integrated with triboelectric nanogenerator (TENG). A paper-based SPEP device driven by a TENG module was demonstrated based on these works, which proved the possibility for a self-powered paper-based device. The response time of paper-based E-paper was 243ms under the external power supply and 880ms under the TENG self-power supply. In the future, the performance of paper-based SPEP devices could be optimized by full integration and the efficiency improvement of TENG modules, which provided a promising future for E-paper devices.

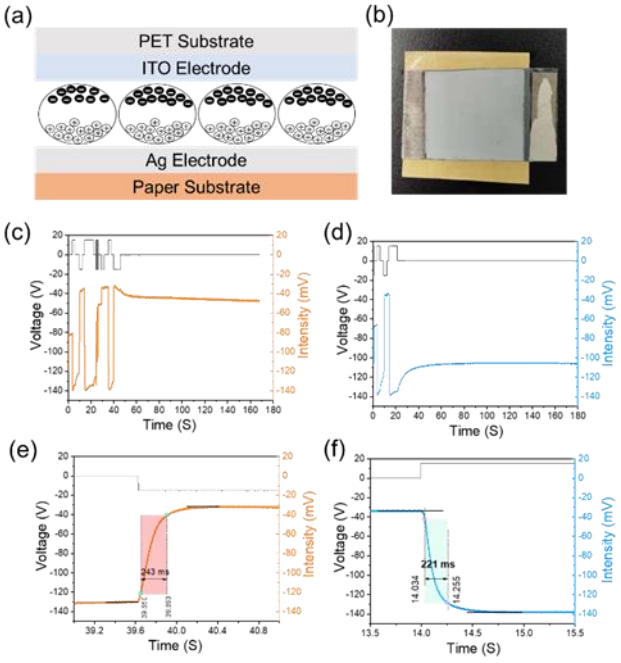

Figure 2 (a) The schematic diagram of Paper-Based E-Paper. (b)The Image of the Paper-Based E-Paper. (c)(d) The electro-optical response of Paper-Based E-Paper. (e)(f) The response time of Paper-Based E-Paper.

Guangyou Liu and Yifan Gu contributed equally.

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