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Self-powered graphene triboelectric biochemical sensor for specific detection

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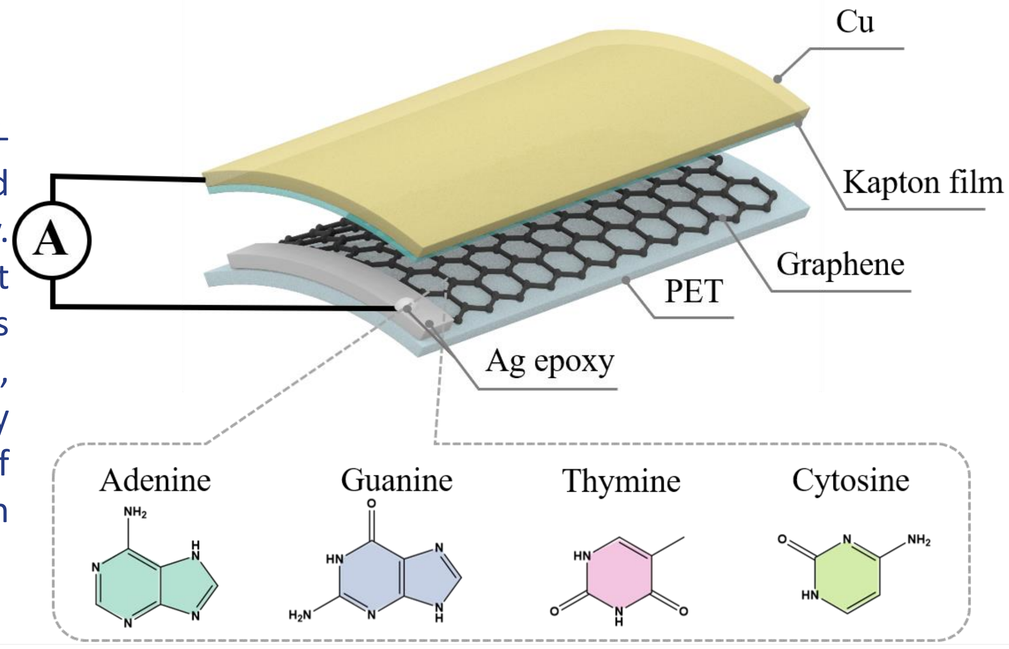
Background

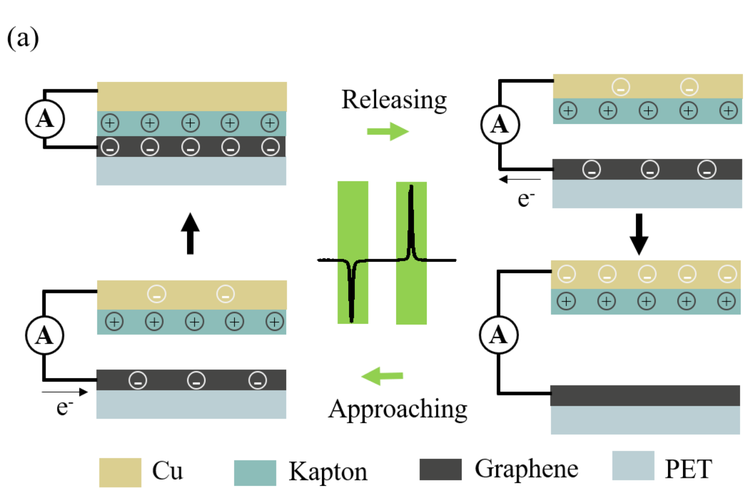
By converting mechanical energy to electrical energy, flexible triboelectric nanogenerators (TENG) have inspired great research interests on self-powered active sensors for wearable and implantable electronics, where a sustainable power source is of key importance. Nevertheless, most of the current developed 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.

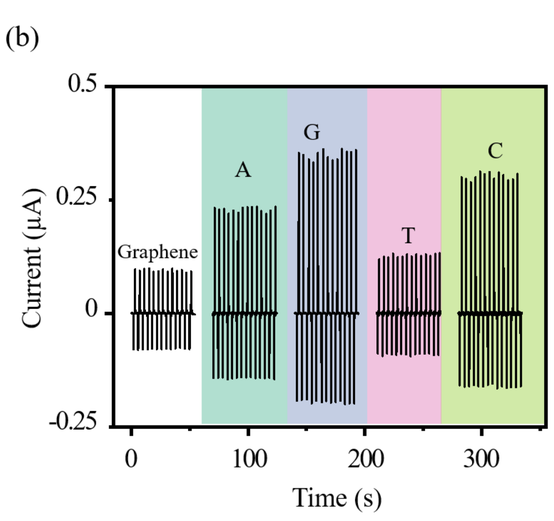
Experiment

Here, 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.

