Quenching rate constants of the nitrogen molecule

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The emission spectroscopy methods are used to measure the lifetime of the excited states of nitrogen molecules and ions corresponding to the second positive and first negative systems of its radiation. The measurements are carried out in mixtures of molecular nitrogen with hydrocarbons in the afterglow of a repetitive high-voltage nanosecond discharge. As a result of processing the data obtained by varying the composition of gas mixtures and their pressure, the rate constants for quenching of the excited states of nitrogen in collisions with hydrocarbon molecules are determined.

The method used was verified by measuring the lifetime of the excited states of nitrogen molecules and ions in pure nitrogen and in a mixture with oxygen. After processing the data and obtaining the values of the quenching rate constants, the results were compared with those obtained by other authors [1, 2].

In this work, the time of the exponential fall of the radiation intensity is measured at various pressures of the studied gas mixtures with a known proportion of the incoming components, which makes it possible to vary the values of $[N_2]$. We find the quenching constants and the radiative lifetime of the vibrational levels $N_2(C^3\Pi_u,\ v' = 0,\ 1,\ 2,\ 3 \rightarrow B^3\Pi_g,\ v)$ and $N_2^+(B^2\Sigma_u^+,\ v' = 0 \rightarrow X_2\Sigma_g^+,\ v)$ corresponding to the second positive and first negative vibrational–rotational nitrogen systems.

The quenching constants of excited states of nitrogen molecules in mixtures containing hydrocarbons, in particular ethane and propane, have been measured. The second positive $N_2(C^3\Pi_u,\ v' = 0,1,2,3 \rightarrow B^3\Pi_g,\ v)$ and the first negative $N_2^+(B^2\Sigma_u^+,\ v' = 0 \rightarrow X_2\Sigma_g^+,\ v)$ nitrogen emission systems were studied.

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References

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