Contribution ID: **68** Type: **Poster**

New data on production of element 115 isotopes in the reaction (Am-243)+(Ca-48)

Tuesday, September 6, 2011 4:45 PM (20 minutes)

Within the framework of the program of synthesis and study of the properties of the new elements a series of experiments were performed to produce the elements with odd atomic numbers 115 and 117 using of the Dubna gas-filled recoil separator.
First run was undertaken in 2003. In the reaction of the actinide target Am-243 and Ca-48 beam the two new elements with Z = 113 and 115 were produced for the first time. Three similar decay chains corresponding to the 3n-evaporation channel were observed. Each of them consists of five consecutive alpha decays and is terminated by spontaneous fission (SF) with a high energy release. A single differing shorter-lived decay chain of sequential alpha decays and terminated also by high-energy spontaneous fission corresponding to the 4n-evaporation channel was registered. The decay properties of the eleven new alpha- and SF-decaying nuclei observed in this experiment are consistent with expectations for consecutive decays originating from the parent isotopes 115-288 and 115-287.
Support for the assignment of the atomic numbers of all of the nuclei in the 115-288 decay chain was obtained in independent experiments performed in 2004 and 2005 in which a long-lived spontaneous fission activity, Db-268, was found to be chemically consistent with the fifth group of the periodic table.
Next bombardment with the purpose of synthesizing a new 117 element was made in 2009. The isotopes 117-293 and 117-294 were produced in fusion reactions between Ca-48 and Bk-249. Decay chains involving 11 new nuclei were identified.
The initially produced in these reactions isotopes of the elements 115 and 117 undergo alpha decay and are progenitors of genetically linked descendant alpha-decay products chains terminated by spontaneously fissioning isotopes of Db and Rg. Thus, 22 new isotopes were observed in these reactions. All of them can be grouped and characterized by four different (N-Z) values of 57, 58, 59 and 60. In the reaction Am-243 with Ca-48 two group decay chains were observed with (N-Z) equal to 57 and 58 that correspond to the 4n- and 3n-evaporation channels respectively. Other two decay chains with (N-Z) = 59 and 60 were observed in the reaction Bk-249 and Ca-48; these correspond to the 4n- and 3n-evaporation channels. Thus no overlapping chains and no coinciding nuclides were registered in these different reactions.
New set of experiments aimed at the synthesis and investigation of decay properties of the element 115 isotopes and their descendant alpha-decay products were performed in the period from October of 2010 up to and including March of 2011. The numbers of decay chains of the 3n-evaporation product and corresponding to (N-Z) = 58, the isotope 115-288, observed at the three Ca-48 energies (248, 243 and 240 MeV in the center of the target layer) were three, six, and twelve, respectively. Radioactive properties of nuclei in these decay chains originating from 115-288 are in full agreement with the data measured for them in the previous experiment performed in 2003.
In addition to twelve decay chains of parent nucleus 115-288 observed at the lowest projectile energy a decay chain of the 2n-evaporation product, isotope 115-289, was produced for the first time in this reaction. Decay properties of nuclei 115-289 (Ealpha=10.38+/-0.06 MeV, t=0.26 s), 113-285 (Ealpha=9.89+/-0.06 MeV, t=1.4 s), and Rg-281 (tSF=2.0 s) were measured to be in agreement with those previously determined for all these three isotopes in the experiment on the synthesis of element 117 in the reaction (Bk-249) + (Ca-48) = (117-293) + 4n where the isotope 115-289 was observed after alpha decay of the parent nucleus 117-293. Thus, in this experiment two transformation chains with (N-Z) equal 58 and 59 were observed that sews tightly together all previous experiments. The nuclide 115-289 was produced in two cross bombardments that, together with the other assignment criteria accepted by IUPAC, such as radioactive properties, excitation function of the reaction and chemical identification of Db-268, provides an extra proof of discovery of elements 113, 115, and 117.

Primary author: Dr ABDULLIN, Farid (JINR Dubna)

Presenter: Dr ABDULLIN, Farid (JINR Dubna)

Session Classification: Poster Session