2-D Nanocarbons: Attraction, Reality and Future

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Carbon element has a great number of allotropes, covering the traditional three dimensional (3-D) diamond and graphite, 2-D graphene, 1-D carbon nanotubes and 0-D fullerenes. Recently, graphyne, a new 2-D carbon allotrope family formed by *sp* and sp^2 hybridization carbon atoms also comes into the stage. Theoretical calculations further indicate that there may exist a *penta*-graphene, formed by a huge number of carbon pentagons in a 2-D fashion instead of the hexagon structure of graphene. Therefore, 2-D nanocarbons including graphene, graphyne, etc have created a new category of carbon allotropes which attract increasing attentions. We have been working on the controlled synthesis of 2-D nanocarbons for many years. Systematic studies have been done on the chemical vapor deposition (CVD) of high quality graphene on various solid substrates ranging from metals (Cu, Ni, Cu-Ni alloy, Pt, Ru, Rh, Ir, Pd), groups IV-VI early transition metal carbides, to dielectric substrates (*h*-BN, STO, glass, NaCl). We also made a great effort for the controlled synthesis of graphdiyne, a representative member of the graphyne family. A brief overview will be made in the talk following a general concept of CVD process engineering by highlighting the catalyst design, super graphene glass and scalable production techniques of graphene and various applications as well as the Glaser-Hay coupling synthesis of graphdiyne nanowalls on Cu foils and foams.