

# Cu {120} 面上に CVD 成長したグラフェンの評価

## Single layer graphene grown on Cu {120} plane by chemical vapor deposition method

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Chemical vapor deposition growth of graphene is widely studied because it is promising method for large-area production with low cost. Surface morphology and crystal relationship of graphene grown on Cu catalyst by CVD have been discussed regarding low index plane, such as {111}, {100}, {101}. Even though commercial Cu foils have polycrystalline structure, some of treatments have been reported to promote single crystal like Cu grain in centimeter scale [1,2] and these process encourage to investigate more variety of crystal relationship between graphene and Cu. Here, we discuss surface morphology and crystal relationship of graphene grown on Cu {120} plane which are prepared by pre-annealing process.

Cu foil (Alfa Aesar, 99.8%) was pre-annealed in  $H_2 \geq 5\%$  (Ar based) at  $1000^\circ C$  and 5 ~ 760 torr for 2 hrs and obtained Cu's grain with centimeter scale. LEED and EBSD results proofed these large Cu grains mainly have {100} and {120} planes. Afterward, graphene were grown on these Cu grains with  $CH_4$  500ppm at  $1040^\circ C$  and 26 torr.

AFM image of as-grown graphene grown on Cu{120} are shown in Fig.1. It has wide step-terrace structure with 100 – 500 nm width, and there are multi triangular structures on terrace region. Crystal orientations of this sample are explained in Fig.2. We have also investigated an effect of UHV annealing, and have observed reconstructions of Cu occurred between 200~500°C by AFM and STM. Additionally, it seems that an effect of graphene as a protect layer for these reconstructions' processes is more important rather than crystal relationship between graphene and Cu{120}, because graphene were not oriented against to Cu{120} analyzed by LEEM observation.

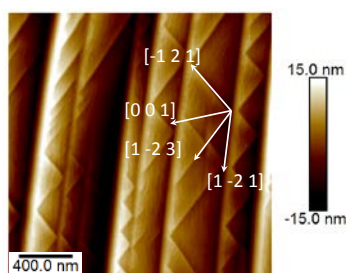


Fig.1 An AFM image of a-grown graphene on Cu{120} plane

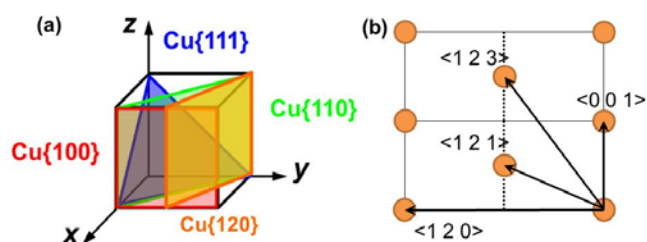


Fig.2 (a) Schematic of crystal planes of Cu. (b) Atomic arrangement of Cu{120}. Arrows indicate step-directions of observed surface morphology by STM and AFM.

Reference : [1] L. Brown *et al.*, *Nano Lett.* 2014, **14**, 5706. [2] V. L. Nguyen *et al.*, *Adv. Mater.* 2015, **27**, 1376.