SPECTROSCOPY OF NEUTRON-RICH ^{96}Y ISOTOPE PRODUCED IN FISSION INDUCED BY COLD NEUTRONS

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The onset of the deformation in neutron-rich nuclei around A = 100 mass region has for many years remained one of the most interesting subjects for nuclear spectroscopy study. For the neutron number N = 60, a sudden onset of the deformation has been observed at the ground state, which is manifested by the presence of rotational bands (e.g. [1]). On the other hand the occurrence of shape coexistence in nuclei with N = 58 and 59, in this region (e.g. [2]), suggests that the evolution of the deformation is a more gradual process. In the yttrium isotopic chain, a rotational band above the 4^-, 496-keV K-isomer has been observed in the N = 59, ^{98}Y nucleus, while there was no evidence of the deformed structure in the Y isotopes with neutron number less than N = 59. Our goal was to investigate N = 57, ^{96}Y isotope where only a few states were known from beta decay study of ^{96}Sr [3] as well as the long 9.6-s (1140-keV) isomer [4].

The yttrium-96 isotope has been produced by fission of both ^{235}U and ^{241}Pu targets induced by cold neutron from the reactor at Institut Laue-Langevin. The level scheme up to excitation energies in excess of 5 MeV has been established based on multi-fold gamma-ray coincidence relationships measured with the EXILL spectrometer [5] which consists of up to 46 HPGe detectors. By exploiting delayed- and cross-coincidence techniques, extensive structure has been delineated. During the analysis, over 50 new gamma transitions which feed previously known low-spin states as well as the long 9.6-s, 8^+ isomer have been identified. Moreover, a new isomeric state at 1655-keV excitation energy has been located with half-life of 175 ns. Angular correlation analysis allows to define spin-parity assignment for most of the identified levels, in particular (7^+) for new isomer. By using the delayed-coincidence method it was possible to identify above the 175-ns state a few weak transitions, which seem to form a rotational band, in analogy to the structure above the 4^- isomer in the ^{98}Y isotope.

The existence of the new isomeric state and the possible deformed band built on that isomer in the N = 57, ^{96}Y isotope shed new light on the study of the onset of deformation in neutron-rich nuclei around N = 60. It shows that the deformed structures appear just after the subshell closure at N = 56 and evolve smoothly when passing through N = 57-59 isotopes, to became a ground state structure in the ^{99}Y isotope, i.e., at N = 60.

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