Role of atomic and molecular nitrogen in carbon nanotube formation

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Abstract: We have investigated the pretreatment effects of nitrogen on the length and the alignment of carbon nanotubes (CNTs) grown on a Ni catalyst by using dc-plasma enhanced chemical vapor deposition system. The surface of the Ni catalyst was pretreated with a mixture of NH_3 and N_2, instead of pure NH_3 and the length of the CNTs has changed from 1.6 ?m to 400 nm as the NH_3/N_2 flow rate ratio was decreased. We showed that the length and the alignment of the CNTs could be controlled by changing the NH_3/N_2 flow rate ratio. The fabricated CNTs were further evaluated by using their Raman spectra. The nitrogen concentration on the surface of the Ni catalyst after the pre-treatment was analyzed by using X-ray photoelectron spectroscopy and the physical structure of CNTs was analyzed using scanning electron microscopy and high resolution transmission electron microscope. We suggest that the N_2 adsorption on the surface of Ni changes the carbon atom diffusion during the CNT growth and that the physical structures of CNTs are drastically changed.

Author Keywords: Cnts; PECVD; Pretreatment; XPS

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