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Plasma Excited Chemical-Oxygen-Iodine Lasers: Optimizing Injection and Mixing for Positive Gain[1] NATALIA Y. BABAEVA, LUIS A. GARCIA, RAMESH A. ARAKONI, MARK J. KUSHNER, Iowa State University — Chemical oxygen-iodine lasers achieve oscillation on the $^2P_{1/2} \rightarrow ^2P_{3/2}$ transition of atomic iodine at 1.315 μm by a series of excitation transfers from $O_2(^1\Delta)$. In electrically plasma excited devices (eCOILs), $O_2(^1\Delta)$ is produced in a flowing plasma, typically He/O_2, at a few to tens of Torr. The iodine is injected into the flow as a He/I_2 mixture immediately upstream (or in) a supersonic nozzle. A small positive gain with I* limited to a narrow boundary layer near the wall indicates slow mixing when the I_2 is injected from the wall. This results in low utilization of $O_2(^1\Delta)$. In this paper we discuss results from 1- and 2-dimensional computational investigations of means to optimize gain in eCOILs by using different I_2 injection strategies. It was found that due to the plasma generated distribution $O_2(^1\Delta)$, placement of injectors closer to the axis significantly increased gain by facilitating complete $O_2(^1\Delta)/I_2$ mixing. This is partly a function of the inlet flow of NO through the discharge which regulates the density of O atoms produced by electron impact dissociation of O_2. By optimizing the nozzle dimensions, their location, and I_2 and NO flow rates, the yield of $O_2(^1\Delta)$ required to achieve positive gain can be minimized.

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