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Two-anode He-Cd$^+$ Laser

by

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Summary. The two-anode He-Cd$^+$ laser is described and the optimum operating conditions are reported. The maximum of laser power can easily be obtained by proper adjustment of the discharge currents of both anodes.

Use of the cataphoresis effect to define the metal vapour density in the bore region of discharge tubes improved the construction and performance of the ion metal-vapour lasers [1]. The optimization of operating conditions in ion metal--vapour lasers of this type, so called positive column (PC) type lasers, is restricted to choosing proper pressure of a buffer gas, discharge current and metal vapour density. Several constructions of the PC ion metal-vapour lasers have been developed to satisfy the laser optimization requirements [1].

A He-Cd$^+$ laser tube using two anodes to obtain the optimum discharge current and cadmium vapour density in the bore region of the discharge tube is described. The two-anode type He-Cd$^+$ laser tube provides an easy means of optimization of the He-Cd$^+$ laser operating conditions with no outside heating of a Cd reservoir required.

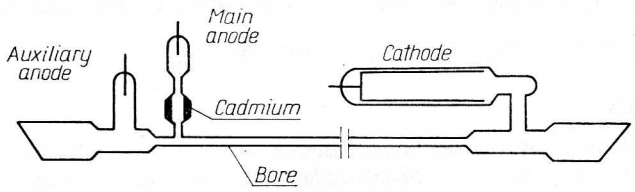

Fig. 1. Diagram of He—Cd$^+$ laser using two anodes

Fig. 1 shows the construction of the two-anode He-Cd$^+$ laser tube. The tube comprises conventional bore, cathode and anode — the anode serving here as an auxiliary one — and so called main anode with a Cd reservoir. The annular Cd-metal element is inserted into the reservoir placed between the main anode and the bore. The main anode discharge current heats the Cd element to supply the Cd vapour in the bore region using cataphoretic transport. The main anode

discharge current required to provide the optimum Cd-element temperature is too low to optimize the bore discharge current. Optimization requirements for this He-Cd$^+$ laser may be satisfied easily by proper choice of both anode currents.

The laser 4416 Å power output variation with auxiliary anode current is shown in Fig. 2. For a 3-mm-bore tube, with thin fiberglass tape surrounding the Cd reservoir, the optimum main anode and auxiliary anode currents are typical in the regions of 65 mA and 55 mA, respectively. Then the optimum bore discharge current is about 120 mA.

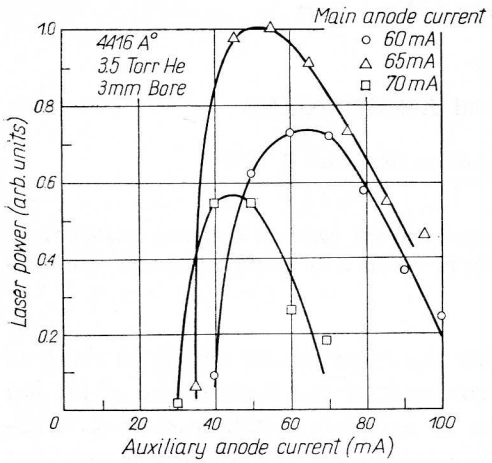

Fig. 2. Laser power output at 4416 Å *vs.* auxiliary anode current at different main anode currents in the two-anode He-Cd$^+$ laser. Bore with 3-mm diameter; He pressure — 3.5 Torr

It is evident from Fig. 2 that in any reasonable case the value of the bore discharge current should exceed that of the main anode current, in order to optimize the two-anode He-Cd$^+$ laser operating conditions. The method of optimization proposed herein is very convenient. It seems that adjustment of the optimum laser conditions in the two-anode He-Cd$^+$ laser tube is easier than in the He-Cd$^+$ laser with one Cd segment developed by Silfvast and Szeto [2,3].

Power output fluctuations of 10—15% and laser-sidelight spontaneous emission fluctuations of about 30% [4], at frequencies of the order of tens or hundreds of kHz, are observed in the two-anode He-Cd$^+$ laser at conditions as specified in Fig. 2. Yet the discharge conditions to obtain the lower power fluctuations need still be tested.

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Ю. Мизэрачик, Ю. Конечка, **Лазер He-Cd$^+$ с двуханодной трубкой**

Содержание. В настоящей работе описаны основы действия лазера He-Cd$^+$ с двуханодной разрядной трубкой. Представлен способ получения оптимальных условий работы этого лазера путем легко выполняемой регулировки тока разряда к обоим анодам.