Voltage Rectification in a Parallel p-n Junction of Graphene

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Graphene, a single layer of graphite, is a promising material system for both fundamental physics and device applications, which is indebted to its unique electrical and mechanical properties. The zero bandgap nature of graphene, however, has been a main obstacle to practical device applications. Graphene nanoribbon with a narrow width is suggested to resolve the issue, but its fabrication is still challenging. Here we report voltage rectification effect observed in a parallel p-n junction of graphene, which consists of two different carrier-type (or -density) regions arranged in parallel along the longitudinal direction. The parallel p-n junction was formed simply by introducing a top-gate electrode covering only the half segment of the graphene. During the current flow, the carriers which meet the interface between different regions can transmit into the other region or be reflected into the same one. It breaks the equipotential state along the transverse direction to the current flow, thus a finite voltage signal is measured. Especially, higher voltage was obtained in a different carrier-type configuration, which is attributed to the Klein backscattering. This rectification effect is robust to be observed even at room temperature. Our experimental results indicate the feasibility of graphene devices for circuit applications without the bandgap.

Keywords : graphene,rectification,p-n junction