Heteroatom-doped graphene for triboelectric nanogenerators

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Triboelectric nanogenerators (TENGs) can convert the mechanical energy into electricity in a viable and sustainable way by exploiting both tribo-electrification and electrostatic induction [1]. The design and optimization of the layers composing the TENG by exploring new tribo-electrically active materials is of paramount importance in order to improve the device performance [2]. To achieve this goal, graphene derivatives have been proposed as high-surface area triboelectric materials that can be integrated into conventional triboelectric material to enhance charge transfer between the TENG layers with opposite tribo-polarity [3]. The introduction of a monolayer made of an electron trapping material into the triboelectric layer has been demonstrated to be an efficient strategy to dramatically improve the output power density in TENGs [4]. On the basis of these results, I will first show boron-doped graphene (B-Gr) as monolayer electron trapping material. This approach enables a 50% enhancement of the power density output of B-Gr-based TENGs compared to B-Gr free counterpart. Subsequently, I will report fluorine-doped graphene (F-Gr) as a high-electronegativity triboelectric material, which is determined by the presence of F atoms. More specifically, a triboelectric layer formed by polydimethylsiloxane (PDMS) containing 1% of F-Gr can yield an output power density 4-times higher compared to the one of pristine PDMS (Fig. 1). These results open the door to the application of heteroatom-doped graphene for TENGs and TENG-related wearable electronics.

References

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Figures

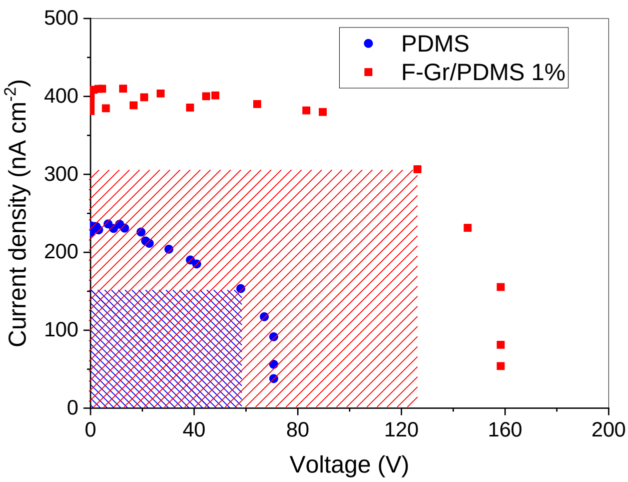

Figure 1: Curves of current density peak as a function of the voltage peak. The area of the largest rectangle defined by the curve is the maximum power density.

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