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Albina I Orlova

University of Nizhni Novgorod, Russia

Preparation of ceramic materials with mineral-like structures by mean of SPS technology for the purpose of radwaste consolidation and radiation and hydrolytic investigations

The transition from vitrified forms of radioactive waste to ceramic characterizes vector of development of promising ways of handling radwaste of nuclear technologies. Special attention should be paid to compounds with structures of natural minerals ("natural experience). To implement the basic concept composition - structure - synthesis method - property, In the present work we selected compounds of the structural families: Pollucite, Monazite, Kosnarite (NZP), Langbeinite - Oxides, Phosphates, Tungstates, and method of ceramic synthesis - SPS Technology, the most important studied properties - behavior in water systems and radiation fields. The compounds containing Cs, Sr, REE, isotopes of which are nuclear fission products, and the latter also Actinide analogs were researched: 0.75ZrO2+0.25SmO1.5, 0.75ZrO2+0.25YbO1.5, fluorite type; CsAlSi2O6, Cs0.875Ba0.125[Li0.125Zn0.875Al0.5P1.5O6] pollucite type;, NdPO4, Y0.95Gd0.05PO4, Monazite/Ksenotime types; CsMgPO4, CsZn-PO4, tridymite type; Ca0.25Sr0.25[Zr2(PO4)3], Sr0.5[Zr2(PO4)3], Kosnarite type, (NZP); K1.4Cs0.3Sm0.3[Mg0.8Zr1.2(PO4)3], Cs2Mg2(WO4)3, Langbeinite type; Synroc. In the first stage, the compounds were obtained in the form of powders by sol-gel method, in the next step thepowders were sintered by the Spark Plasma Sintering method ((DR.SINTER model SPS-625, "SPS SYNTEX INC"). The sintering regimes T and t achieved for the powders of the named compounds were: 620-1360 °C, 0.5-7, 0 min The relative densities achieved 96.4-99.9%.. Hydrolytic tests were carried out in static and dynamic conditions at T 25 and 90 °C. Leaching rates at 28 day had values 5·10-4-1·10^{-7} г/(см^2··сут). Radiation studies of ceramics were performed on cyclotron IC-100 ((Dubna) under accelerated ions 132Xe+26 (E=167 KeV), fluencies 1·1012-3·1013 ion/sm^2. Values of critical fluence were 8·1011-1·1014 ion/sm^2, respectively. The transition of metamictic forms to crystalline ones took place under heating to T=200 °C during 3 hours. Maximum intensity of reflections from X-ray diffraction data was observed after the stepwise heating (step 100°C) up to T=500°C (3 hours on each stage).

Biography

Albina Orlova is Professor, doctor science, works in the field of new inorganic materials for applications in nuclear chemistry for radwaste immobilization of dangerous isotopes, for actinide transmutation, also for construction materials for various technologies (optic, medicine). She uses the structure properties and physicochemical principles for elaboration of new ceramics with many various mineral-like crystal forms. She is a Member of the Editorial Board of the journal *Radiochemistry*, Member of Interdepartmental Council on *Radiochemistry* under the Presidium of the RAS and State Corporation ROSATOM, Member of the IAEA group of consultants on elaboration of IAEA handbook processing of high level waste and spent nuclear fuel declared as waste. She has more than 300 publications: papers, presentations at conferences, patents.

albina.orlova@inbox.ru

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