The Properties of Nitride on Efficient Field Emission Displays

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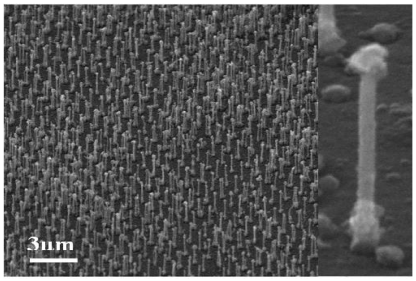
Field emission display (FED) is a promising flat display technology and is based on an array of nanotube based emitters. Each pixel has several nanotubes as a cold cathode (emitter) to release electrons through certain voltages between the electrodes. It is when the electrons collide with phosphors that visible light is emitted. Although plasma display panels (PDPs) and LCDs are delivering quality images, their luminous efficiency is still reported to be low [1]. One of the major issues concerning the enhancement of luminance and luminous efficiency are in the investigation of utilizing Nitride element in the cold cathode [2].

Nitride materials such as Gallium nitride (GaN) have attracted much attention due to their superior properties including chemical stability and negative or low positive electron affinity [1]. In this regards, it is desirable to develop a field emitter which operates at a high emission current and a low applied voltage in comparison with Carbon nanotubes (CNTs). However, amongst all types of CNTs, vertically grown carbon nanotubes are known to be promising electron emitters. The vertical alignment of these superior emitters enhances the field effect on the tip of the CNTs, making them ideal for FEDs [3], [4]. Simulation results in this paper present the properties of different cold cathode materials and their turn-on voltages. The field-emission current-voltage characteristics of a CNT and SiC nanotube, measured under different field amplification factors, demonstrate that GaN yield a significantly lower degradation rate than CNTs in the emission current. Furthermore, high electrical conductivity and environmental stability are prerequisites for any efficient field emitter. The current density of carbon nanotubes often shows saturation at higher voltage in comparison with GaN nanotubes [3]. Fig. 1 (a) presents an 11% improvement on cell efficiency for GaN with an average diameter of 25µm (b) depicts luminous efficiency characteristics measured for GaN samples with various film thicknesses. Henceforth, GaN nanotubes with their high mechanical strength, thermal conductivity, chemical inertness and electron mobility, have been shown and proven to be highly suitable for FEDs.

(a)



(b)

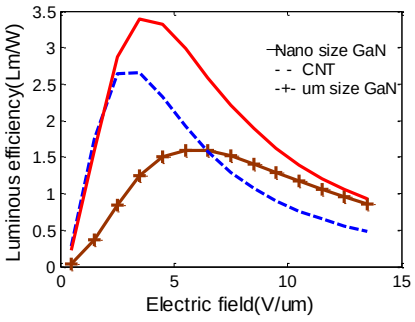


Fig. 1. SEM images corresponding to various stages of the growth **(b) luminous efficiency for GaN samples with various film thicknesses**

References

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