CVD Growth of Graphene and Its 2D Hybrids: Attraction, Reality and Future

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Graphene, the atomic thin carbon film with honeycomb lattice, holds great promise in a wide range of applications, which is however determined by the development of scalable preparation technique. Among various emerging techniques, chemical vapor deposition (CVD) has received the fastest advances in the last few years. For the CVD growth of graphene, the ultimate goal is to achieve the highest quality in the largest scale and lowest cost with a precise control of layer thickness, stacking order and crystallinity. This talk focuses on our recent progresses towards the controlled surface catalytic growth of graphene and its two-dimensional (2D) hybrids via CVD process engineering. Our general strategy involves the rational design of growth catalysts as well as the control of the elementary steps of CVD process for achieving a precise control of layer thickness, stacking order, domain size, doping and energy band structure. For instance, with a designed binary alloy, such as Ni/Mo, Co/Mo, or Fe/Mo, we effectively suppressed the carbon precipitation step and achieved perfect single layer graphene with 100% surface coverage. We also discovered the groups IVB-VIB early transition metal catalysts, which work well for high-quality graphene growth via carbide formation. The stacking structures of bilayer graphene were successfully modulated by using *van de Waals* epitaxy and process control. Very recently, we further succeeded in growing the two dimensional hybrid materials of graphene with *h*-BN and/or doped graphene. These graphene hybrids have demonstrated unique energy conversion properties with high efficiency.

References

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