
Title: Decomposition of ethanol and dimethyl-ether during CVD synthesis of single-walled carbon nanotubes

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Abstract:
In this study, the effect of carbon feedstock decomposition conditions in CVD (chemical vapor deposition) synthesis of SWNTs (single-walled carbon nanotubes) was investigated. Gas-phase thermal decomposition of ethanol and DME (dimethyl ether) at typical SWNT growth conditions were simulated using the chemical kinetic model. The molar fraction was correlated against residence time in the reactor by adjusting the flow rate, and concentration profiles of reaction speices were compared to the predicted decomposition mechanism. FT-IR (Fourier transform infra-red) spectroscopy was used to analyze the concentration of species resulting from ethanol and DME decomposition, confirming expected reaction trends and primary byproducts. Peak intensities were obtained and compared for C2H4, CH4, CO and H2O in the case of ethanol decomposition, and CH4, CO and CH3OH in the case of DME decomposition. FT-IR experimental results at various temperatures and pressures were in agreement with corresponding simulations. In addition, synthesis of aligned SWNT arrays from various isotopes of ethanol was studied by resonance Raman spectroscopy. The results clearly show the dependence on the decomposition condition of the feedstock in CVD for synthesis of SWNTs, which is helpful in clarifying the SWNT growth mechanism.
