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EFFECT OF THRESHOLD VOLTAGE ON BRIGHTNESS OF ZnS:Mn AC THIN FILM EL DEVICE

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ABSTRACT

The aim of this paper is to study of dependence of EL brightness (B) on the applied voltage and dependence of threshold voltage on the temperature of ZnS:Mn thin-film EL devices. We have found that the saturation value of the EL brightness decreases with increasing value of the temperature of the EL device. Furthermore, the threshold voltage also decreases with increasing value of the temperature. The threshold voltage deceases with increasing value of the temperature of the EL device.

KEY WORDS

Electroluminescence, threshold voltage, polarization, activator concentration, electrical stimulus.

INTRODUCTION

The most important aspect of light generation is the response to an electrical stimulus. Hence most investigators characterize ACTFEL devices by the brightness versus voltage (B-V) data. A variable ac voltage source drives the device (typically with a trapezoidal pulse with frequency of 60Hz or 2.5kHz) and a suitable spectrometer is used to record the brightness data. A critical parameter for device performance is the threshold voltage, V_{th}. In terms of device physics, this is the voltage at which electrons are accelerated to sufficiently high energies to excite the luminescent centers and result in light emission. One definition of the threshold is the voltage at which the brightness level reaches 1 cd/m^2.Another definition is the intersection on voltage axis of the extrapolation of the maximum linear slope of the B-V curve. While V_{th} is the voltage at which EL is detected, the applied voltage (V) drops across the dielectric layers in addition to the phosphor according to the equation

$$V = E_i^t d_i^t + E_p d_p + E_i^b E d_i^b \qquad \text{……..……………… (1)}$$

where $E_i^t d_i^t$ and $E_i^b E d_i^b$ are the products of the electric field and layer thickness in the top and bottom dielectrics, respectively, and $E_p d_p$ is the product of the electric field and layer thickness of the phosphor. Therefore the threshold voltage is influenced by the properties of both the phosphor and the insulators. This fact is important in multicolor displays, since matched threshold voltages for different phosphors greatly simplify the drive electronics.

The EL brightness, which is as given below

$$B = \eta\ C_i \left[V - U_s(t)\left(1 + \frac{C_s}{C_i}\right) U_S\ (t)\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where η is the conversion efficiency in lumen/watt, V is the applied voltage, C_i is the capacitance of insulators, C_s is the capacitance of semiconductors, U_s (t) is layer voltage across the semiconductor.

Since the polarization depends very weakly on the temperature, eq. (2) indicates that the decrease in brightness (B) with increasing temperature should be due to the decrease of efficiency η with temperature.

As the dielectric constant of semiconductor and insulators decreases with increasing temperature, the value of C_s and C_i should decrease with increasing temperature of the materials. As the decrease of C_s with temperature will be faster as compared to that of C_i, the ratio C_s/C_i should decrease with increasing temperature of the EL cell. Thus, eq. (2) indicates that the threshold voltage should decrease with increasing temperature of the EL devices.

RESULT

Fig.1 show the dependence of EL brightness (B) on the applied voltage U_p for ZnS:Mn for different temperatures. It is seen that the EL starts beyond a particular voltage, then it increases with voltage and tends to attain a saturation value for higher value of the applied voltage. It is evident that the saturation value of the EL brightness decreases with increasing value of the temperature of the EL device. Furthermore, the threshold voltage also decreases with increasing value of the temperature.

Fig. 2 illustrates the dependence of threshold voltage (U_{th}) on the temperature of the EL device. It is seen that the threshold voltage deceases with increasing value of the temperature of the EL device. It is found that the threshold voltage does not change significantly with increasing concentration of the activator in the phosphors.

