

# **Future Research Direction of Graphene for Real Industrial Applications : Large-Area Single Crystalline Graphene**

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## **Abstract**

Graphene has been intensively studied due to its outstanding properties such as quantum electronic transport, extremely high mobility, high elasticity and high mechanical strength. Since the discovery of graphene in 2004, many approaches to synthesize large-area graphene have been developed, including epitaxial growth on silicon carbide, CVD growth on metal substrate as well as metal-assisted precipitation method. Most of the large-area graphene developed until now is polycrystalline, having grain boundary which is a scattering center to deteriorate electronic conductivity and mobility of graphene. Therefore, uniform growth of single-crystal graphene over large areas is a fundamental issue to make the commercial-level manufacturability of graphene for various electronic, photonic, mechanical, and other device applications. In this study, we developed epitaxial nucleation method to successfully grow large-area single crystalline graphene on the copper substrate by CVD. We devoted to minimize formation of double layer graphene and eventually could grow large-area multi-layer-free single crystalline graphene via epitaxial growth. We will discuss the multi-layer-free growth as well as epitaxial nucleation of single crystalline graphene on copper substrate.

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