**ANALYSIS OF THE APPLICABILITY OF SPECTROSCOPY DIAGNOSTICS OF DC GLOW DISCHARGES TO STUDIES THE TRIPLET STATES OF MOLECULAR HYDROGEN**

Shakhatov V.A. and Lebedev Yu.A.

Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences, Moscow, Russia, [shakhatov@ips.ac.ru](mailto:shakhatov@ips.ac.ru), [lebedev@ips.ac.ru](mailto:lebedev@ips.ac.ru)

In the framework of the semiempirical level-to-level collisionally-radiative model of the hydrogen low temperature plasma, developed in this work, it is carried out analysis of the applicability of spectroscopy diagnostics by triplet radiative states  (= , , , , , , ,  и ) of hydrogen molecules in the positive column of a DC glow discharge in the range of variations of the reduced electric field 30 – 130 Td, pressure 0.3–15 Torr and electron concentration 4.0 × 109–6.5×1010 cm–3.

Secondary processes give the largest contribution to the birth and death of the , , ,  and  states in the investigated range of variation ,  and . The composition, number and hierarchy of processes that determine the balance of the concentrations of the hydrogen molecules in the , , ,  and  states depend on ,  and . The smallest contribution of the secondary processes is given in the birth and death of the , , ,  and  states. The dependence of composition, number and hierarchy of processes, determining the birth and death of the ,  and  states, on parameters ,  and  is weak. The dipole allowed transitions ,  and  can be used for spectral diagnostics of the positive column of a DC glow discharge. For the  and  states, this conclusion is fair in a limited range of variation ,  and : the dipole transitions  can be used for spectral measurements at  = 65 - 130 Td,  = 0.3–0.9 Torr and 4.2 × 109–1.2 × 1010 см–3; the system Fulcher  can be used for spectroscopy diagnostics of the discharges at  = 0.3–2.5 Tor,  = 60 - 130 Td and 4.0 × 109–6.5 × 1010 cm-3.

The mechanism of the birth and death of hydrogen molecules in the triplet states  is determined by the bulk collisional – radiative processes. For the metastable state  of the hydrogen molecule it is necessary additionally to take into consideration the processes of collisional deactivation on the reactor walls. The electronic relaxation time of the populations of the triplet states  and their mechanisms of birth and death differ from one state to another. The composition, number and hierarchy of the processes governing the birth and death of the triplet states  depend on the time residence of hydrogen molecules in the discharge area.

This work was supported by the Russian Foundation for Basic Research, project nos. 15-08-00070.