Direct Deposition of a Graphitic Film on a Dielectric Substrate by Nickel Nanocatalyst

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Chemical vapor deposition (CVD) process usually results in polycrystalline graphitic films [1,2], in which strong electron scattering and reduced group velocity of electrons suppressed the carriers mobility [3]. However, the grain boundaries do not necessarily affect optical properties of these materials because the film thickness is one or two order of magnitude smaller than the light wavelength. This makes development of the CVD process suitable for direct synthesis of graphene and graphitic films on dielectric substrates eagerly awaiting breakthrough in optics and photonics.

Here we demonstrate synthesis of the few tens of nanometer thick polycrystalline graphitic film deposited directly on a silica substrate by using a sacrificial nickel film as a catalyst. In the experiment, the nickel film with thickness of 10 nm was deposited on a smooth silica substrate and coated with a carbon based photoresist. Baking the sample at 800 °C resulted in the formation on the substrate surface a graphitic film with a thickness of a few tens of nanometers decorated with sub-micron Ni particles. By removing these particles by wet etching we arrive at a few tens of nanometer thick graphitic film directly deposited on a silica substrate.

The obtained graphitic film with and without Ni particles was characterized by Raman spectroscopy, optical transmission spectroscopy, multiphoton microscope and nonlinear optical pump-probe technique. We demonstrate that the properties of the fabricated ultrathin films resemble those of multilayer graphene. The proposed simple and versatile approach offers a tempting platform for a multilayer graphene film processing on dielectric substrates.

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