Contribution ID: **171** Type: **Verbal**

Generation and isolation of the positron emitter titanium-45

Friday, 16 May 2014 08:30 (15 minutes)

Objectives: A very promising but so far rather less regarded non-standard PET-nuclide is titanium-45. Its low maximum positron energy in combination with the very weak γ-rays and its relatively long half-life of 184.8 min makes it especially suitable for investigations of slow (patho-)physiological processes. The radionuclide is accessible in high yields via the Sc-45(p,n)Ti-45 reaction and thus expands the scope of labelling possibilities. On the basis of recently specified γ- and positron-intensities of titanium-45 new cross section measurements for this reaction have been performed to further strengthen the data in the lower energy range which is especially relevant for the production of Ti-45. Further, a highly efficient separation of the n.c.a. product from bulk scandium is mandatory for medical application and therefore an improved procedure using the extraction-chromatographic resin DGA-normal was developed.

Methods: For the investigation of the Sc-nat(p,n)Ti-45 reaction pure scandium oxide was sedimented on foils of aluminium. These sediments were covered with thin aluminium foils and irradiated using the stacked-foil technique. Foils of aluminium were also used as energy degraders and copper foils as beam monitors. In total three irradiations of 15 minutes each were carried out at the BC 1710 cyclotron of the institute of the INM-5. The applied beam current was 1 μA of protons with incident energy of 17 MeV.
For production of radiotitanium, milled scandium ingots were irradiated with 12 MeV protons. The needed energy degradation was achieved with aluminium foils, whereas thin copper foils were used for beam monitoring. For the radiochemical separation the irradiated target was dissolved in 4 M HCl. Small amounts of this solution were added to pre-conditioned samples of 100 mg of DGA-normal resin at different concentrations of hydrochloric acid. These samples were shaken thoroughly for at least one hour. Resin and solution were separated and aliquots taken to determine the individual distribution coefficients using γ-ray spectrometry. Thus corresponding separation factors of the system (n.c.a.)Ti / (bulk)Sc were calculated.

Results: The excitation function of the Sc-nat(p,n)Ti-45 reaction was revised based on the new radiation intensities showing a cross-section maximum of about 800 mbarn with 10 MeV proton energy. An improved radiochemical isolation of the n.c.a. product from the bulk scandium was successfully elaborated by utilization of the DGA-normal resin, showing a separation factor of more than 2500.

Outlook: The optimized separation procedure developed in this work could be utilized in a semi-automatized HPLC-based isolation of n.c.a. Ti-45, allowing high-yield production of this radionuclide for medical application.

Primary authors: Dr SPAHN, Ingo (Forschungszentrum Jülich); Mr KUHN, Sebastian (Forschungszentrum Jülich)

Co-author: Prof. COENEN, Heinz H. (Forschungszentrum Jülich)

Presenter: Mr WELS, Tobias (Forschungszentrum Jülich)

Session Classification: Production and Application of Radionuclides 2

Track Classification: Production and Application of Radionuclides