Contribution ID: **156** Type: **Poster**

Measurements of γ- and β+-intensities of Ti-45

Wednesday, 19 September 2012 18:00 (1h 50m)

With rising interest in non-standard PET-nuclides also Ti-45 comes into focus. Its low maximum positron energy of 1.04 MeV in combination with the small amount of γ-rays (most intense at 720.22 keV: 0.15%) and its advantageous half-life of 184.8 min makes it a suitable nuclide, especially for studying some longer termed processes. There have been first investigations about its usability as nuclide in positron-emission-tomography studies [1,2]. However, the corresponding emission intensities have to be known very precisely for medical applications in order to minimize the radiation exposure of the patient and to enhance the diagnostic value by correct quantification.
Ti-45 was produced via the Sc-45(p,n)Ti-45 nuclear reaction. Metallic scandium served as target for irradiation at the Baby Cyclotron 1710 of FZ Jülich with protons of 12 MeV incident projectile energy. Copper foils as beam monitors assured the precision of the proton energy and beam current. After dissolving the irradiated target in 4M HCl, radionuclidically pure Ti-45 was isolated in n.c.a. form via ion chromatography, using 100-200 mesh Dowex 50WX8 resin and 4M HCl as eluent. The co-produced Sc-44 was used as indicator for the absence of scandium. Thin samples were prepared and investigated using positron-counting, x-ray spectrometry and γγ-coincidence measurements to determine the absolute positron intensity. The γ-ray intensities were ascertained relatively to the positron emission intensity using HPGe-detector γ-ray spectrometry.
The performed ⊠- and ⊠-coincidence counting resulted in positron emission probabilities of 82.4% and 84.9%, thus supporting the data given in the literature [3]. The γ-ray intensities were found to be smaller than those given earlier, showing deviations of up to 30% [4-6].

In this study reproducible decay data could be obtained which specify and improve the β+- and γ-intensity values reported so far, thus strengthening the reliability of these important data for quantification and corrections of PET-measurements.

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Session Classification: Poster Session

Track Classification: Nuclear Chemistry, Radionuclide Production, High-Power Targetry