Gamma Rays from ^{109m}Pd

T.NAGAHARA, M.HATTORI and K.KITAO*

Institute for Atomic Energy, Rikkyo University

*National Institute of Radiological Sciences

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A number of measurements of the gamma rays from ^{109m}Pd have been reported¹⁻⁶. However, the agreement of their results obtained is rather poor. Kahn¹⁾ obtained the value of 173 ± 10 keV for the energy of the gamma rays, Flammersfeld²⁾ 160 keV, Stribel³⁾ 188 ± 5 keV, Schindewolf⁴⁾ 170 keV, Starner⁵⁾ 188 keV, and Weirauch⁶⁾ 188 keV. In the Nuclear Data Sheets⁷⁾ and the Landolt-Börnstein Table⁸⁾, the value of 180 keV is adopted. The purpose of the present investigation was a more precise determination of the gamma ray energy by a Ge(Li) detector.

We used a homemade Ge(Li) detector having a cross section of $1\text{cm} \times 1.5\text{cm}$ and thickness of 3.5 mm. The resolution was about 4.5 keV at the 122 keV peak of ^{57}Co .

The Pd sources were obtained by 5 min neutron irradiation of 2.7 mg natural Pd metal (99.9%) at the rotary specimen rack (thermal neutron flux $5 \times 10^{11} \text{ n/cm}^2 \cdot \text{sec}$) of the Rikkyo University TRIGA Mark II reactor (max. 100 kW). Separation of each gamma ray peak from irradiated natural Pd became possible as we used the Ge(Li) detector having excellent resolution to the NaI crystal.

The measurements were started 1 min after the end of irradiation. The gamma ray energy spectrum of the first 10 min and an hour later are shown in Fig. 1. For the energy calibration, we used the values of 67.7, 84.7, 100.1, 152.4, 179.4, 198.4 and 222.1 keV of ^{132}Ta , and 122.1 and 136.4 keV of ^{57}Co . From the calibration curve, we obtained the value of 189.1 ± 0.3 keV for the dominant gamma rays of irradiated Pd.

We also measured the decay of this peak, and obtained the half-life of 4.7 ± 0.1 min in agreement with older data¹⁻⁶. From this

Fig. 1 Gamma ray spectrum of the irradiated Pd with a Ge(Li) detector. Curve (a) shows the spectrum obtained 1 min after the end of irradiation. Curve (b) shows the spectrum 60 min later.

value, we confirmed the 189.1 keV gamma rays come from the transition of the ^{109m}Pd to the ground state of ^{109}Pd .

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