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Abstract
In this study, the carbon nanotubes (CNTs) have been grown on Si and SiO2 substrates using electron cyclotron resonance chemical vapor deposition (ECR-CVD) at low temperature 500℃. ECR grown CNTs are accompanied with the growth of carbon nanoclusters, which appear on the surface of the CNTs as a result of low temperature deposition. To measure the field emission characteristics of CNTs without carbon nanoclusters, the carbon nanoclusters have been removed by (1) mechanical method (2) oxygen plasma post-treatment at 400℃.
The aim of this study is to enhance the field emission efficiency of carbon nanotubes by surface treatment, and then apply it to field emission display (FED). CNTs have been grown under various process conditions, such as: high pressure (~ 10-3 torr)、low pressure (~ 10-5 torr)、centrally located substrate (related to process flow), and inversely located substrate. For the post treatment, the process parameters: O2 gas flow and power are fixed, and different process times are performed at pressure of 20 and 200 mtorr. For the structure analysis, the morphology and microstructure of carbon nanotubes were observed by the scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Raman spectrometry. The results show that the deposition rate and field emission characteristics of CNTs grown at high pressure are better than those grown at low pressure. The difference between the CNT grown on the centrally located substrate and inversely located substrate is that carbon nanoclusters appear only on the centrally located substrate, but not on inversely located substrate. However, CNTs exhibit different morphologies: CNTs are vertically aligned on the centrally located substrate, whereas the top of CNTs tend to curl together on the inversely located substrate. The result of post treatment shows that the field emission characteristics of CNTs are not improved by oxygen plasma treatment at pressure of 20 mtorr. On the other hand, the CNTs treated by oxygen plasma at 200 mtorr shows an enhancement on the field emission characteristics: the turn-on field decreased from 6.9V/um to 5.3V/um, and current densities increased from 0.017mA/cm2 to 0.3mA/cm2 at electric field of 7.3V/um.
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