



Iranian Journal of Physics Research, Vol. 26, No. 2, 2026
DOI: 10.47176/ijpr.26.2.92187

Numerical Investigation of the Physical and Chemical Properties of Dielectric Barrier Discharge in a Low-Pressure Argon–Oxygen Mixture

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(Received 07 September 2025 ; in final form 07 April 2026)

Abstract

Given the increasing development of plasma technology and its wide range of applications in various research and industrial fields, investigating the physical and chemical properties of plasmas produced under different gas compositions is of particular importance. In this study, we evaluate the physical and chemical properties of an argon–oxygen gas mixture by simulating a dielectric barrier discharge at a pressure of 400 Pa under a sinusoidal voltage with an amplitude of 350 V and a frequency of 7 kHz. Argon was considered as the base gas, and oxygen was added at five different concentrations of 1%, 5%, 10%, 20%, and 50%. The simulations were performed using the commercial software COMSOL Multiphysics, and parameters such as the voltage–current characteristic, density distributions of different species, and electron temperature distribution were investigated. The aim of this study is to investigate the temporal evolution of the kinetic properties and densities of various generated species, such as ozone and atomic oxygen, which play an important role in sterilization processes, and to determine their optimal values for improving the efficiency of the system.

Keywords: Dielectric Barrier Discharge, Comsol Simulation, Argon-Oxygen mixture, Physical and chemical properties, Low pressure Discharge.

For full article, refer to the Persian section