Contact Resistivity Model of Metal-Graphene Junctions Based on Bardeen-Transfer-Hamiltonian Method

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Abstract

While graphene-based technology shows great promise for a variety of electronic applications, including radio-frequency devices [1], the resistance of the metal-graphene contact is a technological bottleneck for the realization of viable graphene electronics [2]. One of the most important factors in determining the resistance of a metal-graphene junction is the contact resistivity. Despite the large number of experimental works that exist in the literature measuring the contact resistivity [3], a simple model of it is still lacking. In this paper we present a comprehensive analytical model for the contact resistivity of these junctions, based on the Bardeen Transfer Hamiltonian method [4]. This model unveils the role played by different electrical and physical parameters in determining the specific contact resistivity, such as the chemical potential of interaction, the work metal-graphene function difference, and the insulator thickness between the metal and graphene. In addition, our model reveals that the contact resistivity is strongly dependent on the bias voltage across the metal-graphene junction. This model is applicable to a wide variety of graphene-based electronic devices, and thus is useful for understanding how to optimize the contact resistance in these systems.

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