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Experimental Study on a Radial Uniformity in 2f-CCP Based on the Density Distribution of Metastable Ar($1s_5$) by Way of an OES
TAKASHI YAGISAWA, Keio University, TOMIHITO OHBA, TOSHIAKI MAKABE — The use of different frequencies to a two-frequency capacitively coupled plasma (2f-CCP) realizes an independent control between of a high density plasma generation by VHF electrode and of a high-energy ion impact onto a wafer by LF bias. Metastables with a long lifetime in gas phase make large contributions to the maintenance of high density plasma through multistep ionizations. Density distribution of non-emissive metastable can be optically measured by a careful choice of emission lines consisting of upper resonant state and lower short- and long-lived state [1]. In this paper, our discussion will be devoted on the radial uniformity in front of the wafer in the 2f-CCP driven by VHF and LF sources in Ar at 100 mTorr, based on the density distribution of metastable atom Ar($1s_5$) measured by optical emission spectroscopy (OES). With increasing the voltage amplitude of LF bias, the area of metastable production moves from the center of the reactor to the edge of the electrode, resulting in the non-uniform density profile of Ar($1s_5$).

[1] T. Ohba and T. Makabe, *Appl. Phys. Lett.* **96**, 11150 (2010).

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