

Plasma Parameters in the Positive Column He-Cd⁺ Lasers*)

by

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Summary. Electric field, electron temperature and density have been measured over the whole range of the typical He—Cd⁺ laser discharge conditions with the modified double-probe method. The results can be used for explanation of the saturation effects in He—Cd⁺ lasers.

In the recent years several papers have been published, for instance, [1—6] which report the results of plasma parameter measurements in a positive-column He—Cd laser discharge. A certain knowledge about such plasma parameters as the electric field, electron temperature and density in addition to transition probabilities and cross section data is necessary for investigation of excitation and saturation mechanisms of a PC He—Cd⁺ laser power output. But using the values of plasma parameters obtained in [1—6] to estimate the excitation and destruction processes in the He—Cd laser discharge meets with difficulties. Values proposed by different investigators differ not only quantitatively but even qualitatively as in the case of the determination of electron density.

Reviewing the discrepancy between the results of the previous works and following the increasing interest in determination of the plasma parameters in He—Cd laser discharge the demand arises to measure the electric field, electron temperature and density. This paper reports the measurements of the electric field, electron temperature and density in the He—Cd laser discharge in the whole region of interest and it also comprises the comparison of the obtained results with the previous ones.

The cataphoresis type discharge tube used in these measurements was 3 mm in diameter and about 40 cm in active length. Cadmium of natural isotopic abundance was supplied from the sidearm placed at the 2/3 of the active length, closer to the anode. The sidearm temperature was stabilized to better than $\pm 1/2^\circ\text{C}$. All parts

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of the tube except the small region of cadmium condensation were put in the oven at a temperature of $350 \pm 7.5^\circ\text{C}$. The experiments were made over the following range of parameters: the discharge current, 15–155 mA, helium pressure, 1.5–6

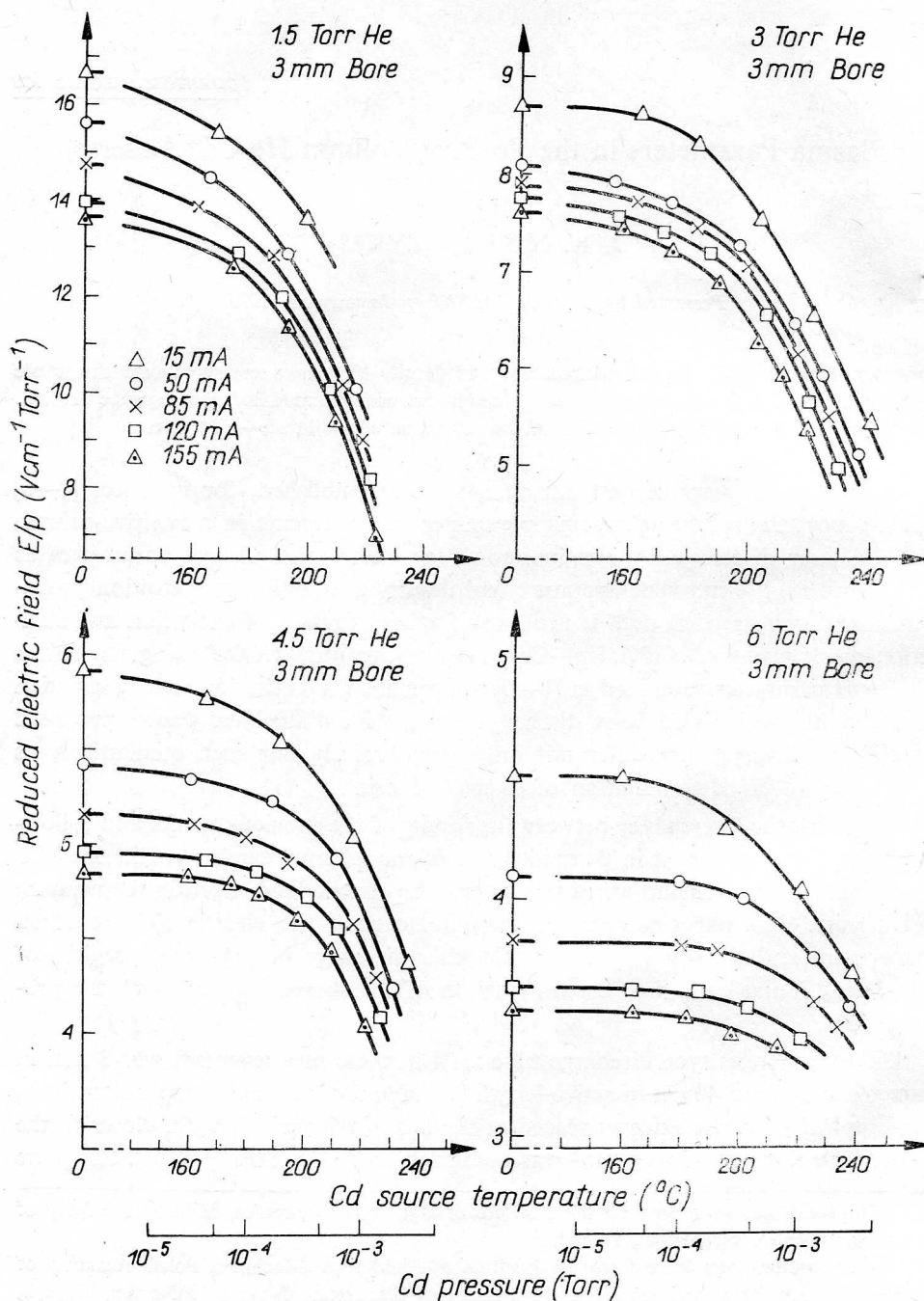


Fig. 1. Reduced electric field E/p as a function of cadmium vapor pressure

