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9″ Color Field Emission Displays Using Carbon Nanotube Emitters

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Carbon nanotubes(CNTs) have been spotlighted as one of promising field emitters for field emission displays(FEDs). For the first time, to authors knowledge, we have developed the 9″ color CNT-FEDs with the resolution of 240x576 lines. The 9″ CNT-FEDs with diode-type and triode-type structures are presented. The well-dispersed CNT paste was squeezed onto the metal-patterned cathode glass. For the anode plate, the Y_2O_2S:Eu, ZnS:Cu,Al, and ZnS:Ag,Cl low-voltage phosphors were printed for red, green, and blue colors, respectively. The vacuum-packaged panel maintained the vacuum level of $1x10^{-7}$ Torr. The uniform moving images were demonstrated at 2 V/μm. High brightness of 800, 200, and 150 cd/m^2 was observed on the green, red, and blue phosphors at 3 V/μm, respectively.

Field emission characteristics of a triode-type CNT-FED were simulated using a finite element method. The resultant field strength on the cathode was modulated by gate bias and emitted electrons were focused on the anode. A relatively uniform emission image was experimentally achieved at the 800 V anode and the 50-180 V gate biases. Energy distribution of electrons emitted from CNTs was measured using an energy analyzer. The maximum peak of energy curve corresponded to the Fermi energy level of CNTs.

The whole fabrication processes of CNT-FEDs were fully scalable and reproducible. Our CNT-FEDs has demonstrated the high potential of large-area and full-color applications with very low cost fabrication and low power consumption.