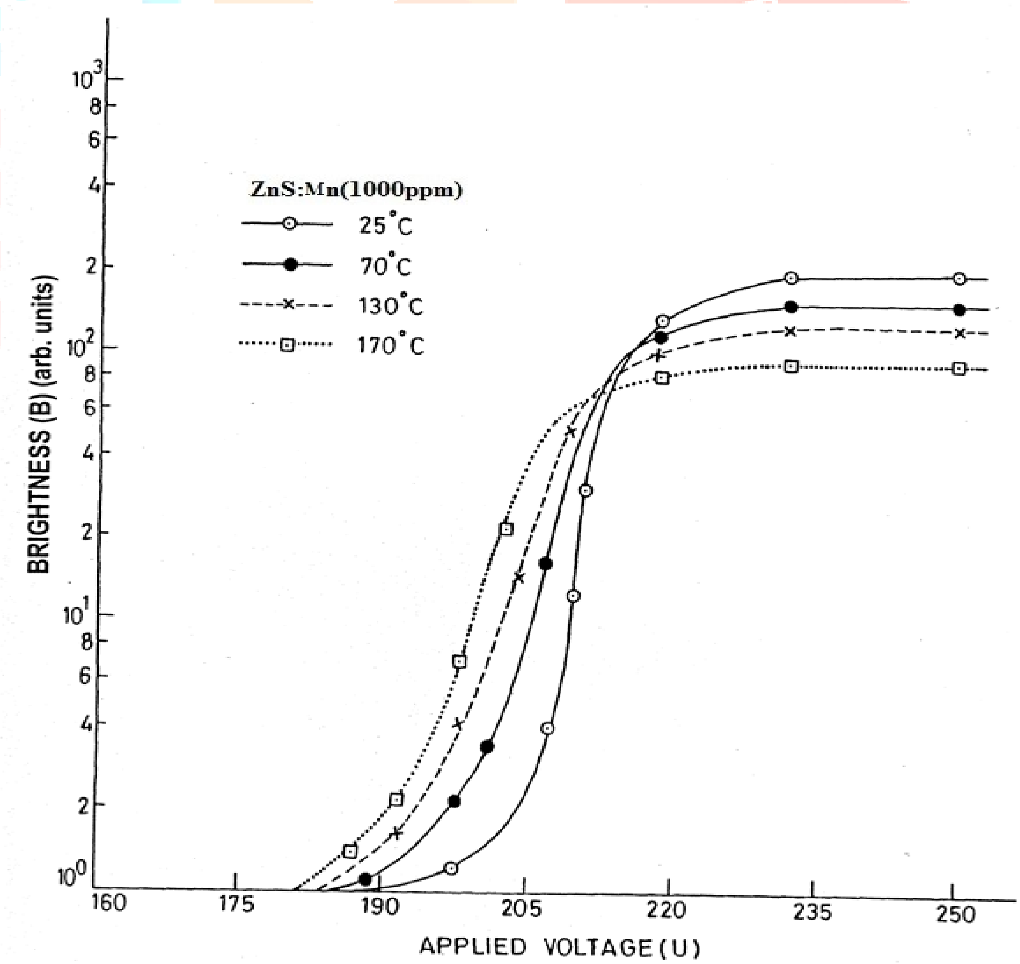

Fig. 1 Dependence of EL brightness (B) on the applied voltage Up of ZnS:Mn (1000 ppm) for different temperature

