

International Conference and Exhibition on Lasers, Optics & Photonics

October 07-09, 2013 Hilton San Antonio Airport, TX, USA

Slab RF discharge cryogenic systems: CO laser development, singlet delta oxygen production and XeO excitation

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Compact slab CO lasers excited by repetitively pulsed capacitive RF discharge with cryogenically cooled electrodes were developed. Maximal CO laser averaged output power of ~12W was obtained in free running experiments on fundamental band (FB) of CO molecule (wavelength 5.0-5.5 microns) with the laser efficiency of ~14%. Frequency selective FB single line lasing was observed on ~100 laser transitions within spectral range 4.9-6.5 micron. First overtone (FO) lasing was obtained in a slab carbon monoxide laser for the first time. Multiline FO lasing was observed on ~80 spectral lines within the spectral range 2.5-4.0 micron. The total output power of the slab FO CO laser was ~2 W, the laser efficiency being 1.6%.

Experimental facility for studying the processes of O_2 ($^{1}\Delta$ g) (singlet delta oxygen (SDO)) production in subsonic gas flow excited with transverse slab RF discharge was developed as the prototype of electric discharge SDO generator for oxygen-iodine laser. Experiments on SDO production and its relaxation for oxygen containing gas mixtures at pressure up to 30 Torr were carried out. It was shown that SDO yield increased with the gas pressure decrease, gas flow deceleration and helium dilution of oxygen at the same input RF power. The concept of oxygen-iodine laser based on transverse gas flow slab RF discharge SDO generator with cryogenically cooled electrodes is discussed.

Intense green luminescence of a XeO molecule was observed in cryogenic RF discharge facility. The spectrum was registered in 510-550 nm range for gas mixtures Xe:O, at pressures below 100 Torr.

Biography

Dmitry V. Sinitsyn obtained his M.S. degree from Moscow Physics-Technical Institute in 1981 and Ph.D. degree (in Physics and Maths) from P. N. Lebedev Physical Institute in 2003. Now, he is a senior scientist at the Gas Lasers Lab of the Institute. His research activities include experimental studies on pulsed and CW molecular gas lasers with electric discharge pumping, and the study of ultra-short UV laser pulses propagation through the atmosphere and its interaction with different media and materials. He has co-authored 3 patents and over 150 papers in the fields of laser physics and applications of lasers.

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