Determination of Collisional Quenching Rate Coefficient of $\text{N}_2(A^3\Sigma_u^+)$ by $\text{H}_2\text{O}$

SUSUMU SUZUKI, HARUO ITOH, Chiba Institute of Technology — The effective lifetimes of metastable excited molecule $\text{N}_2(A^3\Sigma_u^+)$ in $\text{N}_2/10.2$ppm $\text{H}_2\text{O}$ and $\text{N}_2/103$ppm $\text{H}_2\text{O}$ mixtures were measured by waveform analysis$^\text{(1)}$ of the transient ionization current after interruption of the initial electron from the cathode in the Townsend discharge region. The collisional quenching rate coefficient of $\text{N}_2(A^3\Sigma_u^+)$ by $\text{H}_2\text{O}$ was determined together with the diffusion coefficient of $\text{N}_2(A^3\Sigma_u^+)$ in nitrogen and the reflection coefficient of $\text{N}_2(A^3\Sigma_u^+)$ at the cathode surface with the procedure based on the diffusion equation analysis$^\text{(2)}$. The obtained collisional quenching rate coefficient of $\text{N}_2(A^3\Sigma_u^+)$ by $\text{H}_2\text{O}$ is $5.7 \times 10^{-13}$ cm$^3$/s. This value is ten times as large of the value reported by Callear and Wood$^\text{(3)}$.