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$N_2(A^3\Sigma_u^+)$ density in ICP N_2 plasmas measured by diode laser cavity-ringdown absorption spectroscopy Y. HORIKAWA, Nagoya University, K. KURIHARA, Toshiba Corp., K. SASAKI, Nagoya University — There are two candidates for the precursor for nitriding silicon surfaces by nitrogen plasmas: atomic nitrogen and molecular nitrogen at the metastable $A^3\Sigma_u^+$ state. The goal of our work is to identify the nitriding precursor by comparing the precursor densities with the nitriding performance. In this work, we measured the $N_2(A^3\Sigma_u^+)$ density in ICP nitrogen plasmas by cavity-ringdown absorption spectroscopy (CRDS) at the first positive band. By employing a diode laser as the light source, a sensitive detection limit of 10^{-6} for absorption was obtained in our CRDS system. We observed that the increase in the $N_2(A^3\Sigma_u^+)$ density with the rf power was gentle and was saturated at a high rf power. The $N_2(A^3\Sigma_u^+)$ density decreased with the nitrogen gas pressure significantly, and the $N_2(A^3\Sigma_u^+)$ density at 100 mTorr was approximately 1/10 of that at 20 mTorr. We also measured the N atom density at the ground state by vacuum ultraviolet absorption spectroscopy at the ${}^4S^o - {}^4P$ transition. As a result, it was observed that the increase in the N atom density with the rf power was steeper than that in the $N_2(A^3\Sigma_u^+)$ density. In addition, the N atom density increased with the nitrogen gas pressure. At the conference, we will discuss the kinetics of $N_2(A^3\Sigma_u^+)$ and N by comparing their densities.

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