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Self-powered graphene triboelectric biochemical sensor for specific detection

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Abstract
By converting mechanical energy to electrical energy, flexible triboelectric nanogenerators (TENG)[1] have inspired great research interests on self-powered active sensors for wearable and implantable electronics,[2] where a sustainable power source is of key importance. Nevertheless, most of the current developed TENG sensors are based on 1 TENG/1 sensor structure with limited biochemical sensitives, representing a key challenge for its point-of-care (POC) applications.[3] Here, by combining the superior electrical properties of two-dimensional graphene[4] in TENG configuration, we reported self-powered sensors with desired compact device geometry. Such TENG sensors exhibit excellent sensitivity towards different DNA nucleobases, which can be unambiguously ascribed to the change of graphene Fermi level upon biomolecule adsorption. Along with the demonstrated dual-channel self-powered sensing scheme, these achievements open the avenue for compact, multifunctional TENG biochemical sensor platform.

References

[1] F.-R. Fan, Z.-Q. Tian, Z. Lin Wang, Nano Energy, 1 (2012) 328-334.
[2] X. Pu, M. Liu, X. Chen, J. Sun, C. Du, Y. Zhang, J. Zhai, W. Hu, Z. L. Wang, Sci Adv, 3 (2017) e1700015.
[3] Y. J. Su, G. Z. Xie, H. L. Tai, S. D. Li, B. X. Yang, S. Wang, Q. P. Zhang, H. F. Du, H. L. Zhang, X. S. Du, Y. D. Jiang, Nano Energy, 47 (2018) 316-324.
[4] K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, A. A. Firsov, Science, 5696 (2004) 66 –669.

Figures

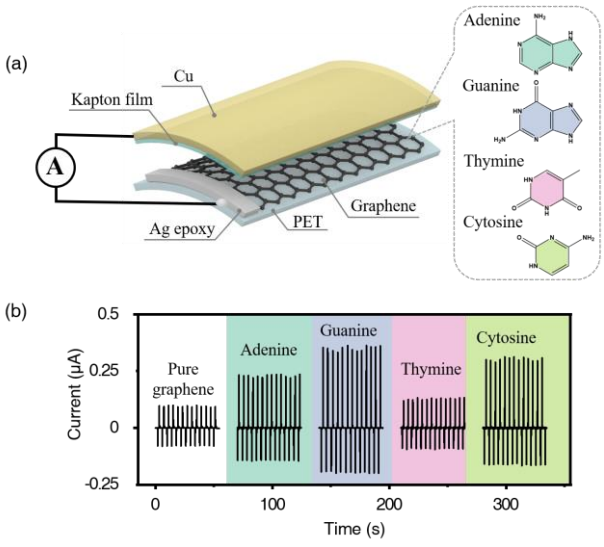

Figure 1: (a) Structure diagram of the graphene-based TENG. (b) The output current of graphene based-TENG adsorbed by different DNA nucleobase solutions.