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### **Effects of Plasma-Ion Irradiation on Structures and Properties of Carbon Nanotubes**

RIKIZO HATAKEYAMA, Department of Electronic Engineering, Tohoku University

Nanocarbons of carbon allotropes have drawn great attention due to their high potential for unique properties and a variety of applications. Since carbon nanotubes among them are furnished with one-dimensional hollow inner-nanospaces, various kinds of atoms and molecules are possible to be injected into the nanospaces based on plasma nanotechnology, which could lead to innovative functionalization of the pristine ones. For that purpose original approaches using nanoscopic plasma processing mainly in ionic plasmas have been performed in order to develop SWNT(single-walled carbon nanotube)-, and DWNT(double-walled carbon nanotube)-based materials with novel functions corresponding to nano electronic and biological applications, where positive and negative ions with their energies and fluxes controlled are irradiated to immersed substrates coated with the pristine carbon nanotubes. Consequently, we have innovatively created various kinds of charge-/spin-exploited atoms and molecules encapsulated SWNTs and DWNTs. Finally, their electronic, magnetic, and optical properties are intensively investigated using a configuration of field effect transistor (FET) and a SQUID magnetometer. As a result, we have for the first time realized air-stable semi-conducting pn control, formed nano structures with magnetic semiconductor and ultimate air-stable nano pn-junctions, found distinct characteristics of negative differential resistance, and observed photoinduced electron transfer phenomena upon the encapsulated SWNTs and DWNTs.