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Fabrication of encapsulated graphene-based heterostructure using molybdenum as edge-contacts

Graphene is an intriguing platform to study exotic quantum transport phenomena due to its intrinsically high mobility and remarkable electronic properties. To achieve high-performance device, graphene is usually encapsulated between thin sheets of hexagonal boron nitride (hBN) to protect graphene layer from extrinsic impurities. Cr/Au is typically employed to make contacts with the edges of the heterostructure. In this research, Mo is used as an alternative electrode for graphene without adhesion layer to simplify the fabrication process. hBN-graphene-hBN heterostructures were fabricated by a pick-up technique and etched in O₂/CHF₃ gases to expose graphene edges. Mo contacts were deposited onto the substrates by sputtering. We achieved ohmic contacts between graphene and Mo. The contact resistance reaches the maximum of around 1,300 Ω·μm at charge neutrality point and decreases to 975 Ω·μm at the density of 4×10¹² cm⁻². We observed that the contact resistance increases over time likely due to the oxidation of Mo but remained ohmic after 2 months. The intrinsic transport characteristics of graphene can still be obtained by using four-probe measurement. Here, we realized a high-quality twisted bilayer graphene device with a room-temperature mobility of 27,000 cm²/v·s indicating that Mo can be used as edge-contacts to probe the transport properties of graphene.

Author: Mr KLANURAK, Illias (Department of Physics, Faculty of Science, Chulalongkorn University)

Co-authors: Dr WATANABE, Kenji (Research Center for Functional Materials, National Institute for Materials Science, Tsukuba, Japan); Dr TANIGUCHI, Takashi (International Center for Materials Nanoarchitectonics, National Institute for Materials Science, Tsukuba, Japan); Prof. CHATRAPHORN, sojiphong (Department of Physics, Faculty of Science, Chulalongkorn University); Dr TAYCHATANAPAT, Thiti (Department of Physics, Faculty of Science, Chulalongkorn University)

Presenter: Mr KLANURAK, Illias (Department of Physics, Faculty of Science, Chulalongkorn University)

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