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Difference in Rotational Temperatures between Neutral Molecules and Molecular Ions of Low-Pressure Discharge N2-O2 Plasmas HIROSHI AKATSUKA, HIROKAZU KAWANO, KOICHI NAOI, HAO TAN, ATSUSHI NEZU, HARUAKI MATSUURA, Tokyo Institute of Technology — For a microwave discharge nitrogen plasma with its discharge pressure about 1 Torr, our OES measurement showed that the rotational temperature of N_2^+ B state by the first negative system (1NS) is about 1.5 times higher than that of N_2 C state by the second positive system (2PS). Meanwhile, it is found that the rotational temperature of O_2^+ b state by 1NS is almost the same as that of O_2 b state by the atmospheric absorption band, which is quite different from N_2 plasma. We consider that the rotational temperature of the ground state O_2^+ X ion should be higher than that of O_2^+ b state due to difference in the internuclear distance, where that of the O_2^+ b state is much larger than that of the ground state O_2^+ X. The angular momentum of both X and b states are almost conserved before and after the electron impact excitation due to small mass of an electron. Therefore, the rotational temperature of the X state of O_2^+ ion should be estimated to be about 1.3 times of that of O_2^+ b state. This value gives a similar result with that of nitrogen plasma, where the internuclear distances of B and X states of N_2^+ are almost the same. It is considered that the ground-state molecular ion has higher rotational temperature than neutral molecule.

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