IBS Center for Multidimensional Carbon Materials

Special Seminar

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Chirality Predicted Growth of SWNTs Array

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Bldg. 101
Seminar Room on the 1st floor

The coming road map of the semiconducting industry will declare that the Moore's law is nearing its end. The pace of pursuing alternative materials, including single-walled carbon nanotubes (SWNTs) of single chirality, for smaller and better nanoelectronic devices remains persistent. However, the direct growth of SWNTs with controlled chirality has not yet been achieved. Here we show that predictable (2m, m) SWNTs with four- or six-fold symmetry can be grown horizontally by optimizing the growth parameters in a chemical vapor deposition (CVD) process. The method is based on a consideration of nanotube/catalyst interfacial thermodynamics determined by symmetry, and the kinetic growth rates set by the number of kinks. The catalyst surface and SWNT should share the same crystal symmetry to have the lowest formation energy. Those SWNTs with the highest kinetic growth rate will be favored, while others are terminated by carbon poisoning of the catalyst; kinetic growth rates can be controlled by the CVD conditions. Using these strategies, horizontally aligned metallic ((12, 6), abundance >90%) and semiconducting ((8, 4), abundance >80%) SWNT arrays with an average density higher than 20 tubes/μm and 10 tubes/μm, respectively, were successfully obtained on uniform solid catalysts. The (2m, m) SWNT arrays can be readily transferred onto arbitrary substrates for on-chip applications.

References:

1. SC Zhang†, LX Kang†, X Wang, LM Tong, LW Yang, ZQ Wang, K Qi, SB Deng, QW Li, XD Bai, F Ding, J Zhang*, Nature 2017, DOI: 10.1038/nature21051.
2. Y Hu†, LX Kang†, QC Zhao†, H Zhong, SC Zhang, LW Yang, ZQ Wang, JJ Lin, QW Li, ZY Zhang, LM Peng, ZF Liu, J Zhang*, Nat. Commun. 6(2015), 6099.
3. QC Zhao, ZW Xu, Y Hu, F Ding*, J Zhang*, Sci. Adv. 2(5)(2016), e1501729.

You are cordially invited to attend!