Observation of a 2 s Activity from Irradiation of Rhenium with Higher-Energy Deuterons

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Following the irradiation of rhenium with deuterons of 45 to 80MeV a 184 keV γ-line was observed which decayed with a half-life of 2.0 ± 0.2 s. A tentative assignment of this activity to ^{183}Os is derived on the basis of yield ratios.

Using the facilities at the Jülich isochronous cyclotron JULIC work has been done concerning both the properties of neutron-deficient nuclei [1, 2] and the mechanisms of (particle, xnyp) reactions [3] used for the production of these nuclei. The investigations were concentrated on rare-earth nuclei and those of somewhat higher mass. In Reference 1 the first observation of the 0.92 s isomer ^{191m}Au was described. We extended the search for activities with half-lives in the region of seconds to other nuclei. It is the purpose of this note to report shortly on a recent result.

In the present experiment foils of natural platinum, iridium and rhenium with thicknesses of about 20 μm were irradiated for 10 s with deuterons of 45, 60 and 80 MeV. A beam current of 50 nA was used. The irradiations were performed within a scattering chamber, a Ge(Li) detector being located at 90 degrees with respect to the beam axis. The γ-ray spectrum ($100\,\text{keV} \leqq E\gamma \leqq 400\,\text{keV}$) was measured after the irradiations using a multispectrum scaling method [1]. For each combination of target and deuteron energy 20 to 40 runs were added to improve statistics.

The results were as follows. In the case of the platinum target two known gold isomers were produced. The 257 keV line of ^{193m}Au and the 253 keV line of ^{191m}Au were found to decay with half-lives of 3.6 ± 0.4 s and 0.83 ± 0.15 s, respectively. These values are in good agreement with those given in the literature [4]. In the case of the rhenium target a new γ-line of 184 ± 2 keV was observed which decayed with a half-life of 2.0 ± 0.2 s. The measured decay curve of this line is shown in Figure 1. Longer-lived lines of 115, 168 and 382 keV belonging to the decay of ^{183}Os and a 171 keV line which probably represents the isomeric transition from ^{183m}Os were also seen in the spectra. No half-life in the region of seconds was observed in the case of the iridium target.

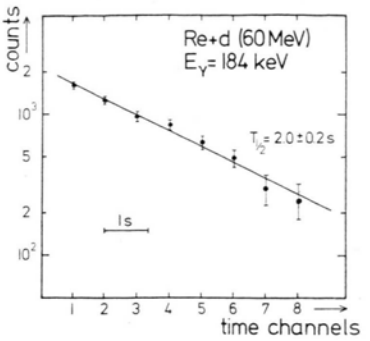

Fig. 1. Decay curve of the 184 keV γ-line.

As a first attempt to obtain an isotopic assignment for the 2 s activity the ratios of the yields for the different bombarding energies were considered. The experimental ratios are

$$\sigma(45) : \sigma(60) : \sigma(80) = (0.50 \pm 0.15) : 1 : (0.42 \pm 0.13).$$

The comparison of this result with excitation functions of (d, xn) and (d, pxn) reactions measured in this mass region [3] leads to the following conclusion: The ratios given above can only be explained by assuming the reactions ^{185}Re (d, 4 n) ^{183}Os and ^{187}Re (d, 6 n) ^{183}Os taking into account the natural abundances of the rhenium isotopes. The ratios derived from the excitation functions [3] of these reactions amount to

$$\sigma(45) : \sigma(60) : \sigma(80) = (0.35 \pm 0.05) : 1 : (0.35 \pm 0.05).$$

It should be emphasized that the assignment of the 2 s activity to ^{183}Os has to be considered as being preliminary as long as the yield argument is the only one available.

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