The kinetics of energetic O\(^-\) ions in oxygen discharge plasmas\(^1\)
ALEXANDER PONOMAREV, SSC Keldysh Research Center, NIKOLAY ALEK-
SANDROV, Moscow Institute of Physics and Technology, SSC KELDYSH RE-
SEARCH CENTER TEAM, MOSCOW INSTITUTE OF PHYSICS AND TECH-
NOLOGY TEAM — Monte Carlo simulation was used to study the translational
relaxation of energetic O\(^-\) ions formed due to dissociative electron attachment to
O\(_2\) molecules in oxygen and oxygen-containing mixtures in a strong electric field.
Initial O\(^-\) ions have rather high energies and are more reactive then the ions reaching
equilibrium with electric field. Therefore, there is a noticeable probability that
electron detachment from the energetic O\(^-\) ions or their charge transfer to form O\(_2^-\) ions proceed prior to energy degradation of these ions. The probabilities of electron
detachment and charge transfer were calculated as a function of the reduced electric
field in oxygen and some oxygen-containing mixtures. Comparison with available
information about the electron detachment and charge transfer rate coefficients for
O\(^-\) ions shows that the effect of high reactivity of the initial energetic ions can lead
to orders of magnitude increase in the effective rates of these reactions and should be
considered in numerical simulation of the properties of discharge plasmas in oxygen
and oxygen-containing mixtures.

\(^1\)This work was partially supported by the Russian Foundation of Basic Research
under the project No. 16-32-00196.

Nikolay Aleksandrov
Moscow Institute of Physics and Technology

Date submitted: 03 Jun 2016

Electronic form version 1.4