CLARIFICATION OF ENERGY VALUE FOR THE ACTIVATION LEVEL IN THE REACTION ^{103}Rh(γ,γ')^{103m}Rh

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In papers [1, 2], the dependences of the absolute yield from energies for reaction A(γ,γ')A^m on the averages (^{77}Se, ^{79}Br, ^{89}Y) and heavy (^{103}Rh, ^{111}Cd, ^{137}Ba, ^{179}Hf, ^{197}Au, ^{199}Hg) nuclei were analyzed for the presence of fractures. Fractures are the points of deviation of the energy dependence of the absolute yield from the monotonically increasing curve. These points are interpreted as individual activation levels or groups of activation levels, through which the isomers of the nucleus are populated.

The experimental data from [1] for ^{103}Rh(γ,γ')^{103m}Rh reaction were approximated by a line (Fig. 1)

$$y = a + bx. \tag{1}$$

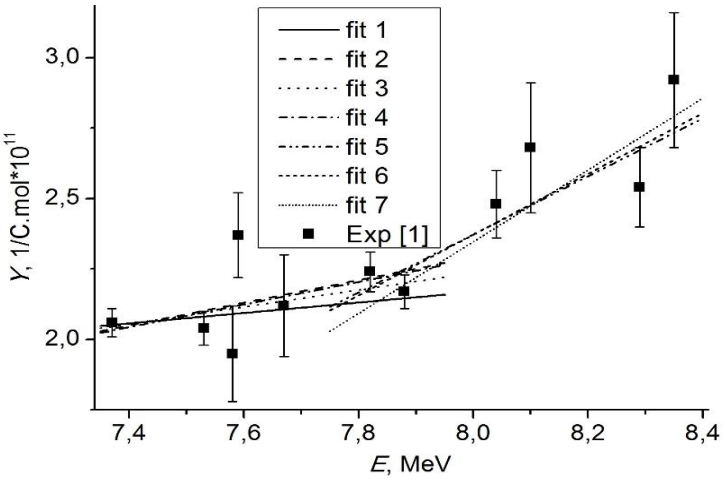

Fig. 1. Energy dependence of the absolute yield for the reaction ^{103}Rh(γ,γ')^{103m}Rh.

The "best" or "worse" approximation can be estimated by comparing the correlation coefficient R or value χ^2, and the different width of energy interval when approximating. Using the values of the parameters a and b for the approximations (step is one experimental point), it is possible to determine the intersection points x_0 for fits 1-4 and 5-7 for the energy intervals ΔE. For these purpose, we use the solution of simple linear two equations:

$$a_i + b_i x_0 = a_j + b_j x_0, \tag{2}$$

where the indexes i and j characterize fits 1-4 and 5-7 respectively. As the analysis of the obtained values x_0 shows (Table 1), the fracture of the experimental curve of reaction yield is localized in the energy interval ΔE=7.76-7.93 MeV. Given the minimum values for χ^2, the "best" approximations are fit 3 and fit 5 for the left and right arrays of energies respectively. Then the intersection point for these functions is located at energy E_a≈7.81 MeV. This value E_a corresponds to the energy of the activation level. In [2] for ^{103m}Rh, the corresponding E_a value was 7.87 MeV.

With this method, can be clarified the energy value for the activation level in the reaction (γ,γ') for others averages and heavy nuclei.

Table 1. Intersection points x_0 for approximate dependencies

fit N (ΔE in MeV)	**fit 5** (7.67-8.35)	fit 6 (7.82-8.35)	fit 7 (7.88-8.35)
fit 1 (7.37-7.67)	7.75693	7.77111	7.83524
fit 2 (7.37-7.82)	7.86915	7.87993	7.93580
fit 3 (7.37-7.88)	**7.81116**	7.82413	7.88537
fit 4 (7.37-8.04)	7.85861	7.87011	7.92806

[1] V.S. Bokhinyuk, O.G. Okunev, O.M. Parlag et al., Study of the ^{103}Rh(γ,γ')^{103m}Rh reaction, Uzhgorod Univ. Scien. Herald. Ser. Phys. **27**, 29-33 (2010).

[2] V.S. Bohinyuk, V.I. Zhaba, A.M. Parlag et al., Investigation of isomeric states in the reaction (γ,γ')^m on nuclei ^{77}Se, ^{79}Br, ^{89}Y, ^{103}Rh and ^{111}Cd, Uzhhorod Univ. Scien. Herald. Ser. Phys. **37**, 161-165 (2015).