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Synthesis and Characterization of Layer-Patterned Graphene on Ni/Cu Substrate

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Graphene is only one atom thick planar sheet of sp²-bonded carbon atoms arranged in a honeycomb crystal lattice, which has flexible and transparent characteristics with extremely high mobility. These noteworthy properties of graphene have given various applicable opportunities as electrode and/or channel for various flexible devices via suitable physical and chemical modifications. In this work, for the development of all-graphene devices, we performed to synthesize alternately patterned structure of mono- and multi-layer graphene by using the patterned Ni film on Cu foil, having much different carbon solid solubilities. Depending on the process temperature, Ni film thickness, introducing occasion of methane and gas ratio of CH₄/H₂, the thickness and width of the multi-layer graphene were considerably changed, while the formation of monolayer graphene on just Cu foil was not seriously influenced. Based on the alternately patterned structure of mono- and multi-layer graphene as a channel and electrode, respectively, the flexible TFT (thin film transistor) on SiO₂/Si substrate was fabricated by simple transfer and O₂ plasma etching process, and the I-V characteristics were measured. As comparing the change of resistance for bending radius and the stability for a various number of repeated bending, we could confirm that multi-layer graphene electrode is better than Au/Ti electrode for flexible applications.

Keywords: Graphene, Oxygen plasma