

# Effects of Catalyst Plasma Pre-Treatment on Surface Morphology and Field Emission Characteristics of Carbon Nanotubes...

葉國輝、李世鴻

E-mail: 9607638@mail.dyu.edu.tw

## ABSTRACT

In this work, tetrafluoromethane (CF<sub>4</sub>) and nitrogen (N<sub>2</sub>) plasma pre-treatments were carried out on the catalyst nickel films in order to study their effects on the surface morphology and field emission characteristics of the synthesized carbon nanotubes (CNTs). Carbon nanotubes were synthesized with a thermal chemical vapor deposition system. Methane (CH<sub>4</sub>) was the main source for carbon, and argon was used as the carrier gas. CNTs were synthesized from carbon atoms obtained from catalytic thermal decomposition of methane. Raman spectroscopy, scanning electron microscope (SEM), and energy dispersive spectrometer (EDS) were employed to study the properties of synthesized CNTs after plasma treatment. From our experimental data, it is found that as the plasma pretreatment duration was increased, the diameter of CNTs became smaller and the surface density of CNTs became higher, and their field emission characteristics were thus enhanced. We can see that after 4 minutes of CF<sub>4</sub> plasma pretreatment, the emission current density of CNTs reached 1.67mA/cm<sup>2</sup>, but after 4 minutes of N<sub>2</sub> plasma pretreatment, the emission current density was only 0.908mA/cm<sup>2</sup>. Therefore, it is evident that CF<sub>4</sub> plasma pretreatment can have a more pronounced enhancement on the emission characteristics of CNTs than N<sub>2</sub> plasma pretreatment can have. Keywords : carbon nanotubes (CNTs), field emission, thermal chemical vapor deposition (thermal CVD)

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