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Morphology Control of Nanostructured Graphene on Dielectric Nanowires

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Graphene is a sp2-hybridized carbon sheet with an atomic-level thickness and a wide range of graphene applications has been intensely investigated due to its unique electrical, optical, and mechanical properties. In particular, hybrid graphene structures combined with various nanomaterials have been studied in energy- and sensor-based applications due to the high conductivity, large surface area and enhanced reactivity of the nanostructures. Conventional metal-catalytic growth method, however, makes useful applications difficult since a transfer process, used to separate graphene from the metal substrate, should be required. Recently several papers have been published on direct graphene growth on the two dimensional planar substrates, but it is necessary to explore a direct growth of hierarchical nanostructures for the future graphene applications.

In this study, uniform graphene layers were successfully synthesized on highly dense dielectric nanowires (NWs) without any external catalysts. We also demonstrated that the graphene morphology on NWs can be controlled by the growth parameters, such as temperature or partial pressure in chemical vapor deposition (CVD) system. This direct growth method can be readily applied to the fabrication of nanoscale graphene electrode with designed structures because a wide range of nanostructured template is available. In addition, we believe that the direct growth growth approach and morphological control of graphene are promising for the advanced graphene applications such as super capacitors or bio-sensors.

Keywords: Graphene, dielectric nanowire, chemical vapor deposition