**Development of high temperature method for selective production of alpha-emitting radionuclides from the thorium carbide target**

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The use of radionuclides decaying with the emission of alpha particles is a very effective tool for therapy of many kinds of malignant tumors and other diseases at an early stage of their appearance. Alpha-emitters $^{223,224}$Ra, $^{225}$Ac are widely used for medical purposes. We plan the production of these isotopes by irradiating the high-density thorium-carbide target at RIC-80 facility [1]. Tests of production and selective extraction of $^{224}$Ra were carried out at proton beam of the SC-1000 synchrocyclotron. The high-temperature method of the alpha-emitters extraction from the high-density thorium-carbide target has demonstrated high efficiency (~90%) of selective production of $^{212}$Pb and $^{224}$Ra. Alpha-spectrum of $^{224}$Ra, measured at the collector of the mass-separator is presented on Fig. 1. The high-temperature method has a range of advantages as compared to the radiochemical methods: 1) high isotope purity of $^{224}$Ra and other radionuclides; 2) the absence of liquid radioactive waste; 3) the extraction process with no target destruction allows the production of different isotopes from the same target; 4) for $^{224}$Ra production on mass-separator, one can apply the target, used for production of other nuclides and irradiated by protons for a long period (≥10 days). The optimal temperature for selective extraction of $^{224}$Ra on mass-separator was determined. In the target material temperature of 1550 - 1700°C and vacuum of $10^{-5}$ mbar or better, 80% of the radium atoms can be extracted for about 1 hour.

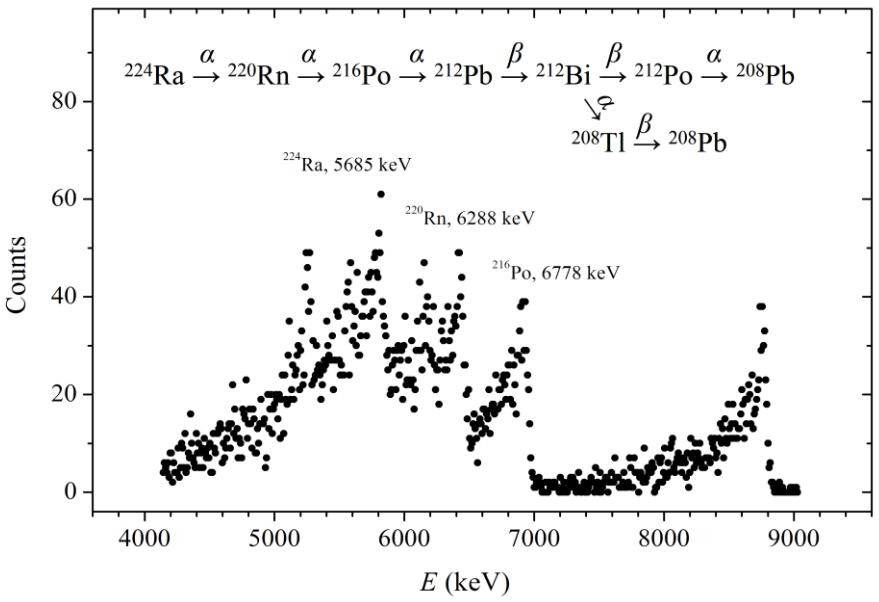


Fig. 1. Alpha-spectrum of $^{224}$Ra, measured at cold collector and target material temperature of about 1500°C.

*[1]. V.N. Panteleev, et al., Development of high temperature and mass-separation methods for selective production of medical radionuclides, INTERNATIONAL CONFERENCE ON RADIATION APPLICATIONS (RAP 2019) 16–19.09.2019 | 88 ROOMS HOTEL | BELGRADE | SERBIA | www.rap-conference.org*