In-Beam Gamma-Ray Spectroscopy of 95Ru

I. 7 In-Beam Gamma-Ray Spectroscopy of ^{95}Ru

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The nuclear structure of $^{95}_{44}Ru_{51}$ has been investigated in several experiments.[1] The information obtained is, however, still poor; the nuclear spins and parities of its levels are uncertain except for the ground $5/2^+$ state and the 0.779-MeV first-excited $1/2^+$ state[1], and only four in-beam γ-rays from ^{95}Ru have been reported in a study of the ^{92}Mo(α,nγ)^{95}Ru reaction.[2] The present experiment was undertaken with the aims of finding new γ-rays from ^{95}Ru through the ^{94}Mo(α,3nγ)^{95}Ru reaction and studying the nuclear structure of ^{95}Ru.

The experiment was performed with an α-particle beam from the CYRIC cyclotron. The Target used was a self-supporting metallic ^{94}Mo foil of 3 mg/cm^2 thickness isotopically enriched to 93.9 %. Excitation functions of γ-rays and γ-γ coincidences have been measured so far. Higher energy γ-rays were measured with a 90-cm^3 Ge(HP) and a 90-cm^3 Ge(Li) detector, each having an energy resolution of 2.2-2.5 keV (FWHM) for the ^{60}Co 1333-keV line. Lower energy γ-rays were measured with a 5-cm^3 Ge(HP) detector having an energy resolution of 0.6 keV for the ^{57}Co 122-keV line.

Relative yields of γ-rays from the ^{94}Mo(α,3nγ)^{95}Ru reaction were measured at α-particle energies of 30, 35, 40 and 45 MeV, and an optimum α-particle energy of 40 MeV has been obtained to populate the excited states in ^{95}Ru. A singles γ-ray spectrum at E_α = 40 MeV measured with the 90-cm^3 Ge(Li) detector is shown in Fig. 1. The γ-γ coincidence measurements were made with two combinations of detectors, i.e. 90-cm^3 Ge(HP) – 90cm^3 Ge(Li) and 90-cm^3 Ge(Li) – 5-cm^3 Ge(HP). Fig. 2 shows a coincidence spectrum measured with the 90-cm^3 detector gated on the 255-keV γ-ray detected with the 90-cm3 Ge(HP) detector.

From the γ-ray excitation functions and γ-γ coincidence relations, thirteen γ-rays (E_γ = 207, 224, 239, 247, 255, 282, 284, 292, 313, 410, 622, 927 and 1292 keV) were identified as the γ-rays from the ^{94}Mo(α,3nγ)^{95}Ru reaction in addition to the four (E_γ = 255, 678, 941 and 1346 keV) previously reported in the study of the ^{92}Mo(α,nγ)^{95}Ru reaction.[2] The 255 keV line has been confirmed to be a doublet from the evidence of coincidence between two 255 keV γ-rays. Among the thirteen γ-rays, three (E_γ = 410, 622 and 1292 keV) have been observed in a study of the β decay of ^{95}Rh.[3] There is, however, a possibility that the 1292 keV γ-ray observed in the β-decay study comes from the transition different from the one that gives rise to the 1292 keV γ-ray observed in the present experiment, because we have not observed the 229 keV γ-ray which is expected to be detected when the 1292 keV γ-ray following the β decay of ^{95}Rh is detected.

A detailed analysis of the γ-γ coincidence data and angular distribution measurements of the γ-rays are in progress.

References

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2) Lederer C. M., Jaklevic J. M. and Hollander J. M., Nucl. Phys. A169 (1971) 489.
3) Weiffenbach C., Gujrathi S. C. and Lee J. K. P., Can. J. Phys. 53 (1975) 101.

