Single crystal graphene synthesis by controlling the plane direction of polycrystalline Cu foil

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Abstract

Graphene has attracted attention since it was first isolated from HOPG in 2004, due to its excellent mechanical, electrical and chemical properties as well as good flexibility, high optical transparency. These excellent material properties have made graphene a promising candidate for a wide variety of applications in next generation devices. Today, Chemical vapor deposition should be the most promising way enabling a high quality and large area graphene cost-efficiently. However, the graphene on a polycrystalline transition metal by CVD is synthesized in a polycrystalline. As the electrons are scattered from the grain boundaries of graphene, the electrical properties of graphene are reduced. Thus, a monocrystalline copper foil is needed for a single crystal graphene film.

In this work, we could prepare a Cu foil with single surface direction vs high temperature annealing in hydrogen atmosphere and synthesized large area single crystal graphene film in a hydrogen and methane atmosphere. This study provides a fundamental understanding of Cu phase transition and reproducibility of graphene growth for large scale single crystal the CVD process to industrial production. The phase transition of the Cu foil surface by annealing process was confirmed by scanning electron microscope, Atomic force microscope, X-ray diffraction, Electron backscatter diffraction. Additionally, Transmission electron microscope analysis was performed to confirm the crystallinity of graphene. the quality of the synthesized graphene was analyzed by Raman spectroscopy.

References

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[2] Lola Brown, et al.,Nano Letters, 2014, 14, 5706, Polycrystalline Graphene with Single Crystalline Electronic Structure

[3] Xiaozhi Xu, et al., a Science Bulletin 62 (2017) 1074–1080, Ultrafast epitaxial growth of metre-sized single-crystal graphene on industrial Cu foil

Figures

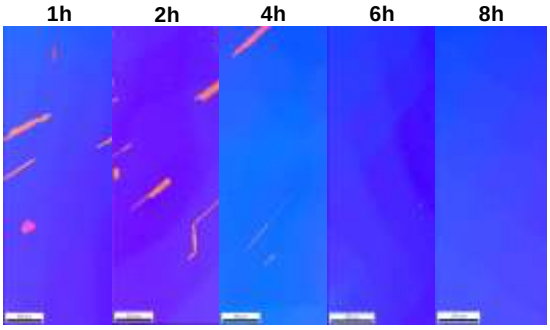

Figure 1: EBSD image showing the change of surface direction of Cu with annealing time.
The scale bars are all 300 ㎛.