Influence of Cu Crystallographic Orientations on graphene anisotropic etching

°サラマ　カマル 、カリタ　ゴラップ, 種村 眞幸(名工大工)

°Kamal P. Sharma, Golap Kalita, Masaki Tanemura (Nagoya Inst. Technol.)

E-mail: kamalprasads@gmail.com

Etching process has been established as an important tool to understand the growth of graphene and other 2D materials; as well as enabling fabrication of various well-defined structures [1-3]. Here, we reveal the influence of Cu crystallographic orientation on graphene anisotropic etching process. Graphene crystals were synthesized on polycrystalline Cu foil by a low-pressure chemical vapor deposition (LP-CVD) system. Bare Cu foil loaded into the growth furnace and maintained at 2 Pa base pressure. The growth furnace was heated at 15°C/min from room temperature to 1050°C with 2.8 sccm H_2 flow at a pressure of 13 Pa. After annealing the Cu foil for 1hr, carbon source polystyrene was evaporated for 20 min. with average heating rate of 3°C/min. Subsequently, the growth furnace was rapidly cooled down to room temp within 30 min.

Microscopic analysis showed different shape and size of graphene crystals with dissimilar nucleation within closure vicinity of neighboring Cu grains (Fig 1a). Post-growth etching of such graphene crystals was also significantly affected by the crystallographic orientation of Cu grains as observed by the field emission scanning electron microscope (FESEM) and electron back scattered diffraction (EBSD) analysis (Fig. 1b, c). We observed difference in etched direction and formation of graphene structures depending on the base Cu grain orientations (position 1 and 2) as shown in Fig. 1b-c.

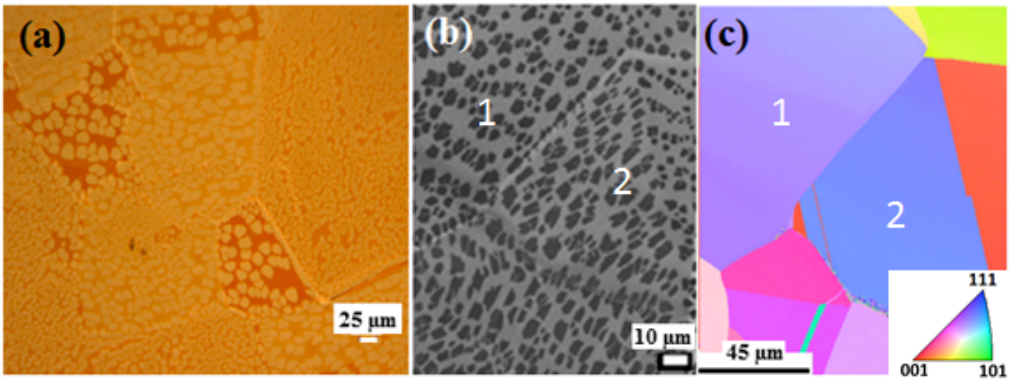

Fig. 1 (a) Optical microscope, (b) FESEM image with (c) corresponding EBSD map of Graphene crystals with different shape, size and nucleation density within neighboring grain by LP-CVD with polystyrene as precursor.

References

[1] A. Thangaraja, et al. Appl. Phys. Lett. 106, 253106, (2015)

[2] S. Sharma, et al. Sci. Rep. 5, 10426, (2015)

[3] R. Papon, et al. RSC Adv. 5, 35297-35301 (2015)