The Effects of Chemical Solution Post-Treatment on the Properties of ThermalChemical Vapor Deposited Carbon Nanotubes

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ABSTRACT

In this work, thermal chemical vapor deposition was utilized to grow carbon nanotubes (CNTs) on Si type, catalyst metal is Ni, methane (CH4) 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. A simple acid treatment method was applied to functionalize the surface and to modify the structures of multi-walled carbon nanotubes (CNTs) grown on silicon substrates by thermal chemical vapor deposition (thermal CVD) using sulfuric acid (H2SO4). Scanning electron microscopy (SEM), Raman spectroscopy, and energy dispersive spectrometer (EDS) were employed to investigate the mechanism causing the modified field emission (FE) properties of the CNT film. From our experimental data, it is found that after 20 min of H2SO4 treatment the emitted currents were enhanced by more than one order of magnitude compared with those of the untreated CNTs. We can see that after using H2SO4 of 20 min, the emission current density of CNTs reached 9.44 mA/cm2. The method provides a simple, economical, and effective way to enhance the CNT field emission properties.

Keywords : carbon nanotubes (CNTs)、emitted currents、thermal chemical vapor deposition (thermal CVD)

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