OPTICAL SPECTROSCOPY OF NEGATIVE IONS BASED ON LASER ASSISTED ELECTRON ATTACHMENT

E. B. GORDON, and O. S. RZHEVSKY, *Institute for Energy Problems of Chemical Physics (branch), 142432 Chernogolovka, Moscow Region, Russian Federation*.

Along with known processes of atoms and molecules photoassociation, another process of photoassociative electron attachment, $A + e + h\nu \rightarrow A^{-**} \rightarrow A + e$, must exist for any particle, including those without positive electron affinity; its rate constant providing laser light flux of $I \sim 10^8\ W/cm^2$ is estimated by us to amount to $10^{-13} cm^3 s^{-1}$. The corresponding spectrum lies at energies of $10..15$ eV and contains quantum state and structure information scarcely attainable theoretically.

The feasibility of developing universal technique for obtaining the short-lived negative ion spectra is discussed. It is based on the following considerations:

– since the energy of an ion state is a sum of those of a photon and an impact electron, the KrF excimer laser ($h\nu = 5\ eV$) can be used, whereas the tuning is implemented by the electron beam energy variation in the range of $\varepsilon = 5..10\ eV$;
– since the energy of a secondary electron arising after a negative ion decay exceeds that of an impact electron by the value of $h\nu$, secondary electrons could be separated easily by the methods of electron optics;
– moreover, in a number of cases the spatial distribution of secondary electron velocities correlates with the laser light polarization;
– impact electrons having the energy of several eV can penetrate into the high electron density regions of target atoms and molecules , so that the probability of photoassociative electron attachment seems to be considerable even in the case of species with negative electron affinity.