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Takahiro Maruyama

Meijo University, Japan

Single-walled carbon nanotube synthesis by alcohol catalytic chemical vapour deposition in high vacuum using platinum-group metal catalysts

For the realization of application of single-walled carbon nanotubes (SWCNTs) to electronics devices, control of chirality and reduction of growth temperature have been significant issues. At present, 3d transition metals, such as Fe, Co and Ni, are widely used as catalysts for SWCNT growth in chemical vapour deposition (CVD). However, due to Ostwald ripening, these catalysts are apt to aggregate at the growth temperature, resulting in enlargement of both diameter and chirality distribution of SWCNTs. We performed SWCNT growth by a gas source-type alcohol catalytic CVD system using platinum-group metal catalysts (Ru, Rh, Pd and Pt). By optimizing the ethanol gas supply using a CVD system in a high vacuum, SWCNTs were grown from these metals between 400 and 700°C. In particular, SWCNTs were grown from Rh catalysts even below 300°C. Irrespective of catalyst metals, the diameter and chirality distribution of grown SWCNTs became narrower, as the growth temperature decreased. The diameters of most SWCNTs grown from Pt catalysts were below 1 nm, having a narrow chirality distribution. We demonstrated that the platinum-group metal catalysts are effective for both low temperature growth and narrow chirality distribution. Based on the SWCNT diameter and catalyst particle size, we discuss the growth mechanism of SWCNTs from the platinum-group metal catalysts.

Biography

Takahiro Maruyama is a Professor in the Department of Applied Chemistry at Meijo University, Nagoya, Japan. He has completed his Graduation in Factory of Science at Kyoto University; PhD at Kyoto University and; Postdoctoral studies at University of Tsukuba and Ritsumeikan University. He is the Director of Nanomaterials Research Center at Meijo University. He has published more than 100 papers in peer-reviewed international journals and has been serving as an Editorial Board Member of *GCET.*

takamaru@meijo-u.ac.jp

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