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Effect of Atomic Hydrogen and Ions on Carbon Nanotube Growth in PECVD KOSTYA (KEN) OSTRIKOV, IGOR DENYSENKO, Plasma Nanoscience, The University of Sydney — A surface diffusion model for multi-wall carbon nanotube (MWCNT) growth in plasma-enhanced chemical vapor deposition (PECVD) is developed. It is assumed that growth is due to deposition of hydrocarbon (HC) molecules, ions and an etching gas (atomic hydrogen) from plasma. The model accounts for reactions of HC neutrals and carbon atoms with an etching gas, decomposition of absorbed particles due to ion bombardment, decomposition of HC ions on MWCNT surface, thermal decomposition of HC neutrals on MWCNT surface, in addition to the film growth between MWCNTs, etching of the film and carbon sputtering. Using the model, MWCNT growth rates are calculated for different substrate temperatures and HC, hydrogen and ion fluxes on the substrate. It is shown that at low substrate temperature the MWCNT growth is mainly due to reactions of ions with HC neutrals and the decomposition of HC ions on the MWCNT surface. Meanwhile, at large ion and low hydrogen fluxes on the substrate the film growth between MWCNTs can dominate over the MWCNT growth. The model reveals that the growth rate is dependant on substrate temperature which has a maximum (T_{max}) that agrees well with experimental data on MWNT growth. T_{max} increases with an increase of the hydrogen atom flux, the ion and HC fluxes.
[1] K.Ostrikov, A. B. Murphy, J. Phys. D:Appl. Phys. 40, 2223 (2007)

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