

SUMMARY

The subject of research of the presented doctoral thesis was to obtain complexes of lanthanides with N- donor ligand, both organic (1,10-phenanthroline or 2,2'-bipyridine) and inorganic (isothiocyanate anion). The main aim of the dissertation was to develop a method of synthesizing lanthanide complexes with selected N-donor ligands and to study their physicochemical and photophysical properties. For this purpose, a number of basic tests were carried out, which allowed to determine the optical properties of the obtained complexes and indicated the influence of the position of the rare earth element in the series of these ions on the coordination bond of the lanthanide-ligand.

The developed methods of synthesis and the development of crystals made it possible to obtain fourteen complexes in the form of single crystals. The crystal structure of complexes was determined by an X-ray diffraction analysis and X-ray powder diffraction patterns. Moreover, in order to complete the structural studies, the obtained complexes were characterized by elemental analyses, IR absorption spectra and Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). In order to describe the optical properties of the obtained compounds, the electronic absorption spectra, the luminescence and excitation spectra were performed at room and low temperature (liquid nitrogen and helium). Spectroscopic investigations of the crystals at room and low temperatures were performed in order to understand the nature of Ln^{3+} -ligand interactions. The variation of spectroscopic parameters of the title compounds (e.g. Sinha's parameter δ , β parameter or "red shift") and their correlation with the nature of Ln^{3+} -N or Ln^{3+} -O bonds were discussed.

The most important achievement of the presented doctoral dissertation is the study of the influence of the organic N-donor ligand on the structural and optical properties of the obtained lanthanide complexes. The analysis of absorption spectra and the values of semi-empirical Judd-Ofelt parameters (τ_λ) allows to conclude that the complexes in which 2,2'-bipyridyl was used as the organic N-donor ligand show lower symmetry of the immediate surroundings of lanthanide ions in relation to the complexes with 1,10-phenanthroline. Hypothetically, it may be caused by the steric effect of the rigid 1,10-phenanthroline molecule compared to the flexible 2,2-bipyridyl. Moreover, based on the analysis of the luminescence lifetimes measured at room and low temperatures, it can be concluded that the energy transfer from the organic ligand to the metal center is more effective in complexes with 2,2-bipyridyl than with 1,10-phenanthroline.