

15 J/l Energy Density from a TEA CO₂ Laser with Four Preionization Circuits

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A new transverse electric atmospheric laser by four very compact preionizer circuits was made. It was able to generate a volumetric energy density of 15 J/l with a pulse time duration of about 30 ns. The output energy behaviour was studied by a plane parallel cavity on total pressure value and on the total laser shots. The uniformity of the output beam was not excellent while its divergence was very low. By this laser we treated samples of polymers useful in bio-medical fields.

High power laser pulses are very interesting for application in industrial and scientific fields. In order to improve the laser efficiency, authors have developed different pumping and preionizing circuits[1]. The transverse electric atmosphere (TEA) laser that we present, was powered by a capacitor charge transfer circuit with a nominal primary and secondary capacitance of 60 and 50 nF, respectively. The laser chamber was made of a 60-cm-long, commercially available PVC tube which contains the electric structures. The discharge electrodes were 50 cm long, 3.5 cm width, with a separation of 2 cm. The active discharge width was of about 1 cm. The preionization of gas mixture was provided by four sectors composed of 14 spark gap circuits. Each spark gap was supplied by a capacitor of low capacitance, 625 pF. The preionizers were placed near the main electrode edges, Fig. 1. The optical resonator was plane parallel. It was comprised by a ZnSe window output coupler and gold disk as full reflector, at a separation of 65 cm.

The gas mixture was CO₂ 4.5 %, N₂ 13% and He 82.5%. The maximum laser action was achieved with a gas pressure of 2000 mbar. Fig. 2 shows the output energy as a function of the total pressure. In all these preliminary experiments, the charging voltage was of 40 kV and the maximum output laser energy was of 1.5 J. Considering the discharge volume, the volumetric energy density was of 15 J/l.

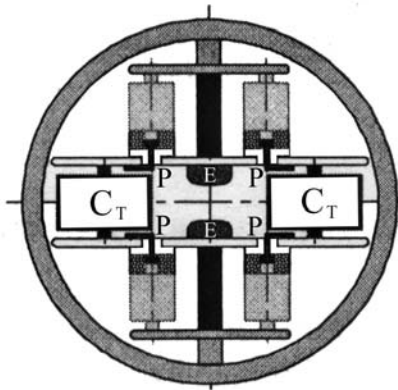


Fig. 1. Cross section of the laser head. E: electrodes; P: preionizers; C_T: main capacitors.

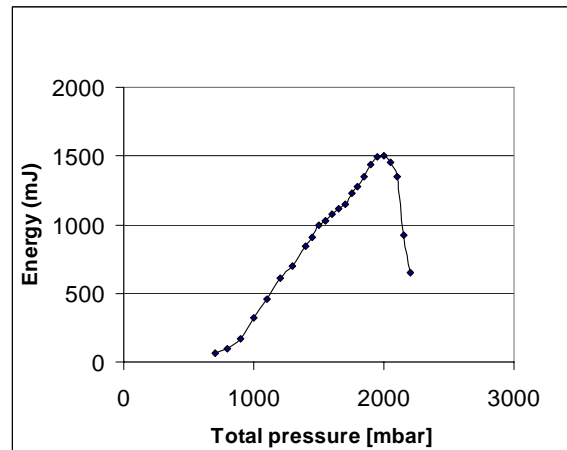


Fig. 2. Output laser energy vs mix gas pressure.

[1] V. Nassisi, *Appl. Phys B* **53**, 14-18 (1991)

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