

Study of extraction system "N,O-donor heterocyclic amide/europium nitrate" by EXAFS and ¹H-NMR spectroscopy.

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One of the major problems of nuclear energy is long-term nuclear waste reprocessing and storage. Current technologies are able to partially regenerate nuclear fuel but lead to the accumulation of long-living high-level nuclear waste (HLW). Reducing nuclear waste levels requires the effective and selective separation of minor actinides from HLW possessing high content of lanthanides.

Recently we study derivatives of diamides of 2,2'-bipyridyl-6,6'-dicarboxylic acid, such as bipy-4Hex as an extraction material. For deeper understanding of extraction process we study the structure of the europium complex of this ligand in crystal and solution, as well as an extraction system with a ligand and europium nitrate.

In order to establish the atomic environment of europium we used the experimental EXAFS technique. The absorption spectra of X-ray radiation for crystalline compounds and solutions of europium complexes with nitric acid were measured. Experimental data on X-ray spectroscopy were obtained at the STM station of the Kurchatov Synchrotron Radiation Center. The detection was carried out in the "transmission" mode and by the output of fluorescent radiation. A visual comparison of the XANES spectra confirms the preservation of the degree of oxidation of Eu both in solution and in the crystalline state. Comparison of the Fourier transformed spectra of EXAFS shows the identity of the coordination spheres near Eu ion. In order to clarify the atomic geometry, the EXAFS spectra were adjusted.

In addition, we used ¹H-NMR spectroscopy to study extraction systems: the ligand solutions in nitrobenzene-d₅ and an aqueous solution of europium nitrate with different concentrations of nitric acid were mixed and the spectrum was obtained from the organic layer. At concentrations of nitric acid 1M and lower only ligand peaks were observed in the spectrum, at higher concentrations of nitric acid, peaks of the complex appeared. For such systems, we calculated the complex-ligand concentration ratio from the spectra and distribution coefficients.

The speaker is a student or young scientist

No

Section

1. Synchrotron and neutron radiation sources and their use in scientific and applied fields

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