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Scaling of an Electric Discharge Excited Oxygen-Iodine Laser[1]
JOHN BRUZZESE, MUNETAKE NISHIHARA, WALTER LEMPERT, J. WILLIAM RICH, IGOR ADAMOVICH, The Ohio State University — Electric discharge excited oxygen-iodine laser apparatus has been scaled to increase the electric discharge volume and power, the laser mixture flow rate, and the gain path in the M=3 laser cavity. Specifically, singlet delta oxygen (SDO) generator discharge power has been increased at least up to 3.5 kW, laser mixture flow rate up to 0.5 mole/sec, and gain path up to 10 cm. Steady-state run time of the new scaled-up laser apparatus at these conditions is up to 10 sec. Two different discharge configurations have been used to generate singlet delta oxygen, crossed nanosecond pulser / transverse DC sustainer discharge and capacitively coupled transverse RF discharge. Flow temperature downstream of the discharge, singlet delta oxygen yield, and laser gain have been measured in a wide range of discharge powers, nitric oxide mole fraction in the main oxygen-helium flow, and oxygen percentage in the mixture, at discharge pressures ranging from 60 to 90 torr. The results demonstrate that SDO yield increases with the discharge power for both discharge configurations, although highest yields achieved so far remain low, 3.6-3.7%, due to fairly low energy loading per oxygen molecule in the discharge. Small signal gain measured in the M=3 cavity of the new laser apparatus is up to 0.116%/cm (2.3% gain per single pass), at the flow temperature of T=125 K.

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