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Growth of SWNTs from Alloy Catalyst Nanoparticles

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Abstract : Single wall carbon nanotubes are seen as excellent candidate for application on nanoelectronic devices because of their remarkable electronic and mechanical properties. These unique properties are highly dependent on their chiral structures and the diameter. Therefore, structure controlled growth of SWNTs, especially directly on final device's substrate surface, are highly desired for the fabrication of SWNT-based electronics. In this work, we present a new approach to control the diameter of SWNTs and eventually their chirality. Because of their potential to control the SWNT's chirality, bi-metalics nanoparticles are used to prepare alloy nanoclusters with specific structure. The catalyst nanoparticles are pre-formed following a previously described process. Briefly, the oxide surface is first covered with a SAM (self-assembled monolayer) of a pyridine-functionalized silane. Then, bi-metallic (Fe-Ru, Co-Ru and Ni-Ru) complexes are assembled by coordination bonds on the pre-formed organic SAM. The resultant alloy nanoclusters were then used to catalyze SWNTs growth on SiO2/Si substrates via CH4/H2 double hot-filament chemical vapor deposition (d-HFCVD). The microscopy and spectroscopy analysis demonstrate the high quality of SWNTs that were furthermore integrated into high-quality SWNT-FET.

Keywords: nanotube, CVD, device, transistor

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