Low-Temperature Growth of Multiwalled Carbon Nanotubes and Their Field-Emission Properties

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ABSTRACT

A highly active Fe-film prepared by electrodeposition over ITO glass substrate were employed to conduct atmospheric thermal chemical vapor deposition at low temperature(600°C) in C2H2 flow to form multi-walled carbon nanotubes. Experimental results indicate that the Fe catalysts under reducing ambient of NH3 were very effective for the growth of multi-walled carbon nanotubes with average tube diameter of 20~40 nm. The as-deposited carbon nanotubes films was tested for its field emission properties. The two-electrodes electron emitting device was tested by a Keithley 236 high-voltage measuring unit under vacuum chamber of 10-5 Pa. The turn-on voltage was 5.5 V/μm and the threshold voltage was around 9.2 V/μm with an maximum emission current density of 14.3 mA/cm2. The Fowler-Nordheim plot showed a good linear fit, indicating that the emission current of the as-fabricated carbon nanotubes emitter follows the Fowler-Nordheim behavior. The calculated field enhancement factor was 2225 calculated from the slope of FN. This value shows a typical multi-walled carbon nanotubes field emission behavior.

Keywords: Thermal CVD; Electroplated; Multi-walled carbon nanotubes; Field-emission

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