Abstract

The presented thesis is focused on a spectroscopic study of unstable radicals, ions and molecules in a positive column glow discharge and laser plasma. The research of these fragments is supplemented by a study of biomolecules formation from these species and influence of catalysts.

Molecular dynamics of radicals, ions and unstable molecules has been studied using a time resolved Fourier transform infrared spectroscopy. Time resolved spectra of CH_4, $HCONH_2$, BrCN, CH_3CN, CF_3Br, $(CF3)_2CHBr$ positive column glow discharges have been measured and simulated using a kinetic model including molecular dynamics, collisions and chemical and radiation transfer processes. The model has been compared with our experimental results and time resolved spectra were described in details. Fit to a complex reaction mechanism has been used to estimate a rate constant of a HCN conversion to HNC by a collision with H radical.

The study of *precursors of biomolecules* was focused on chemical consequences of a laser induced dielectric breakdown in formamide vapor and gaseous carbon monooxide with ^{18}O labeled water. Dissociation products have been detected using the Fourier transform absorption spectroscopy. The experimental results have been explained by a help of a chemical laser spark dynamics model. Additionally, our the most recent unpublished results suggest formation of nucleic bases in samples of high power laser irradiated formamide ices. Since the isotopic labeled water and catalytic $Ti^{16}O_2$ and $Ti^{18}O_2$ were used, an isotopic exchange between CO_2 and $Ti^{18}O_2$ has been studied using the high resolution Fourier transform spectrometry. This metal oxide is an important catalyst and the isotopic exchange effect suggests that oxygen can be released from the crystal surface, however, these active centers can be blocked by water or HCOOH. Additionally, after an irradiation, formation of methane and acetylene from carbon monoxide and decomposition of HCOOH photocatalyzed by TiO_2 has been observed.