Electrical Characterization for Graphene Film Grown by Low-temperature Microwave Plasma CVD

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We have developed the microwave plasma CVD technique combined with the roll-to-roll process to deposit the graphene film. In this method, a continuous deposition process of graphene film has been demonstrated at low temperature in a few ten seconds [1]. To attain higher electrical conductivity, the details of the electrical properties of the graphene film deposited by plasma CVD technique must be clarified. Hall effect measurement is useful to measure the electrical properties for graphene, which is expected to understand the mechanism of its electrical conductivity. In this study, we discuss the details of the electrical properties of the graphene films deposited by low-temperature plasma CVD based on Hall effect measurements.

The graphene film was deposited by microwave plasma CVD technique on Cu foil typically at 300 – 400 degC. Then, it was transferred to the quartz substrate. After that, the van der Pauw device for Hall effect measurement was fabricated using conventional photolithography, metal deposition and lift-off processes. The fabricated devices show that the mobility is estimated to be from 10 to 100 cm\(^2\)/Vs. To investigate the mobility dispersion, we quantify defects and disorder for graphene by Raman mapping. The results suggest that the intensity of the D/G ratio could correlate with the mobility. Based on these results, we’ll discuss the cause which predominates the present conductivity of the films and how to improve the electrical conductivity of graphene film.