High Precision Site-selective Growth of SWNTs and its Applications

○Rong Xiang, Shinya Aikawa, Erik Einarsson, Junichiro Shiomi, Shigeo Maruyama

Department of Mechanical Engineering, the University of Tokyo

We recently proposed a versatile wet chemistry method to localize the growth of SWNTs to desired regions via surface modification. By functionalizing the silicon surface using a classic self-assembled monolayer (SAM) and then selectively removing the SAM by ultraviolet (UV) light, the catalyst can be dip-coated onto only the hydrophilic areas of the substrate. Using the e-beam in a conventional SEM, a 50 nm SWNT pattern can be easily obtained. This technique was successful in producing both random and aligned SWNTs with various patterns.[1]

In this work, we will further discuss the mechanism of such growth selectivity. By AFM imaging of the SAM formation process, we clearly reveal the effect of wettability on the density of SWNTs grown on the surface. Meanwhile, the compatibility and scalability of this method will be presented. Large area pattern can be obtained by applying this technique into commercial e-beam lithography. Since monolayer (~2 nm high) reduces the electron scattering, the resolution is further improved. In the end, the application of current method for the easy fabrication of a field effect transistor will be demonstrated.

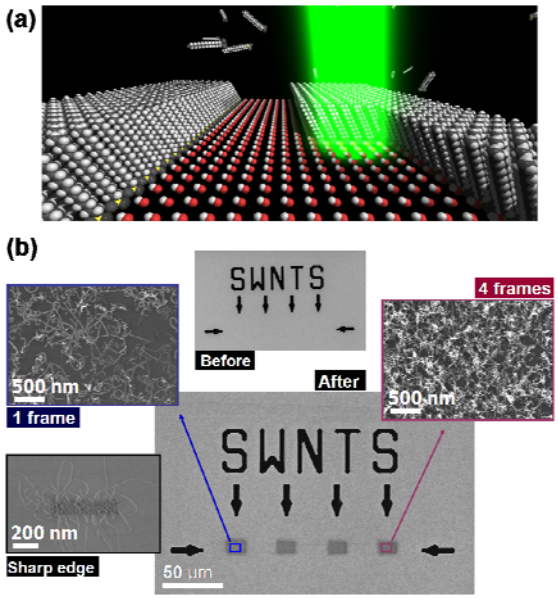

Figure 1: (a) Schematics describing the process of removing OTS by nanometer-size electron beam; (b) SEM images of SWNTs grown in the regions where OTS were selectively removed, suggesting the location and density of SWNTs can be controlled.

References:

1. R. Xiang, T. Wu, E. Einarsson, Y. Suzuki, Y. Murakami, J. Shiomi, S. Maruyama, *J. Am. Chem. Soc.*, submitted.

Corresponding Author: Shigeo Maruyama
E-mail: maruyama@photon.t.u-tokyo.ac.jp