# CVD Graphene: Scalable Growth & Killer Applications

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Graphene fever has passed over a decade since its first isolation in 2004 and a great number of applications have been demonstrated in laboratories and even at industrial scale. However, a huge gap still exists between the ideality and the reality. The ideal graphene material is composed of single crystalline hexagonal honeycomb lattice of sp2 hybridized carbon atoms while the experimentally available graphene is a polycrystalline film with lots of structural defects and unexpected noncarbon impurities. As a result, the observed properties of graphene are far from theoretical predictions. The key to bury this gap is the controlled synthesis towards perfect graphene. It is no doubt that the synthesis will determine the future of graphene material. On the other hand, it is also a crucial challenge to find out the killer applications of graphene, which would create a realistic graphene industry.

We are targeting to build the footstone of future graphene industry from the material synthesis point of view. We have made great efforts to grow high-quality graphene film on copper foil towards industrial level mass production. A breakthrough has been made on growing super-clean graphene films with a clean area over 99%. Our CVD graphene film has reached a level of 4 inch single crystalline domain size with high growth rates. We have also succeeded in growing high quality graphene films on traditional glasses. The graphene endowed glass with extremely high thermal and electrical conductivities, leading to a new type of super graphene glasses. In a similar way, the graphene film has been deposited onto optical fibers under a high-temperature growth process, creating a graphene-decorated optical fiber. Various promising applications are demonstrated with these super graphene glasses and graphene-covered optical fibers. Moreover, we found that the graphene monolayer directly grown on sapphire wafer plays a wonderful buffer layer role for further growing AlN for fabricating LEDs. Over 20% increase of energy conversion was obtained for such graphene-aided LED devices.