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Transfer free graphene growth at and below 250 °C using novel catalysts

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Graphene, 2-dimensional carbon nanomaterial, is promising for various kinds of devices of next generation. In the graphene research, the low-temperature growth and transfer free growth onto the substrate as well as the controllable growth in position and quality are still challenging. Chemical vapor deposition (CVD) is widely used for the synthesis of high quality graphene on the catalyst surface. In CVD, unfortunately, high temperature (~1000 °C) and transfer processes are generally unavoidable. From a viewpoint of the future device applications, especially for transparent and flexible devices using non-heat tolerant substrates, and also of the energy saving, graphene itself should be synthesized at lower temperatures. Here we will deal with a novel approach different from the conventional CVD to grow graphene at and below 250 °C. The key in this approach is the selection of catalyst metal. The metal catalysts employed here were never popular for CVD graphene growth. Catalyst metal films were deposited onto amorphous carbon coated substrates of SiO_2 and glass. The samples thus prepared were simply annealed in vacuum at 150-250 °C. A typical example of a Raman spectrum obtained for a graphene flake thus synthesized at 250 °C on a glass substrate is being shown. As seen in the Raman spectrum, the surface was characterized by the intense G and 2D peaks together with a small D peak, confirming the growth of bilayer graphene directly on the glass substrates. Although the domain size of the graphene formed by this method was still small (<20 um), this approach will open up a new route for transfer free and position control graphene growth at low temperatures.

Biography

Masaki Tanemura is currently a Professor at Nagoya Institute of Technology (NITech), Nagoya, Japan and Special Adviser to the NITech President as well as a Director of Multi-Energy Innovation Center at NITech. Before joining NITech, he has worked at Toyota Central Research and Development Laboratories, Inc., Aichi, Japan and at Bonn University, Germany, as Alexander von Humboldt Fellow. His recent research activities include the synthesis, characterization using *in situ* TEM (transmission electron microscopy) and application of 1- and 2-dimensional nanomaterials, such as carbon nanofibers (CNFs), graphene, boron nitride and transition metal dichalcogenide materials.

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