

Graphene based tunable Schottky barrier for high performance devices

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Graphene has been one of attractive candidates to replace the silicon technology due to its unique physicochemical properties. However graphene is a zero band gap semiconductor, the on/off ratio of conventional graphene FETs are lower than 100, which is one of key issues to overcome. Several types of graphenes and their structures were reported such as graphene nanoribbon, bi-layered graphene, which induced an inevitable decrease of mobility or high power consumptions.

Here we reported the new structural graphene transistor with high on/off ratio. Since it does not need any structural deformation of graphene, several unique properties were also preserved. Tunable Schottky barrier was simply formed by transferring the CVD grown graphenes on hydrogenated silicon surfaces. And then a gate electrode, to control the work function of graphene, was also formed on the silicon contacted graphene, which is passivated by oxide insulators. All of device fabrications were easily done by 6 inch wafer scale with comparable size of thermally grown graphene. By adjusting graphene's work function, we got a shift of diode threshold voltages and high on/off ratio, 10^5 . Inverter as a fundamental logic circuit was demonstrated by combining n and p type silicon-graphene tunable Schottky diode.