**Facile Preparation of Single Crystalline Cu Foil for High-quality Graphene Growth**

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## Abstract

Large area monolayer graphene can be easily synthesized on copper foil using chemical vapor deposition (CVD) method. However, due to the crystalline structure of metal catalyst, synthesized graphene usually has inevitable structural defects, such as grain boundaries (GBs), which make characteristic differences with ideal graphene. Many synthetic methods have been suggested to reduce graphene defects, epitaxial graphene growth on specific oriented single crystalline metal catalyst is one of the most efficient ways. With suitable substrate such as Cu(111) surface, graphene sheets without GB can be synthesized in short time, but the fabrication of single crystalline metal is still challenging for practical application. Here we report facile preparation of single crystalline Cu(111) surface using commercial polycrystalline copper foil by intensifying abnormal grain (AGG) and fast synthesis of grain boundary-free graphene. The recrystallization and AGG of Cu foil was completed in annealing step and we found that strain energy of Cu foil and annealing atmosphere significantly affect the transformation of polycrystalline structure to (111)-oriented single crystalline. In the following graphene growth step, all the graphene domains were nucleated along the Cu(111) surface and formed continuous graphene sheet without creating grain boundaries. The GB-free graphene sheets have high carrier mobility of ~13,000 $cm^2$/Vs at room temperature. These findings provide more expeditious way for production of high quality graphene and can be applied to various metals for growth of other two-dimensional materials such as h-BN and $MoS_2$.

## References

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## Figures