STUDIES OF DEPENDENCE OF ISOMERIC YIELD RATIOS ON THE GAMMA QUANTA ENERGY IN THE ^{140}Ce(γ,n)^{139m,g}Ce REACTION

Mazur V.M., Symochko D.M., Marinets T.I., Derechkey P.S.
Institute of Electron Physics, Ukrainian National Academy of Sciences, Uzhhorod
E-mail: derecskei89@gmail.com

The ^{140}Ce nucleus under consideration is a magical one having a neutron number N=82 and a completely filled $1h_{11/2}$ shell. Here we present the experimental results of studying the isomeric yield ratios $d=Y_m/Y_g$ in the ^{140}Ce(γ,n)^{139m,g}Ce reaction in the giant dipole resonance region. The experiments were carried out with the bremsstrahlung gamma-beam of the microtron M-30 of IEP, NAS of Ukraine, in the region of 10–18 MeV with a step of ΔE=0.5 MeV. The energy spread of the accelerated electron beam was not worse than 40 keV at the average 5μA current. In the experiments, the activation technique was applied. To study the decay of the isomeric ^{139m}Ce state ($T_{1/2}$=54.8 s) the E=754 keV gamma-line was used, while for the ground ^{139g}Ce state ($T_{1/2}$=137.6 days) – the 165.8 keV line. The measurements were carried out with a gamma-spectrometer on the basis of a semiconductor HPGe-detector with the 175 cm^3 volume.

The resulting experimental curve of the dependence of the isomeric ratios $d=f(E_{\gamma max})$ on the maximum energy of the bremsstrahlung spectra starting from the threshold has a growing trend and in the region of 18.0 MeV it reaches the value d=0.103(5). Experimentally the dependence of the isomeric ratios $d=f(E_{\gamma max})$ was approximated by a Boltzmann curve using the least-square method:

$$d=A+(B—A)/[1+\exp((E-E_0)/\Delta E_1),$$

here A, B, E_0, ΔE_1 being parameters. As a result of approximation the following values were obtained for the parameters: A=—0.0253±0.010, B=0.1123±0.0087, E_0=13.67±0.32 and ΔE_1=1.66±0.33.

The experimental isomeric ratios of the ^{140}Ce(γ,n)^{139m,g}Ce reaction were compared with the those measured earlier for the ^{138}Ce(γ,n)^{137m,g}Ce reaction [1]. The results obtained will be discussed at the Conference.

1. V.M.Mazur, D.M.Symochko, Z.M.Bigan, P.S.Derechkey // Book of abstracts LXIII meeting on nuclear spectroscopy and nuclear structure, Moscow, 2013. St.-Pb, 2013. P.142.