

Graphene films: CVD growth and promising applications

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Graphene has excellent properties, such as high mechanical strength and modulus, high thermal and electrical conductivities, very stable thermal and chemical stabilities, and unique electronic properties, and consequently is expected to be used in various applications. CVD is the most popular method for the growth of graphene films with controlled domain sizes and number of layers. (1) We have developed an ambient pressure CVD to synthesize various graphene materials in a controllable and efficient way, such as monolayer large single-crystal domains, small domains in nano-meter sizes and large-area graphene films, and perfect AB stacked bi-layer graphene films. In particular, an ultra-fast growth technique was invented. (2) For efficient and non-destructive transfer, we invented an electrochemical bubbling transfer method, and large area and continuous graphene transparent conductive films are produced by an integrated R2R process of CVD and bubbling transfer. (3) We have found a highly-efficient doping agent which can not only significantly decrease the electrical resistance, but also increase the transmittance, of graphene films with good stability. (4) These graphene films have been demonstrated to be used in many fields, from electronics to optoelectronics, and from sensors to wearable devices. However, great efforts are still needed for the research, development, commercialization and market explorations of graphene films.