

Liquid Cu catalyst phase effect on graphene growth

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The catalytic effect of liquid Cu was studied via post-annealing of graphene grown on solid Cu and melting catalyst phase. As-grown graphene samples were prepared on solid Cu, and heated up to higher than melting point of Cu *in-situ*. Nuclei density and grain size including growth morphologies were studied by electron microscopy and Raman spectrum analysis. Average size of graphene grains ($0.6\ \mu\text{m}^2$) grown on solid Cu merged into larger size ($68.16\ \mu\text{m}^2$) during the annealing on liquid Cu. Graphene growth shows self-assembly behavior on liquid Cu despite of its original irregular shape and orientation on solid Cu. Introduction of hydrogen results in well-aligned hexagon shape in the same direction graphene single crystal on liquid Cu. Each merged graphene grains shows single crystal by diffraction pattern studies. Even for the full coverage graphene on solid Cu, defect structure was healed on liquid Cu which was also verified Raman spectrum analysis. This simple post-annealing by melting Cu catalyst can be used as enhancement of graphene property.