Graphene Films and Membranes: Fabrication and Applications

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Graphene is a single-atom-thick sheet of hexagonally arranged, sp2-bonded carbon atoms that is not an integral part of a carbon material but is freely suspended or adhered on a foreign substrate, and 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. Graphene films and membranes are expected to be used in various applications. Therefore, synthesis of graphene films and membranes in large area at reasonable cost is very important.

Basically, graphene films and membranes can be synthesized by CVD and assembly from chemically exfoliated graphene sheets. We developed an ambient pressure CVD to synthesize large and small size single crystal graphene grains, and their continuous films [1,2,3,4]. Moreover, we invented an electrochemical bubbling method to efficiently transfer these grains and films [2]. Large area and continuous graphene transparent conductive films are produced by an integrated R2R process of CVD and bubbling transfer. Very recently, we have developed a green electrochemical water oxidation exfoliation process of graphite to produce high-quality graphene oxide in large quantity and high yield [5], and invented a continuous centrifugal casting process to rapidly produce high-quality graphene membranes in large area and tunable thickness from chemically exfoliated graphene sheets [6]. These graphene films and membranes may have wide applications in many fields, from electronics to optoelectronics, from sensors to wearable devices, and from separation to water treatment [7,8]. However, great efforts are highly needed for the research, development, commercialization and market explorations of graphene films and membranes.

References

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