HIGH FREQUENCY DISCHARGES AND SOME POSSIBLE APPLICATIONS*

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High frequency discharges burning in pure inert gases like Ar, He, Ne emit continuous spectra of bremsstrahlung at pressures from 10^2—10^4 Pa, which within the region of approximately 200 mμ to 600 mμ may serve as a normal of radiation.

ВЫСОКОЧАСТОТНЫЕ РАЗРЯДЫ И ИХ НЕКОТОРЫЙЕ ВОЗМОЖНЫЕ ПРИМЕНЕНИЯ

Высокочастотные разряды, возникающие при горении в чистых газах, таких как аргон, гелий или неон, излучают при давлениях 10^2—10^4 Па сплошной спектр тормозного излучения, который в области примерно 200—600 mμ может служить в качестве нормали излучения.

I. INTRODUCTION

Glow discharges — dc discharges — are used as a radiation normal if burning in Ar [1, 2]. High frequency discharges also emit a continuous spectrum, which has been experimentally proved for discharges burning in Ne and Ar both under reduced and normal pressures [3, 4].

II. METHODS

From the results of experiments it follows that the bremsstrahlung can be applied as a normal of radiation if the discharge burns in He at a reduced pressure.

It is possible to determine the intensity of radiation emitted through the discharge theoretically [5]. Thus, after expressing the measured values, substituting and calculating them by the help of a computer, we obtain the dependence of the emitted radiation on the wavelength, where the parameters N_e and T_e mean the density and temperature of electrons, Fig. 1, 2.

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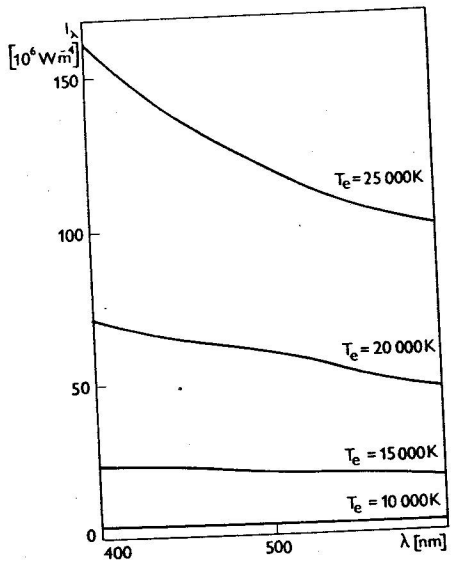

Fig. 1. Dependence of emitted radiation on the wavelength, Ar, $p = 10^2$ Pa, $n_e = 10^{16}$ m^{-3}.

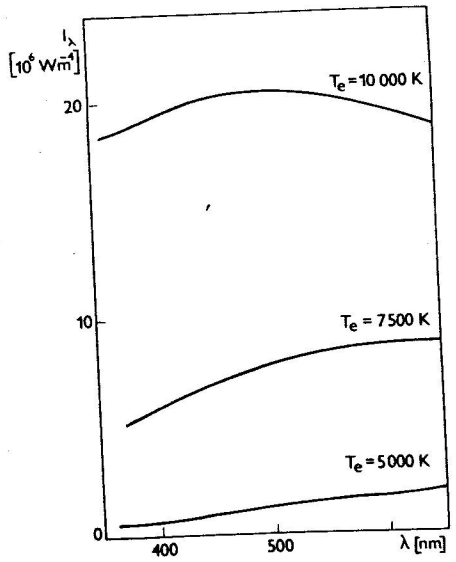

Fig. 2. Dependence of emitted radiation on the wavelength, He, $p = 2.6 \times 10^2$ Pa, $n_e = 10^{18}$ m^{-3}.

III. RESULTS

In our case we measure the continuous spectrum photometrically from the spectral desk, using an ISP-22 spectrograph. The high frequency generator works on a frequency of 1 MHz. The current through the discharge ranges between

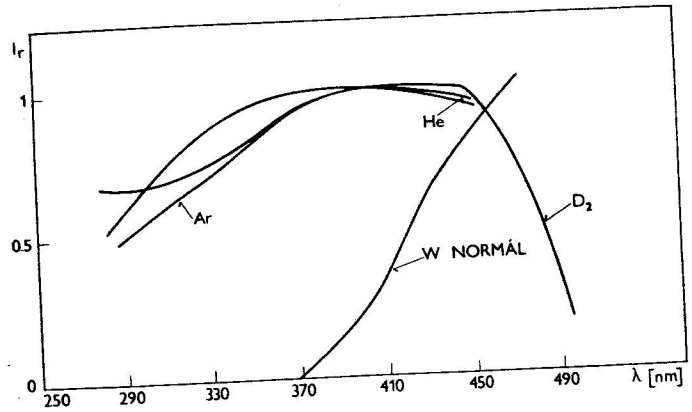

Fig. 3. The dependence of the bremsstrahlung relative intensity on the wavelength for He, Ar; D_2 discharge and W normal. (Hf discharge in He — $p = 10^2$ Pa, 100 mA. Hf discharge in Ar — $p = 2 \times 10^3$ Pa, 150 mA; D_2 E Narva — 0.3 A; W normal — $T = 1700$ K).

40—200 mA, the discharge tube has inner electrodes (molybdenum of a 0.003 m diameter). Discharge tubes with outer electrodes have also been tried. The arrangement of electrodes has considerably influenced the excitation of the atomic lines. Especially in the case of the arrangement with the cylindrical outer electrodes there are even generated lines with an increased excitation potential if compared with cases of other arrangements.

In the region of wavelengths over 350 mμ the bremsstrahlung intensity absolute value can be determined as well, by using a tungsten normal. Fig. 3 shows the dependence of the bremsstrahlung relative intensity on the wavelength [6].

IV. DISCUSSION

High frequency discharges burning in pure inert gases like Ar, He, Ne emit continuous spectra of bremsstrahlung at pressures from 10^2—10^4 Pa. Consequently, from the given results we may conclude that it is possible to use the above discharge as a normal of radiation. In comparison with other radiation normals like the tungsten normal, the deuterium discharge tube, the exposure is about 5 times longer.

REFERENCES

[1] Krysmanski, K. H., Pfau, S., Rutscher, A.: IC PIG 1977, Berlin DDR, 197.
[2] Pfau, S., Ruttscer, A., Winkler, R.: IC PIG 1975, Eidhoven, 65.
[3] Kapička, V.: Folia, Brno, *17* (1976), 5.
[4] Batenin, V. M., Belevtzev, A. A., Chinnov, V. P., Zrodnikov, V. S.: IC PIG 1977, Berlin DDR, 195.
[5] Kasjanov, V. A., Starostin, A. N.: ŽETF *48* (1965), 295.
[6] Ryl, M.: Folia UJEP Brno, in press.

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