DEVELOPMENT OF SELF-CONSISTENT COLLISION-RADIATION MODEL OF CARBON DIOXIDE MOLECULE DISSOCIATION IN LOW-TEMPERATURE PLASMA AT ATMOSPHERIC PRESSURE [[1]](#footnote-1)\*)

Shakhatov V.A.

A.V. Topchiev Institute of Petrochemical Synthesis of Russian Academy of Science, Moscow, Russia, shakhatov@ips.ac.ru

Currently, there is an increased interest in creating plasma-chemical reactors that use low – temperature plasma of various atmospheric pressure gas discharges (barrier, microwave, and high-frequency discharges, DC glow discharge, etc.) for the utilization of carbon dioxide CO2.

Important step in creating and optimizing the operation of plasma-chemical reactors is the development of self-consistent collision-radiation (high-dimensional) models of multicomponent low-temperature plasma in pure CO2 and in gas mixtures containing CO2.

This work is devoted to the development of consistent mathematical and physical models of low-temperature plasma in pure CO2. The mathematical model includes: component composition (models of chemical compounds with corresponding quantum states), physical and chemical processes (with databases of cross sections, velocity constants, transfer coefficients, etc.), equations (electrodynamics, radiation transfer processes, gas medium components, and thermal conductivity), and methods for self-consistent solution of equations. The physical model of a multicomponent low-temperature plasma is based on assumptions under which the equations and methods for solving them are valid. The main attention is paid to the analysis of poorly studied physical and chemical processes that cause dissociation of carbon dioxide under non-equilibrium conditions.

It is established that in the low-temperature atmospheric pressure plasma elastic collision and inelastic collisions of the first and second kind between electrons and excited molecules of CO2 cause a complicated dependence of the relaxation of stored energy in the translational degrees of freedom of the electrons:

on parameters of gas discharge (electric field intensity E, the concentration of plasma gas, pressure, and translational temperature of gas), component composition and concentrations of heavy particle vibrational - and electron - excited states;

on residence time of the excited particles in gas discharge and its afterglow;

on completeness and granularity (the quantum states of the heavy particles) kinetic scheme describing the elastic collision and inelastic collisions of the first and second kind of electrons with heavy particles;

on absolute values of the cross sections corresponding to elastic and inelastic collisions of electrons with heavy particles.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Lt/ru/EX-Shakhatov.docx) [↑](#footnote-ref-1)