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Effect of gas mixture ratio on atomic oxygen density in an inductively coupled plasma in O_2/Ar mixture TOSHIKAZU SATO, TOSHIAKI MAKABE, Keio Univ. — Oxygen plasmas are extensively used in material processing such as ashing of photoresist, surface modification and oxidation. It is well known that dilution of oxygen by rare gas increases the plasma density and enhances the processing speed. Kitajima et al experimentally investigated argon diluted oxygen plasma and showed that the metastable argon efficiently produces metastable atomic oxygen in capacitively coupled discharge [1]. In this work, we perform a two-dimensional modeling of an inductively coupled plasma (ICP) in O_2/Ar mixture and investigate the effect of Ar dilution on the mechanism of the atomic oxygen production. A steady state plasma structure and the spatial distribution of neutral species are calculated by using the relaxation continuum model. Atomic oxygen is produced mainly through the dissociation of oxygen molecule by electron impact and the recombination on the reactor surface is the most dominant loss mechanism of atomic oxygen in highly diluted O_2/Ar ICP at 100 mTorr. Ground state atomic oxygen increases monotonically with increasing O_2 fraction (less than 10%), on the other hand, metastable atomic oxygen steeply increases under the O_2 fraction less than 3%.
[1] T. Kitajima, T. Nakano, and T. Makabe, Appl. Phys. Lett. 88, 091501 (2006).

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