LETTERS TO THE EDITOR

CONVERSION COEFFICIENT OF THE 96 keV TRANSITION IN ^{79}Se

INTEREST in the study of high multipole transitions is evinced, since the discovery[1] of sizeable discrepancies (in a few E3 and M4 transitions) between theoretical and experimental values of conversion coefficients In a number of cases studied by Bhuloka Reddy[2], such discrepancies were also noticed. A survey[3] of the available data on high multipole transitions indicated that in a number of cases the experimental accuracies were not adequately high to enable a systematic comparison between theory and experiment. The 96 keV transition in ^{79}Se is an example of this type. It is an E3 ($1/2^- \rightarrow 7/2^+$) transition, with the isometric state half life of 3·91 mts.

Weigmann[4] determined the K conversion coefficient of this transition using the X/γ method and obtained a value of $7{\cdot}4 \pm 0{\cdot}6$. In the summary furnished in *Nuclear Data Sheet*[5] an earlier measurement of Drabkin *et al.*, was adopted as $7{\cdot}5 \pm 3{\cdot}0$. The error in these measurements being large, a careful measurement of a_k of the 96 keV transition is undertaken.

The radioactive source ^{79m}Se is produced by $(n, 2n)$ reaction on natural Se using the 14 MeV neutrons generated at the cascade accelerator in the Laboratory. Considering the relative percentage of abundances of the different isotopes in Se, the half lives of the resultant activities and the relative cross-sections it can be seen that, for short irradiation times less than 10 mts. and thin samples, the effect of the interfering activities could be neglected. The gamma ray spectrum due to the decay of the irradiated activity was recorded with a 35 CC coaxial Ge(Li) detector and ND512 channel analyser system. The spectrum showed only one peak at 96 keV. The peaks expected at 103 keV and 162 keV due to the possible interferences from the activities ^{81m}Se and ^{77m}Se respectively were not observed, establishing that the contribution of interfering activities could be neglected. Several targets of thicknesses, in the range 1 gm/cm^2 to 50 mg/cm^2, were irradiated and the resultant gamma spectra were recorded with a thin crystal ($1\frac{1}{2}''$ dia. $\times$ 3 mm thick, attached to RCA 8575 photomultiplier) NaI (Tl) scintillation spectrometer which was initially calibrated carefully for photopeak efficiency using ^{57}Co, ^{241}Am, ^{75}Se and ^{133}Ba standard sources. The gamma spectrum with ^{79m}Se showed prominent peaks at 11 keV (K X-ray) and 96 keV. The areas A_x and A_γ under respective peaks, corrected for photopeak efficiencies ε_x and ε_γ are employed for the evaluation of a_k using the formula

$$a_k = \frac{A_x}{A_\gamma} \cdot \frac{\epsilon_\gamma}{\epsilon_x} \cdot \frac{1}{\omega_k}$$

where ω_k is the K-shell fluorescent yield, which is obtained as $0{\cdot}596 \pm 0{\cdot}031$ from the data of Bambynek *et al.*[6]. The areas employed in the above relation were the extrapolated zero target thickness yields to minimise the self absorption correction.

The final a_k is obtained as $6{\cdot}84 \pm 0{\cdot}40$. A large part of the error is due to the error in the K-shell fluorescent yield, the errors in the relative photopeak efficiencies and statistical uncertainties being 3% and 1% respectively. The present experimental value of a_k agrees with that of Weigmann *et al.*, which includes a larger error.

The 96 keV isomeric state in ^{79}Se is of established $1/2^-$ character, the ground state configuration being $7/2^+$. Thus the 96 keV transition corresponds to E3 and the theoretical value obtained from the computer programme of Hager and Seltzer[7] is 7·26. The present experimental value of a_k is about 6% lower than the theoretical value, but the experimental error is also about 6%. It is therefore hard to conclude whether or not real discrepancy exists. A more accurate value of ω_k is therefore essential for further improvement of the accuracy in the determination of a_k.

The transition probability of 96 keV transition is estimated from the half life of the isomeric state, the present value of $a_k = 6{\cdot}84$ (40) and K/L ratio 3·8 (4). The transition is found to show a hindrance of 51 (7) over the Weisskop single particle estimate. An anomalous conversion is therefore not unexpected.

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