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Micro glow plasma for localized nanostructural modification of carbon nanotube forest

By: [Sarwar, MSU](#) (Sarwar, Mirza Saquib Us)^[1]; [Xiao, ZM](#) (Xiao, Zhiming)^[1]; [Saleh, T](#) (Saleh, Tanveer)^[1]; [Nojeh, A](#) (Nojeh, Alireza)^[1]; [Takahata, K](#) (Takahata, Kenichi)^[1]

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Abstract

This paper reports the localized selective treatment of vertically aligned carbon nanotubes, or CNT forests, for radial size modification of the nanotubes through a micro-scale glow plasma established on the material. An atmospheric-pressure DC glow plasma is shown to be stably sustained on the surface of the CNT forest in argon using micromachined tungsten electrodes with diameters down to 100 μm. Experiments reveal thinning or thickening of the nanotubes under the micro glow depending on the process conditions including discharge current and process time. These thinning and thickening effects in the treated nanotubes are measured to be up to similar to 30% and similar to 300% in their diameter, respectively, under the tested conditions. The elemental and Raman analyses suggest that the treated region of the CNT forest is pure carbon and maintains a degree of crystallinity. The local plasma treatment process investigated may allow modification of material characteristics in different domains for targeted regions or patterns, potentially aiding custom design of micro-electro-mechanical systems and other emerging devices enabled by the CNT forest. Published by AIP Publishing.

Keywords

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Author Information

Reprint Address: Sarwar, MSU (reprint author)
 + Univ British Columbia, Vancouver, BC V6T 1Z4, Canada.
Addresses:
 + [1] Univ British Columbia, Vancouver, BC V6T 1Z4, Canada

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