The thesis is devoted to the optical spectroscopy (photoluminescence, transmission, ultrafast photoluminescence) of nanocrystalline diamond films and silver nanoparticles in titanium dioxide matrix. We studied the influence of the laser irradiation on optical properties of both materials under various conditions.

Nanocrystalline diamond exhibits strong subpicosecond and picosecond photoluminescence parameters of which (intensity and decay rate) change with the laser irradiation and ambient air pressure. The effects are accompanied by a change in optical thicknesses of the nanocrystalline diamond films. We assigned the phenomena to light induced adsorption processes which influence the subgap states originating from surface and grainboundaries atoms.

We implemented and optimized the preparation technique of the nanocomposite Ag-TiO2films exhibiting the multicolour photochromic effect. The analysis of the initial stages of the photochromic transformation revealed that during the laser irradiation the plasmon frequency of the resonating silver nanoparticles was blue shifted. The photoluminescence spectroscopy confirmed an increase in number of the Ag+ ions during the photochromic transformation. The photoluminescnece of the nanocrystalline TiO2 is due to the two types of radiative transitions: the recombination of the self trapped excitons and the transitions related to the surface states. The ratio between the two photoluminescence contributions can be changed by the excitation wavelength, temperature of samples annealing and the ambient air pressure.