Properties of Graphene Nanoribbon with Zigzag Edges Attached to Two Normal Metals

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A graphene nanoribbon with the zigzag shaped edges, which is abbreviated to zigzag GNR in the following, is known to possess the remarkable property that the material is classified into an insulator due to vanishing Drude weight even though the energy gap is closed at the Fermi energy. It originates from the fact that the one-particle states close to the Fermi energy are well localized around the zigzag edges. Thus, it is expected that the unusual transport properties are observed in the material.

We have theoretically investigated the transport properties of the junction where the zigzag GNR is sandwiched by the two normal metals.[1] It has been found that the transport properties are strongly dependent on the parity of the width. Especially, those for $E \simeq 0$ with E being the energy of an electron can not be understood from the electronic states of the isolated zigzag GNR. In the present work, in order to clarify the roles of the zigzag edges on such anomalous transport properties, we investigate the system with the zigzag GNR where the hopping at the two zigzag edges are modified compared to those at the other bonds. In addition, the local density of states of the zigzag GNR sandwiched by the two normal metals are examined and discrepancies from that of the isolated zigzag GNR are discussed.

[1] Y. Mochizuki and H. Yoshioka, J. Phys. Soc. Jpn. **78**, 123701 (2009).