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Production of $O_2(a^1\Delta_g)$ molecules in flowing Ar-O_2 surface-wave microwave discharges KINGA KUTASI, Research Institute for Solid State Physics and Optics of HAS, Budapest, Hungary, VASCO GUERRA, IPFN-LA, Instituto Superior Tecnico, 1049-001 Lisboa, Portugal, PAULO SA, Dep. de Eng. Fisica, Faculdade de Engenharia da Universidade do Porto, Portugal — The possibility of development of an electric discharge oxygen-iodine laser stimulates nowadays many studies on the production of O_2(a) in discharges. The laser would operate on the electronic transition of the iodine atom at 1315 nm, the population of the upper laser state occurring in the reaction of O_2(a) with I. In order to achieve population inversion between the iodine upper and lower states and thus positive gain, the yield of O_2(a), $[O_2(a)]/[O_2(X)]$, should be at least equal to the threshold yield, which at 400 K is 24%. In this work we develop a discharge model to investigate the O_2(a) yield in an Ar-O_2 flowing surface-wave microwave discharge created in a 1 cm diameter tube and follow its evolution in the afterglow downstream the discharge. Our calculations show that the O_2(a) threshold yield necessary for positive gain can be achieved at 10 mbar, the yield increasing with pressure and reaching 50% at 50 mbar. Furthermore, the yield increases with Ar addition into O_2, as a result of the enhancement of O_2 dissociation with the Ar content. We also show that the density of O atoms in the afterglow, which can quench the upper laser state, can be tuned to the desired levels.

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