Abstract Submitted
for the GEC10 Meeting of
The American Physical Society

Kinetics of $A^3\Sigma_u^+$ state of molecular nitrogen in inductively-coupled nitrogen plasmas YOSHIMINE HORIKAWA, Nagoya University, KAZUAKI KURIHARA, Toshiba Corporation, KOICHI SASAKI, Hokkaido University — This paper discusses the loss kinetics of the metastable $A^3\Sigma_u^+$ state of molecular nitrogen in inductively- coupled nitrogen plasmas. The loss frequency of the $A^3\Sigma_u^+$ state was evaluated from its density and the production rate. The density of the $A^3\Sigma_u^+$ state was measured by diode laser cavity ringdown absorption spectroscopy. The production frequency was estimated by evaluating the rate coefficients for electron impact excitation to the $A^3\Sigma_u^+$, $B^3\Pi_g$, and $C^3\Pi_u$ states. In the evaluations of the rate coefficients, we took into account the variation of the electron temperature, which was estimated on the basis of optical emission intensities. The variation of the loss frequency, which was evaluated from the balance between the production and loss frequencies, suggested the quenching loss of the $A^3\Sigma_u^+$ state in the gas phase. However, the loss frequency of the $A^3\Sigma_u^+$ state according to the rate coefficients of quenching processes known to date ($N_2(A^3\Sigma_u^+) + N(^4S) \rightarrow N_2(X^1\Sigma_g^+) + N(^2P)$, $N_2(A^3\Sigma_u^+) + N_2(A^3\Sigma_u^+) \rightarrow N_2(B^3\Pi_g) + N_2(X^1\Sigma_g^+)$, and $N_2(A^3\Sigma_u^+) + N_2(A^3\Sigma_u^+) \rightarrow N_2(C^3\Pi_u) + N_2(X^1\Sigma_g^+)$) are smaller than the diffusion loss frequency. Further investigations are necessary to identify the dominant loss process of $N_2(A^3\Sigma_u^+)$ in nitrogen plasmas.

Koichi Sasaki
Hokkaido University

Date submitted: 02 Jun 2010 Electronic form version 1.4