

# 10-60 kHz operation mode of waveguide CO<sub>2</sub>-laser with wavelength selection option

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**Abstract**—Possibility of obtaining the pulse-periodic lasing mode with 100% modulation at pulse repetition rates from 10 kHz to 60 kHz is reported.

**Keywords**—waveguide CO<sub>2</sub>-laser, Z-shaped cavity, RF excitation, wavelength selection

## I. INTRODUCTION

Compact CO<sub>2</sub>-lasers of over 10 W average power with possibility of wavelength selection and controllable pulse repetition rate have their demand in material processing, medicine and dual use technologies. Study of the slab waveguide CO<sub>2</sub>-laser with radio frequency (RF) pumping in pulse-periodic lasing mode is reported in proceedings [1]. We report the results of the study of the sealed-off waveguide RF pumped CO<sub>2</sub>-laser with Z-shaped metal-ceramic waveguide featured by the sufficiently higher amplification coefficient in comparison with the slab configuration.

## II. MAIN RESULTS

### A. Laser information

The studied laser is designed as an integrated unit consisting of the amplification unit and RF power supply.

The total length of the cavity is 1.2 m, pressure of the gas mixture CO<sub>2</sub>:N<sub>2</sub>:He:Xe=1:1:6+5% is 75 tor, operating frequency of RF power supply — 144 MHz.

The amplification unit is designed so that it can be easily modified from fixed wavelength mode into widely tunable laser source for spectroscopic applications [2].

The intracavity Q-switch can be added for increasing pulse power.

### B. Operation mode

Operation of the laser was studied in the range of pulse width from 3 μs to 270 μs. Maximal pulse repetition rate was 60 kHz.

### C. Results

The dependence of the pulse form and width on the pulse repetition rate was studied at maximal output power. Parameters of RF pumping pulse were defined for obtaining maximal output power at 100 % modulation. The dependence of the output power on the pulse repetition rate was defined for different levels of amplitude of modulation. Special focus in the study was made on 15 kHz operation mode with average power up to 24 W. Typical pulse shapes are shown in Fig. 1.

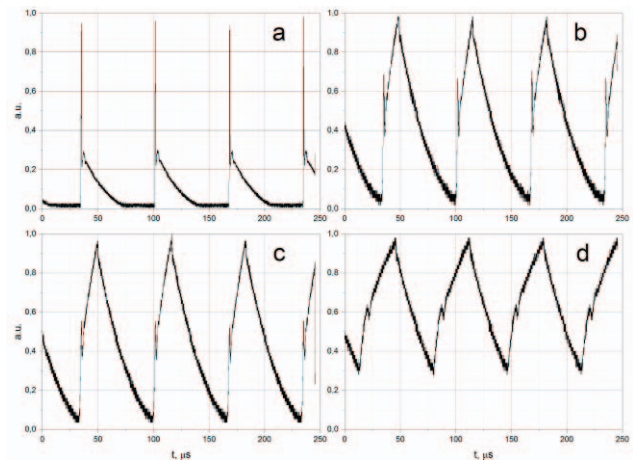


Fig. 1. Pulse shape at 15 kHz and different RF pumping pulse width. RF power 900 W. Mode a —  $\tau=13 \mu\text{s}$ , output power  $P_{\text{avg}}=6.17 \text{ W}$ ; Mode b —  $\tau=19 \mu\text{s}$ , output power  $P_{\text{avg}}=12.73 \text{ W}$ ; Mode c —  $\tau=20 \mu\text{s}$ , output power  $P_{\text{avg}}=13.32 \text{ W}$ ; Mode d —  $\tau=36 \mu\text{s}$ . In the mode d maximal output power  $P_{\text{avg}}=23.8 \text{ W}$  was obtained.

## III. REFERENCES

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