Nanotubes - Science and Applications
Room Exhibit Hall C & D - Session NM-TuP

Poster Session

NM-TuP1 Growth and Purification Characteristics of Isolated and Aligned Carbon Nanotubes, ***M. Kang***, *K. Ryu, Y.C. Kim,* Hanyang University, Korea; *H. Jeon,* Hanyang University, Korea, South Korea

Carbon nanotubes of the interesting applications is reported for display application, but neither industrial fabrication technology nor performance has been reported for practical display application. Therefore, we studied that carbon nanotubes (CNTs) were grown on nickel deposited glass substrates at low temperature (about 650°C) by plasma enhanced chemical vapor deposition (PECVD) method using a mixture of CH@sub 4@, NH@sub 3@, and H@sub 2@ gaseous sources. CH@sub 4@and H@sub 2@ were used as main reactant gases, and NH@sub 3@ was used as both dilution and nickel layer pretreatment source. Nickel layer with a thickness of several hundreds nm was deposited using ultra high vacuum (UHV) e-beam evaporator and pretreated with NH@sub 3@ plasma to form isolated nano size nickel island before CNTs deposition. Nickel catalyst thickness and NH@sub 3@ plasma treatment significantly affected CNTs microstructure and alignment. CNTs size was generally increased with increasing nickel thickness. Aligned@footnote 1,2@ and isolated CNTs with a typical dimension of a few hundreds nm in diameter and several @micro@m in length were observed. Post hydrogen and oxygen plasma treatments successfully eliminated carboneous impurities and nickel caps on CNTs. In this presentation, a comprehensive understanding of the effect of NH@sub 3@ plasma treatment on nickel catalyst layer and plasma purification processing will be described. We examined the properties of carbon nanotubes by SEM, XRD, Raman spectroscopy and TEM. @FootnoteText@ @footnote 1@ Synthetic Metals 108(2000) 159-163 @footnote 2@ Appl.Phys.Lett., Vol.75, No.8, 23 .

NM-TuP2 Selective Area Growth of Carbon Nanotubes on Glass Substrate, ***J.B. Yoo***, *J.H. Han, H.J. Kim, W.S. Yang, J.H. Yang, C.Y. Park,* Sungkyunkwan University, Korea

Carbon nanotubes have received considerable attention because of their own unique physical properties and many of potential applications. Selective area growth of carbon nanotubes is very important for the electronic device applications such as FED, TubeFET, SET, interconnects, sensor etc. In this study, selective area growth of vertically aligned carbon nanotubes was performed on nickel-coated glass and silicon (100) with and without buffer layer at temperatures below 600°C by hot filament plasma enhanced chemical vapor deposition (HFPECVD). The effects of growth parameters on the growth and emission characteristics of carbon nanotubes were investigated and compared to planar growth. Growth mechanism of selective area growth was proposed. The morphology of nanotubes was examined by field emission scanning electron microscopy (FESEM), and the microstructure of selective area growth of carbon nanotubes was investigated by high resolution transmission electron microscopy (HRTEM).

NM-TuP3 Effects of Metal-Catalyst and Buffer Layer on Growth and Emission Properties of Carbon Nanotubes, ***J.H. Han***, *H.J. Kim, W.S. Yang, J.B. Yoo, J.H. Yang, C.Y. Park,* Sungkyunkwan University, Korea; *Y.H. Song, K.S. Nam,* ETRI, Korea

Carbon nanotubes have been extensively studied because of their own unique physical properties and their potential applications such as flat panel displays and vacuum microelectronics. In practical applications, roles of metal-catalyst and buffer layer, particularly, are very important to growth and adhesion of carbon nanotubes respectively. Therefore, a systematic study for metal-catalyst and buffer layer has been so indispensable. In our experiments, we have used buffer layer such as chrome or molybdenum or titanium to improve the adhesion between metal-catalyst layer (such as nickel, cobalt, and nickel-cobalt composite) and glass substrate. We have grown the vertically aligned carbon nanotube arrays on nickel-coated glass and silicon (100) with adhesive buffer layer at temperatures below 600°C by plasma enhanced chemical vapor deposition (PECVD). In this work, a dc plasma was employed, and acetylene gas was used as a carbon source and ammonia gas was used as a catalyst and dilution gas. We examined the effect of thickness of metal-catalyst and buffer layer on the growth and emission properties of carbon nanotubes. The emission characteristics of nanotubes were evaluated in vacuum chamber using phosphor-coated anode. The morphology of nanotubes was examined by field emission scanning electron microscopy (FESEM), and the microstructures of interface between metal-catalyst and buffer layer or buffer layer and glass (or silicon) were investigated by high resolution transmission electron microscopy (HRTEM).

NM-TuP4 Emission Properties of Field Emission Triode using Carbon Nanotubes Grown on Glass Substrate, ***H.J. Kim***, *J.H. Han, W.S. Yang, J.B. Yoo, Y.W. Jin, J.E. Jung, J.H. Yang, C.Y. Park,* Sungkyunkwan University, Korea; *N.S. Lee, J.M. Kim,* Samsung Advanced Institute of Technology, Korea

Carbon nanotubes are potential candidates for cold cathode field emitter because of high aspect ratio and small radii of curvature at their tips with high chemical stability, thermal conductivity, and mechanical strength. The vertical alignment of carbon nanotubes in large area is important to FED application. We have fabricated the triode for field emission display using carbon nanotube as an emission tip. First, 1.2 @micro@m thick SiN@sub x@ as an insulator was deposited on the Ni coated glass substrate with Cr buffer layer by PECVD, and 100nm thick Mo as a gate electrode was deposited by DC sputter. Carbon nanotubes were directly grown on substrate using selective area growth technique after gate opening and insulator etching using conventional lithography process. Vertically well-aligned multiwall carbon nanotubes weres grown by PEHFCVD(Plasma Enhanced Hot Filament Chemical Vapor Deposition). The carbon nanotubes were about 40nm in diameter. The emission characteristics of the fabricated carbon nanotube triode shows very low operating voltage compared to that of conventional Spindt-type FEDs. The uniformity of emission characteristics of nanotubes were evaluated in vacuum chamber using phosphor-coated anode. The morphology of nanotubes was examined by field emission scanning electron microscopy (FESEM).

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