Charge transport through graphene pn and pnp junctions with spin-orbit interaction

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Charge transport in graphene pn and pnp junctions is analyzed theoretically. The model assumed includes a square potential barrier (pnp junction) or a potential step (pn junction) in an infinite graphene plane. Spin-orbit coupling of both Rashba and intrinsic type is taken into account. The main focus of the work is a detailed analysis of the influence of the coupling on the linear junction conductance. First, we find the transmission probability for an arbitrary angle of incidence on the barrier (or a step), then we calculate the junction conductance as an integral over all incidence angles. The influence of spin-orbit coupling is directly related to the corresponding modifications of the relevant band structure. The intrinsic spin-orbit coupling opens an energy gap at the Dirac points, which significantly changes transmission through the junction. The Rashba coupling in turn lifts the spin degeneracy of both the conduction and valence bands, which makes transmission through the system more complex. Moreover, the Rashba coupling depends on external electric field, and this dependence has been also taken into account when considering transport through the junction.

9.7 cm

13.4 cm

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