Control of nucleation density in CVD-grown graphene using pre-treated Cu foil

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Abstract

After a decade of discovery of graphene flake which was exfoliated from graphite, we have now established large scale and fair quality graphene film synthesis technology using chemical vapor deposition (CVD). However, CVD-grown graphene have not yet shown such a high quality as compared to mechanically exfoliated graphene. While many factors influence the quality of graphene, the root causes are poly-crystallinity and domain boundaries in the CVD-grown graphene. Therefore, large size single crystal graphene has been desired and recent studies achieved remarkable size of single crystal graphene via pre-treated growth substrate using pre-oxidation [1-3] and planarization [4-6]. Here, we examined the utility of copper foil pre-treatment in the perspective of controlling nucleation density. Besides, we studied the growth of graphene domain from carbon nuclei by changing growth conditions during CVD process. Characterization of obtained graphene through above process was processed with scanning electron microscope, Raman spectroscopy, Hall effect measurement, and atomic force microscopy.

References

[1] H. Zhou et al., *Nat. Commun.,* **4** (2013), 2096
[2] Y. Hao et al., Science, **342** (2013), 720-723
[3] L. Gan et al., ACS Nano, **7** (2013), 9480-9488
[4] S. M. Kim et al., Nanotechnology, **24** (2013), 365602
[5] D. Lee et al., Nanoscale, **6** (2014), 12943-12951
[6] V. L. Nguyen et al., Adv. Mater., (2014), doi: 10.1002/adma.201404541

Figures

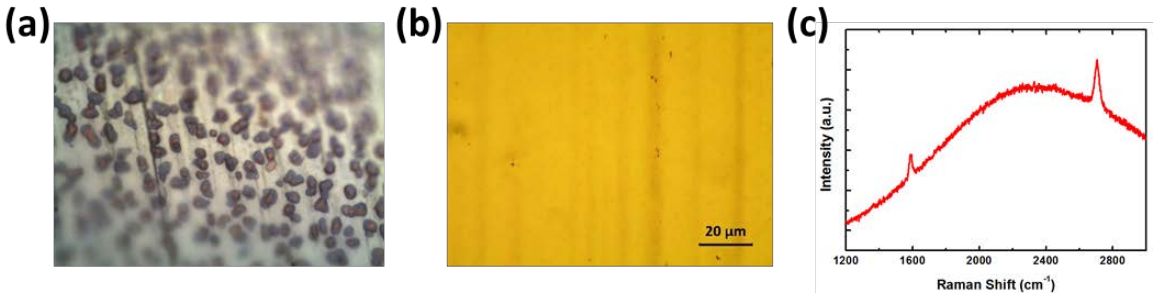

Figure 1. (a) Optical microscope image of partially oxidized Cu foil. (b) Optical microscope image of Cu foil covered with fully grown graphene (c) Raman spectrum of as grown graphene (on Cu foil) after growth steps.