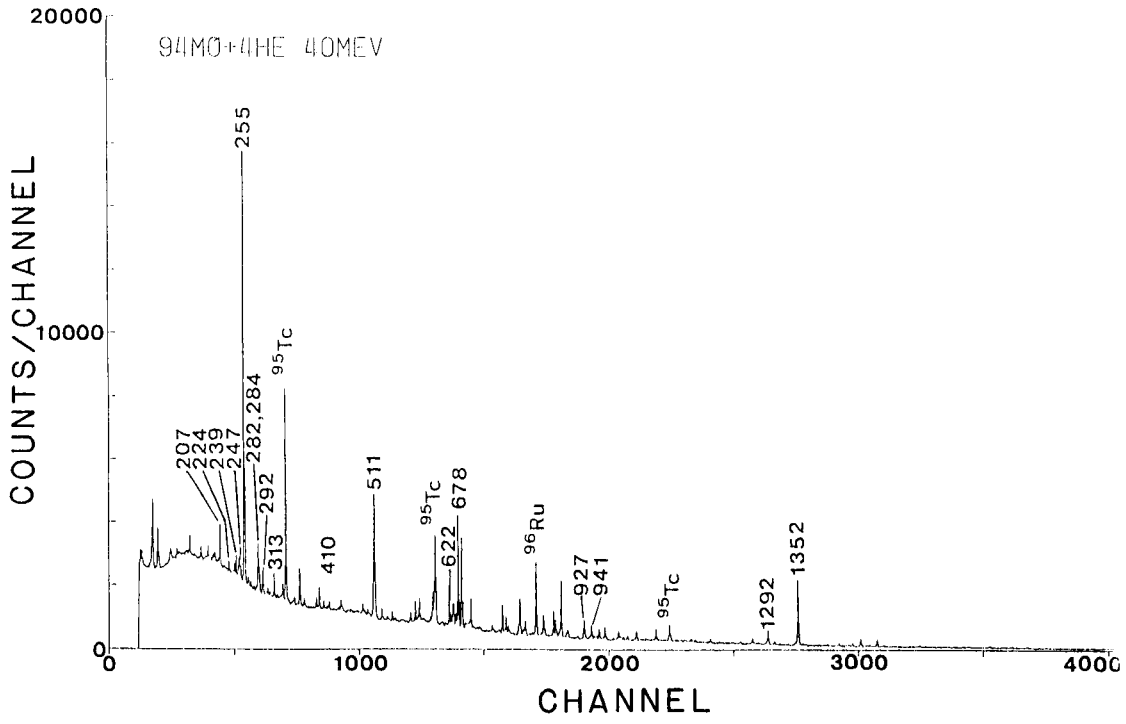

Fig. 1. The singles γ-ray spectrum from the bombardment of ^{94}Mo with 40 MeV α-particles measured with a 90 cm^3 Ge(HP) detector.

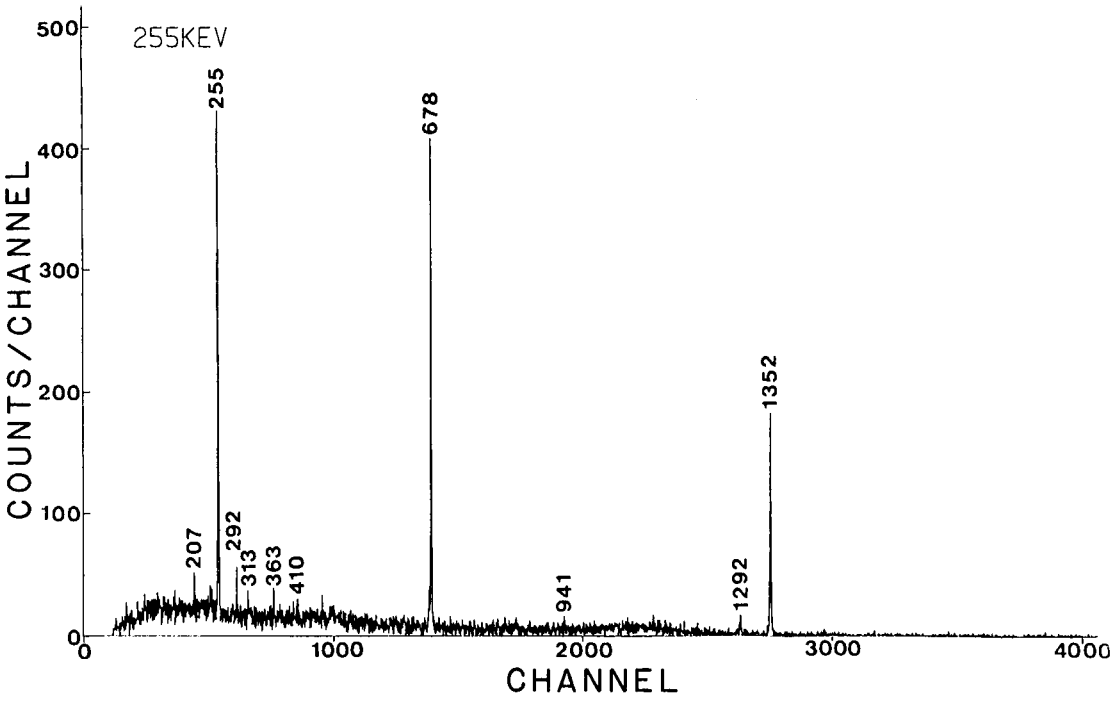

Fig. 2. The γ-γ coincidence spectrum from the $^{94}Mo(\alpha,3n\gamma)^{95}Ru$ reaction measured with a 90 cm^3 Ge(Li) detector. The gate is set on the 255 keV γ-ray measured with a 90 cm^3 Ge(HP) detector.