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Growth of carbon nanofibers in plasma-enhanced chemical vapor deposition IGOR DENYSENKO, V. N. Karazin Kharkiv National University, KOSTYA OSTRIKOV, CSIRO, EUGENE TAM, The University of Sydney, PLASMA NANOSCIENCE TEAM — A theoretical model describing the plasma-assisted growth of carbon nanofibers with metal catalyst particles on top is proposed. Using the model, the plasma-related effects on the nanofiber growth parameters such us the surface diffusion growth rate, the effective carbon flux to the catalyst surface, the characteristic residence time and diffusion length of carbon on the catalyst surface, and the surface coverages, have been studied. It has been found how these parameters depend on the catalyst surface temperature and ion and etching gas fluxes to the catalyst surface. The optimum conditions under which a low-temperature plasma environment can benefit the carbon nanofiber growth are formulated. It has been also found how the plasma environment affects the temperature distribution over the length of the carbon nanofibers. Conditions when the temperature of the catalyst nanoparticles is higher than the temperature of the substrate holder are determined. The results here are in a good agreement with the available experimental data on the carbon nanofiber growth and can be used for optimizing synthesis of nanoassemblies in low-temperature plasma-assisted nanofabrication.

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