通電加熱による非晶質カーボンからのグラフェン形成のその場観察

Visualizing copper assisted transformation of amorphous carbon into graphene by current-induced annealing

Nagoya Inst. of Tech.[1], Univ. Pend. Sultan Idris[2], Univ. Tech. Malaysia[3], Univ. Putra Malaysia[4]

○Mohamad Saufi Rosmi[1, 2], Mohd Zamri Mohd Yusop[1, 3], Golap Kalita[1], Yazid Yaakob[1, 4], Chisato Takahashi[1], Masaki Tanemura[1]

E-mail: saufirosmi@gmail.com

Recently, graphene has attracted intense scientific interest due to its magnificent properties. Much of the research on graphene have been focus towards control synthesis of high quality large-area graphene on transition metals (TMs) by chemical vapor deposition (CVD) [1]. Here, we reveal the direct observation of copper coated carbon nanofiber (CNF) structural transformation to graphene by in situ transmission electron microscopy (TEM). In our approach, amorphous carbon nanofiber (CNF) was grown on the edge of graphite foil by ion irradiation of Ar^+ at room temperature [2]. Then, the CNF was coated by copper (Cu) film using thermal evaporator. Cu coated CNF was then mounted on two probe system and significant structural transformation was observed with an applied potential. The coated Cu particle recrystallize and agglomerate toward the cathode with applied potential due to joule heating and large thermal gradient. Consequently, the amorphous carbon start crystallizing and forming sp2 hybridized carbon to form graphene sheet from the tip of Cu surface. We observed structural deformation and breaking of the graphene nanoribbon with a higher applied potential, attributing to saturated current flow and induced Joule heating. Thus, the in situ TEM studies was undoubtedly a promising tool to study the formation of graphene by solid phase reaction of amorphous carbon. The details findings will be discussed in the presentation [3].

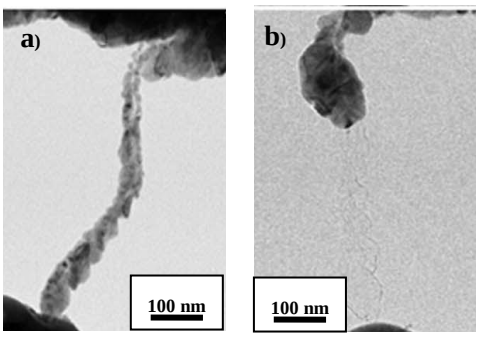

Fig. 1. TEM image of Cu coated CNF (a) before current flow (b) after current flow (graphene formed).

References:

[1] Seah, C.M., *et al.*, Carbon, 70, 1-21 (2014)

[2] Tanemura, M. *et al*., Applied Physics Letter, 84, 3831-3833 (2004).

[3] Rosmi, M.S. *et al.*, Scientific Report, 4:7653, 1-6 (2014)