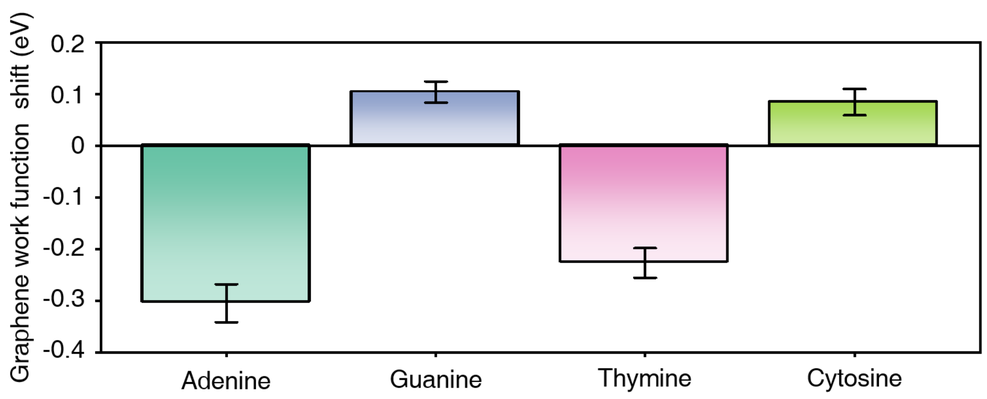


Results

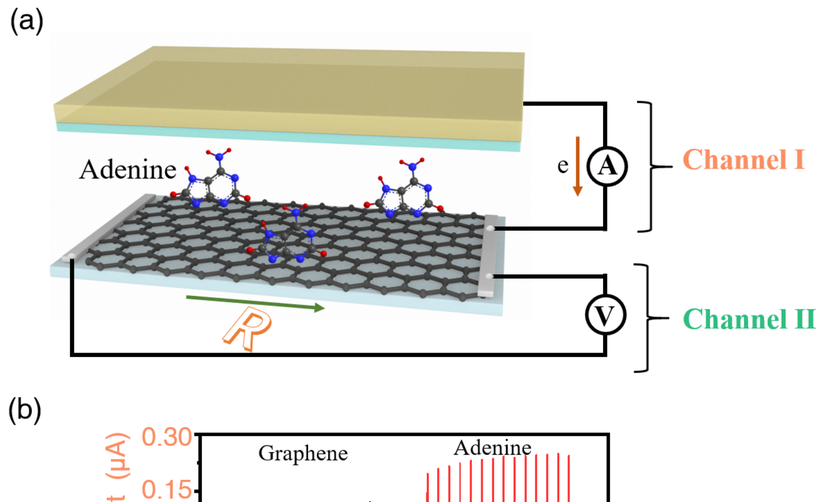


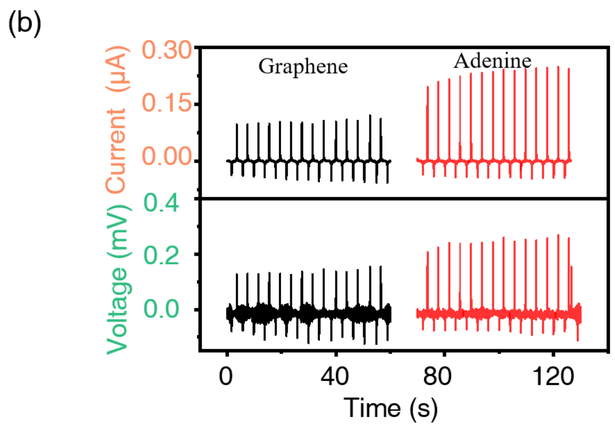


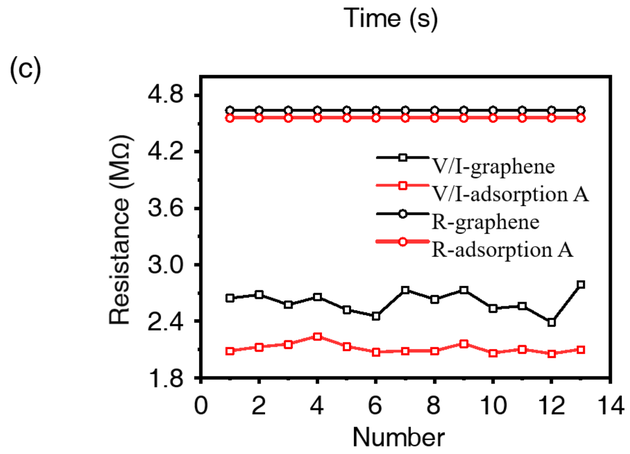
When the two layers are separated or contacted, electrons will flow in the external circuit due to electrostatic induction[1]. It is worth noting that the TENG with different nucleobase shows a changed output current compared with the other nucleobase, which is explained by the work function change in the graphene surface after adsorption.



Each type of nucleobase solution modified graphene exhibit characteristic work function variations.







We also extended the two-channel sensing approach to detect adenine molecules

Conclusions and Perspectives

Our approach offers a number of achievements in using the self-powered biochemical sensor to detect any type of molecules by changing work function of electrification layer for portable biomedical diagnosis and environmental monitoring in the near future.

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