Nanocarbon Thin Films for Flexible Electronics Applications

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We present the synthesis of the high quality single walled carbon nanotubes (SWCNT) as well as discuss their formation mechanisms during floating catalyst CVD synthesis from CO at ambient pressure and at temperature range 800-1100 °C using iron nanoparticle catalyst. We discuss the effect of reactor operating temperature on the individ al tube as well as bundle length and their diameter distributions, being determined both by electron microscopic as well as optical methods. Especially, we discuss the control of tube chirality distributions via introducing trace amounts of CO_2 and NH_3 into the reactor. Also, we present the novel nanocarbon material, carbon nanobud (CNB), combining fullerene molecules covalently bonded onto the outer surface of SWCNTs.

Methods for SWCNT as well as CNB dry deposition at ambient temperature to manufacture transparent thin film electron emitters, sensors and field effect transistor (TFT) with high carrier mobility as compared to organic semiconductors as well as transparent and flexible thin film conducting electrodes (TCE). To summarize, we have developed a novel, ambient temperature and ambient pressure method for manufacturing SWCNT thin films based transparent, flexible electrodes and thin film field effect transistors. This method is based on floating catalyst, high temperature CVD synthesis of high quality SWCNTs from using Fe nanoparticle catalyst followed by SWCNT ambient temperature, direct, dry deposition onto the substrate. SWCNT-PET conducting films show transparency-sheet resistance properties similar to ITO-PET films. SWCNT network TFTs on both silicon as well as polymeric substrates exhibit mobilities above 1 cm^2/Vs and on/off ratio of 10^5.