عنوان مقاله:

Modeling transport in graphene-metal contact and verifying transfer length method characterization

محل انتشار:

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خلاصه مقاله:

kground and Objectives: One of the common methods for measuring the contact resistance of graphene sheets is the transfer length or transmission line method (TLM). Apart from the contact resistance, TLM gives the resistance of the channel sheet and the effective transfer length of the measured samples. Furthermore, the implementation of TLM is simple. To analyze this method, one can use circuit modeling (CM).Methods: An important parameter of TLM is the contact resistance between the metal electrode and the graphene channel. To compare this parameter with other measures, it is normalized by multiplying it by the channel width. In this research, for TLM analysis, all the components of the structure including electrodes, graphene channel, and metal-graphene contact are modeled in a circuit.Results: PSpice and MATLAB are integrated for TLM circuit modeling. The metal electrodes and the graphene channel are modeled based on the values of the resistances measured in the laboratory using the van der Pauw method and the resistances reported in the article in ohms per square. Moreover, the metal-graphene contact resistance is considered based on the values reported in the literature in ohms-micrometers.Conclusion: The modeling results show that, in addition to the effective transfer length, the effective transfer width can be defined on a contact, according to the dimensions of the structure. Therefore, the channel width is a vague characteristic of the TLM measurement, which plays a very important role in measuring contact resistance. Furthermore, the contact resistance and the resistance of the channel sheet are independent of each other and of the distance between the contacts. If defects in the graphene channel are randomly distributed along the channel between the contacts, they do not have a significant impact on the contact resistance, while they increase the resistance of the graphene sheet provided that they do not disrupt the channel. Indeed, for a ۱۰% defect (or ۹۰% coverage along the channel), the resistance of the sheet increases by ۱۶%. In addition, by using this modeling, parameters such as the distribution of the contact current, the sources of errors, and their influence in determining the contact resistance and resistance of the channel sheet are investigated.

کلمات کلیدی:

Graphene-metal Contact, Contact Resistance, Transfer Length Method, Circuit Modeling, Effective Channel Width

لینک ثابت مقاله در پایگاه سیویلیکا: