Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Electron detachment from O_2^- ions in oxygen and air in a strong electric field ALEXANDR PONOMAREV, SSC Keldysh Research Centre, Moscow, Russia, NICKOLAY ALEKSANDROV, Moscow Institute of Physics and Technology, Dolgoprudny, 141700, Russia — Electron detachment from O_2^- ions have been theoretically studied in oxygen and O_2-N_2 mixtures when the ions are heated in a strong external electric field. Properties of the ions were studied by a Monte Carlo simulation technique. Collisional cross sections for ion-molecule scattering was calculated on the basis of the statistical approach for the vibrational transfer and relaxation in collisions between O_2^- ions and O_2 molecules. To validate the statistical approach used, we calculated ion mobility and diffusion coefficients under conditions under which experiments are available and obtained good agreement with measurements in pure oxygen. The detachment rate was determined under the assumption that electron detachment proceeds via the formation of vibrationally excited temporary O_2^- ions. The obtained detachment rate constants turned out to agree well with available measurements in oxygen. This method was extended to calculate detachment rates in air and other O_2:N_2 mixtures. It was shown that, for a given value of the reduced electric field, the detachment rate coefficient increases with decreasing mole fraction of oxygen in mixtures. In particular, the detachment rate in air is much higher than that in oxygen. The reason is that the effect of resonant charge transfer in collisions between O_2^- and O_2 is less profound in the mixtures with lower fraction of oxygen; as a result, the average ion energy is higher.

Nickolay Aleksandrov
Moscow Institute of Physics and Technology, Dolgoprudny, 141700, Russia

Date submitted: 08 Jun 2014 Electronic form version 1.4