Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Influence of Molecular Gas Concentration on Measurement of Plasma Electron Density by Saturation Spectroscopy S. NISHIYAMA, H. WANG, K. SASAKI, Hokkaido University — Recently, we applied saturation spectroscopy to electron density measurement of argon plasmas. In general, the peak height of saturation spectrum or the saturation parameter is a function of the relaxation frequency of related energy levels. In the case of the metastable level of argon in argon plasma, the relaxation frequency is dominated by electron impact quenching, hence we can deduce the electron density from the saturation parameter. On the other hand, in the case of mixture plasma of argon and molecular gas, molecular species also contribute to the relaxation frequency of the metastable level. In this study, we investigated the influence of molecular gas concentration on the electron density measurement. An ICP source was used for producing argon-nitrogen and argon-hydrogen mixture plasmas. The frequency of a tunable diode laser was scanned over the Doppler width of the $4s[3/2]^o_2 - 4p[3/2]_2$ transition (763.51 nm). We confirmed a linear relationship between the inverse of the saturation parameter and the electron density in the argon-nitrogen mixture plasma. However, the linear relationship was not found in the argon-hydrogen mixture plasma. The breakdown of the linear relationship is caused by the change in the density of molecular hydrogen due to dissociation.

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Date submitted: 18 Jun 2015 Electronic form version 1.4