STUDY by THE METHOD OF EMISSION SPECTROSCOPY OF THE INTERACTION high-speed AIR FLOW WITH VOLUME-CENTERED DISCHARGE at INJECTION OF PROPANE WITH THE ADDITION OF OXYGEN IN THE BASE AREA

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Actuality of the research is defined by the demand for new sources of low-temperature plasma in plasma-chemical technologies for conversion of associated petroleum gas and the deepening of oil refining, for ignition and stabilization of ignition of the fuel-air mixture in high-speed flows. One of the necessary stages of development and optimization of the technologies it is investigation of introducing reagents and catalytic additives in the discharge area and output products of plasma chemical reactions from the discharge zone depending on mechanisms of chemical transformations of organic compounds in discharges. Of particular importance it is the development of spectral methods not disturbing quantitative diagnostics of plasma by the criterion of cost-effectiveness. This paper is dedicated to the development of spectral methods of diagnostics translational gas temperature and nonequilibrium energy distribution of the internal degrees of freedom of molecules and atoms and their use for diagnosing volume-centered DC discharge in high speed air flow [1]. The discharge is initiated in the working chamber of the wind tunnel (current to 10 A, voltage up to 10 kV) when the injection of propane (C3H8) and propane with a small addition of oxygen (C3H8/O2) into area between the electrodes (anode and cathode), formed by the interaction of the electrodes with high-speed air flow (at M=2 and static pressure of 120-200 tor and a temperature of 160 K). For measurements of intensity in the spectrum of the emission from different parts of the discharge it is applied spectrometer HR4000CG-UV-NIR (195.63 – 1123 nm) with a spectral resolution (0.6 nm) with reverse dispersion (18.2 nm/mm). In the experiments, it is recorded the emission spectrum with the unresolved electron-vibrational-rotational structure with complete or partial resolution of the atomic lines and molecular bands. In the emission spectrum of the discharge the molecular bands of the Swan system C2(d3Пu-a3Пg), of the Violet system CN(B2Σ+→X2Σ+), of NH(A3П→X3Σ-), of ОH(A2Σ+→X2П) and lines of Hα(λ=656.28 nm), Hβ(λ=486.13 nm), Hγ(λ=434.05 nm) atoms of the Balmer series and of OI (λ = 777.194, 777.4166, 777.539 nm and 844.625, 844.636, 844.676 nm) atoms are dominated. For processing the emission spectra of discharge the methods of unresolved and partially resolved rotational vibrational structure [2] are developed. The translational gas temperature and nonequilibrium distribution of the energy of the internal degrees of freedom of particles (molecules and atoms) are determined from a comparison of the measured and calculated spectra emitted by the discharge.

References

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