

The Characteristics of Current and Voltage in an External Electrode Fluorescent Lamp

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Recently, the EEFLs developed for the light sources in a liquid crystal display (LCD) backlight, have been achieved to a high brightness comparable to the cold cathode fluorescent lamps (CCFLs) with a low frequency operation less than 100 kHz [1–2]. From the general I-V characteristics of EEFLs, the important issues in this study are to obtain the Townsend coefficients of the discharge, the ionization rate α and the ion induced electron emission rate of the effective γ corresponding to EEFLs. The first coefficient is determined in the analysis of the dark current region.

In this study the non-uniform field in cylindrical tube geometry is considered. Second, the range of gamma value will be estimated. The EEFL discharge is the phenomena under the non-uniform electric field.

In this experiment the dark current region shows the parameters $A=0.4/(\text{cm torr})$ and $B=71 \text{ volt}/(\text{cm torr})$ in the first Townsend coefficients [3]. Townsend breakdown region having the second coefficient of $\gamma=0.57$ shows the increasing of the current with the constant voltage about 1 kV. Finally, the normal glow region represents the behavior of the positive resistance in I-V.

[1] T. S. Cho, et al., IEEE Trans. on Plasma Science, Vol. 30, No. 5, 2002, p. 2005–2009.

[2] G. S. Cho, et al., J. Phys. D: Appl. Phys., 36, 2003, p. 2526–2530.

[3] A. von Engel, Ionized Gases, Oxford, 2nd ed., Chap. 7, 1964.