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Plasma Decay in Oxygen-Containing Mixtures Excited by High-Voltage Nanosecond Discharge EUGENY ANOKHIN, MAKSIM POPOV, Moscow Institute of Physics and Technology, IGOR KOCHETOV, TRINITI, ANDREY STARIKOVSKIY, Princeton University, NIKOLAY ALEKSANDROV, Moscow Institute of Physics and Technology — Atoms and radicals produced in the discharge plasma possess excessive translational energy (a few electron-volts) The results of experimental and numerical study of the high-voltage nanosecond discharge afterglow in CO_2:O_2 and Ar:O_2 mixtures are presented for room gas temperature and a pressure of 10 Torr. Electron density during the plasma decay was measured with a microwave interferometer for initial electron densities in the range between 10^{12} and 10^{13} cm^{-3}. Plasma properties in the discharge afterglow were numerically simulated by solving the balance equations for charged particles and electron temperature. Calculations showed that the dominant positive ion species was O_2^+ and that the loss of electrons was controlled by dissociative and three-body recombination with these ions. An agreement between the measured and calculated values of electron density during plasma decay in air and pure oxygen was reached only under the assumption that the rate of three-body electron recombination with O_2^+ ions is much higher than the rate of thoroughly studied three-body recombination for atomic ions. Based on the analysis of the experimental data, the rate of three-body recombination with O_2^+ ions was extracted for thermal electrons and for electron temperatures up to 6000 K.

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