Kinetics of bilayer graphene growth on copper

Ning Yang, Kyoungjun Choi, Hyung Gyu Park*

Nanoscience for Energy Technology and Sustainability
Department of Mechanical and Process Engineering (D-MAVT)
Eidgenössische Technische Hochschule Zürich
Tannenstrasse 3, Zürich CH-8092, Switzerland

E-mail: parkh@ethz.ch

Bilayer graphene has been attracting great interest due to its unique electronic and thermal transport properties. However, scalable synthesis of AB-stacked bilayer graphene remains challenging. Here, we report a regrowth method on copper, conjoining two sequencing processes of low pressure chemical vapor deposition (LPCVD) growth, which provides uniform, high coverage ratio bilayer graphene with conserved stacking order and inhibited the growth of unwanted layers. We anticipate that by changing the edge termination state of top layer graphene, the expansion of underneath layer could be controlled. Applying the regrowth method, we rationalize the secondary layer growth kinetics with Gompertz function. Our observations supports the postulate of a time dependent transition from diffusion limited to reaction limited regime. We find that it is the continuous carbon supply, rather than the initially captured carbon species, which drives the secondary graphene layer enlargement, implying the role of surface diffusion between the top layer graphene and copper surface. Based on these findings, we present strategies for growing large-scale, continuous bilayer graphene synthesis on copper.