Contribution ID: **326** Type: **Poster**

Comparative study of the thermal, hydrolytic, radiation stability and mechanical properties of Cs, Ba, Sr, and Ln-containing ceramic materials for radiochemical problems and applications.

Tuesday, 13 May 2014 17:15 (1h 30m)

Knowledge of the behavior of materials in radiation fields need if ones are elaborated for radwaste immobilization. Also it is important to prepare a ceramic with high density for aims: medical, research and material science problems, consolidation and transformation of radwaste. Among these materials deserve special attention mineral-like. Natural "experience" shows the ability to save (stability) of mineral-like materials under the influence of heat, pressure, hydrolytic solubility, radiation fields in a long time.
Used for a long time methods for the synthesis of ceramics (cold pressing with following hightemp firing; multistage hot pressing) have several disadvantages: prolonged exposure to high temperature, low relative density of the resulting product, multi-stage processes, high energy and time costs. This work focuses on the development and multitasks application of new methods for the synthesis of high-density ceramics (Spark Plasma Sintering), reducing temperature, duration of the process and the number of steps on the example of monophase polycrystalline compounds.
The objects of research were following compounds: Ca0.25Sr0.25[Zr2(PO4)3] (NZP-type); CsBa(Sr)[Fe2(PO4)3], Cs2[Mg2(WO4)3] (langbeinite type); NdPO4 (monazite type); Y(1-x)GdxPO4 (x=0, 0.05, 0.25; xenotime type); Cs0.875Ba0.125Li0.125Zn0.875Al0.5P1.5O6 (pollucite type). This chemical compositions were choose as stable mineral-like matrixes, containing Cs, Ba, Sr, Ln jointly or separately.
At the first stage we obtained the samples of composition as powders by using the sol-gel process. Step by step the gel formed and then powders were heated, dispersed and examined by X-Ray analysis. Then ceramics on the base of compounds named were sintered by Spark Plasma Sintering (SPS) method.
Obtained powders and ceramic pellets were tested for thermal stability up to 1350 ℃, hydrolytic stability in distillated water (20 and 90-100 °C (Soxhlet extractor, 7-28 days). Prepared cylindrical tablets (d=10, 20 mm) were irradiated with accelerated Xe-ions (E=167 MeV) stream at 6•1010 - 1•1013 fluences (1/sm2). The experiments were carried out at room temperature on the IC-100 FLNR JINR (Joined Institute of Nuclear Research) cyclotron.
All compositions were stable after heating up to 1100 ℃. High relative density was reached for all compounds by using SPS method for 0-5 min: 99,6-99,9 % (NZP); 96,2-99,9 % (langbeinite); 98,3 % (monazite); 98,8-99,9 % (xenotime); 99,9 % (pollucite). Ceramic materials with NZP and pollucite-like structure were stable after radiation till 1•1013 fluences (1/sm2) [1, 2].

1. A.I. Orlova, V.Yu. Volgutov, D.A. Mikhailov et al. // J. Nuc. Mat., 2014, vol. 446. P. 232 –239.
2. A.I. Orlova, A.N. Troshin, D.A. Mikhailov et al. // Radiochemistry, 2014, Vol. 56, No. 1, pp. 98–104.

Primary author: Mr MIKHAILOV, Dmitriy (Nizhny Novgorod State University)

Co-authors: Prof. ORLOVA, Albina (Nizhny Novgorod State University); Mr NOKHRIN, Alexey (Nizhny Novgorod State University); Mr BOLDIN, Maksim (Nizhny Novgorod State University); Mr KIRILKIN, Nikita (JINR, Dubna); Mr SAKHAROV, Nikita (Nizhny Novgorod State University); Mr BELKIN, Oleg (Nizhny Novgorod State

University); Mr VOLGUTOV, Valeriy (Nizhny Novgorod State University); Dr CHUVIL'DIEV, Vladimir (Nizhny Novgorod State University); Dr SKURATOV, Vladimir (JINR, Dubna)

Presenter: Mr MIKHAILOV, Dmitriy (Nizhny Novgorod State University)

Session Classification: Poster Session - Radionuclides in the Environment, Radioecology

Track Classification: Radionuclides in the Environment, Radioecology