DNA-Gated Graphene Nanopore FETs

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Abstract

A graphene nanopore field effect transistor (FET) gated by DNA strands was proposed and fabricated. Nanopore-based sensors have emerged as versatile analytic platforms because of their extremely high sensitivity. Nanopores with the similar size as the key analytes enable the accurate single-molecule detection. Electrophoresis is used to drive charged analytes such as DNA strands to the nanopore, and the resulting changes in electrical signals are detected through various methods. Graphene is highly regarded as the proper material in sensors for DNA sequencing because ultrathin graphene electrode can result in the single-base separation. Detection of the change in potential using graphene electrode and FETs allow an independent electric field for signal detection and multiplexing. We fabricated the graphene FETs with wafer-scale fabrication and nanometer-scale patterning, and the nanopores to detect the voltage change was positioned in the middle of the suspended graphene. An Individual single molecular DNA was transmitted via nanopore and we can conclude the occlusion of the nanopore by the strand successfully gated the graphene FET as a DNA strand was translocated through a graphene nanopore.

References

[1] Saha, K. K.; Drndic, M.; Nikolic, B. Nano Lett. **12**, (2012) 1, 50-55.

Figures

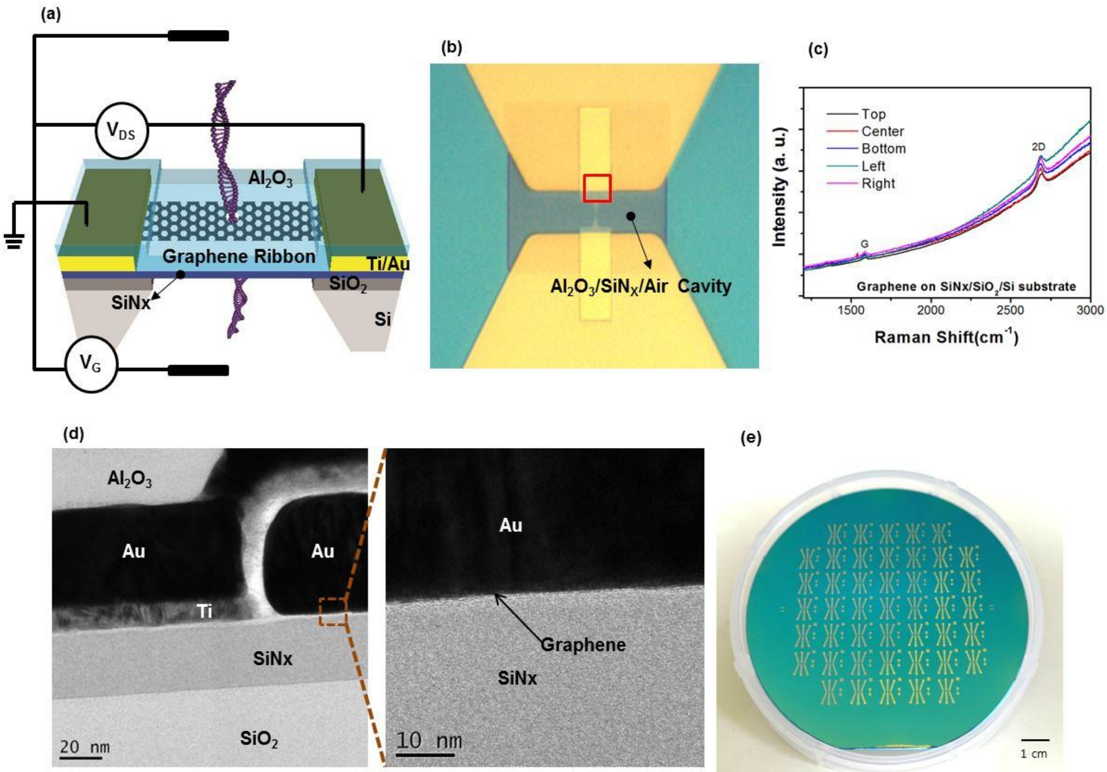

Fig. 1. Graphene nanopore FET. (a) Configuration of the graphene nanopore FET and measurement setup. (b) Optical image of free-standing Al_2O_3/SiNx membrane aligned to the electrode. (c) Raman spectrum of graphene transferred. (d) Cross-sectional TEM images of the graphene nanopore FET. (e) Graphene ribbon FETs fabricated on a 4-inch Si wafer.