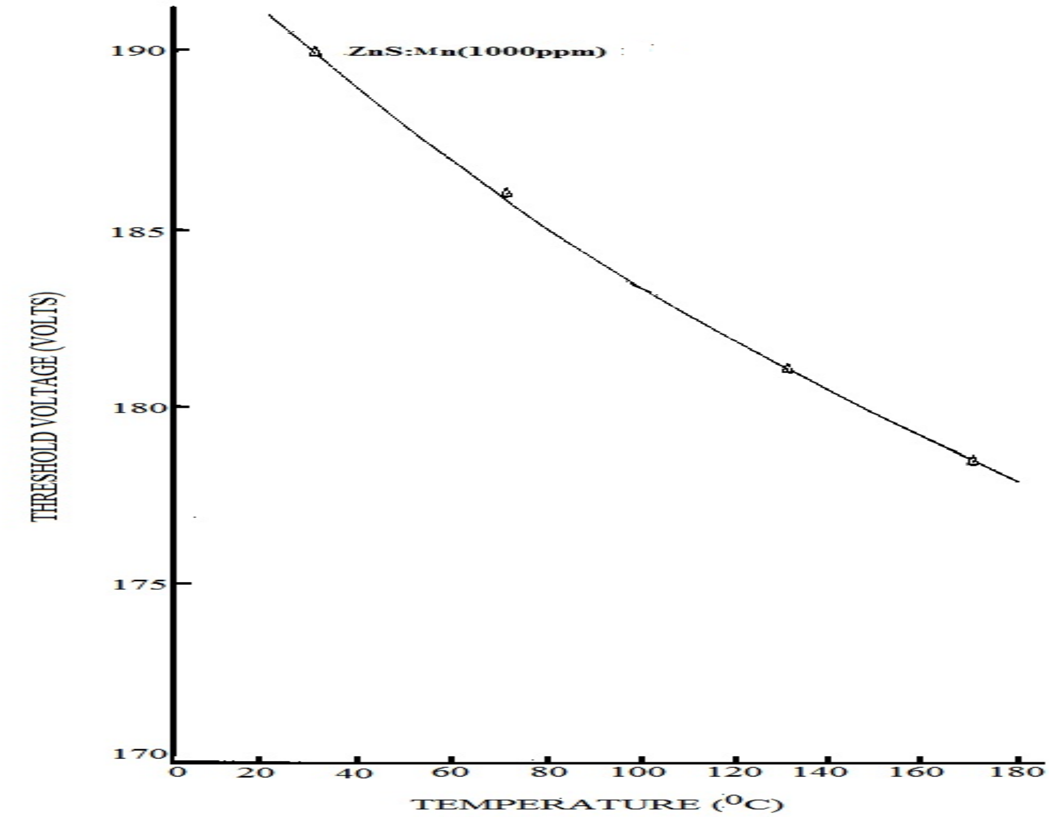

Fig.2 Dependence of threshold voltage (U_m) on the temperature EL devices

DISCUSSION

The saturation value of the EL brightness and the threshold voltage decreases with increasing temperature of the EL devices. The rate of decreases of brightness with temperature is faster for the electroluminescent devices in which the active layer contains higher concentration of the activators. The threshold voltage does not change significantly with increasing concentration of the activator in the active layer of the thin-film electroluminescent devices. The polarization is only very weakly dependent upon temperature. This fact rules out the possibility that the decrease of EL brightness with increasing temperature could be caused mainly by a variation of the number of hot electrons. It may rather be due to a variation of the ratio of radiative to non-radiative processes with temperature.

REFERENCES

[1] Mummer, G.O. 1984. Phys. Stat. Sol.(a), 81: 597.

[2] King, C N. 1996 . J Soc. Inform. Display, 1: 1.

[3] Dimitrova V D and Tate J, 2000. Thin Solid Films: 365.

[4] Vecht, J. 1968. Appyl. Phys., 1: 134.

[5] Smith D H, 1981. J. Lumin., 23: 73.

[6] Gumlich, H.E. 1970, Der Energietransport in der Electroluminescent and Electrophotoluminescent von II-VI Verbindungen, Sammlung Vieweg, Braunschweig, Vol. 133

[7] Meng, L., LI, C. and Zhong, G. 1987,: J. Luminescence 39:11.

[8] Yang, K.W., Owen, J.T. and Smith, D.H. 1981, IEEE Trans. Electron Devices 28**:** 703.

[9] Mach, R. AND Muller, G.O. 1982, Phys. Stat. Sol.(a), 69: 11.

[10] S. Tiwari, shikha and B P Chandra, 2004, Journal of material science, 15.