AUXILIARY HEATING INFLUENCE ON BARIUM LOSS FROM FLUORESCENT LAMP ELECTRODE UNDER HF OPERATION

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In this paper an experimental investigation of a low pressure mercury discharge lamp (T5), especially the region nearby its electrode is reported. These investigations were performed under HF operation and in dimming mode.

The main objective of this work is to better understand processes limiting fluorescent lamp lifetime, and more precisely the sputtering and the evaporation of the emissive material covering the electrode[1].

In general, a hot cathode in fluorescent lamps consists of tungsten coils coated with mixed alkaline earth oxides. This oxide coating is used to lower the electrode work function and to allow electron emission at very high efficiency.

During normal operation, barium is extracted either by evaporation or by sputtering, causing the depletion of the electron emitter and finally the lamp failure[2]. If the discharge current flowing through the lamp, and/or the heating current flowing through the electrode move away from nominal values (during which the discharge is sustained by thermionic emission from the (hot) electrode),.evaporation and/or sputtering can reach a very high magnitude and can drastically shorten lamp lifetime.

Using high-sensitivity spectroscopy emission method, we have identified the barium atom and ion emission, in the cathode region, which can be correlated to barium disappearance at the electrode surface.

In a second experiment, the intensity of these lines is processed to find out the electrode operating mode for several electrical operating conditions. To characterize the presence of barium in the vapor phase, an original indicator, which is the half-width of the profile of the total luminance of the line of BaI (553.5 nm) or BaII (455.4 nm) integrated over the length of the electrode is proposed. This indicator is dependant, on one hand, the discharge current and, on the other hand, the heating current of the electrode.

It is possible to distinguish the effects of the discharge current and the heating current of the electrode on the evaporation and on the sputtering of barium and, therefore, determine an area where the compromise between evaporation and sputtering is optimum. The heating current must be regulated according to the discharge current to minimize the consumption of the emissive material of the electrode.

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2. A. K. Bhattacharya, Journal of Applied Physics, Volume 65, Issue 12, June 15, 1989, pp.4603-4607.