LETTERS TO THE EDITOR

ON THE MEASUREMENT OF ABSOLUTE YIELD OF FLUORESCENT X-RAYS EMITTED FROM A TARGET IRRADIATED WITH GAMMA-RAYS

In two recent communications[1,2] we reported the measurements of photo-electric cross-sections and Compton scattering cross-sections from bound electrons. The measurements involved the determination of the absolute yield of fluorescent K-radiation that are emitted when the target is irradiated with known flux of gamma-rays.

The value of the absolute yield of fluorescent K-radiation was calculated from the intensity measured under the photo-peak in the spectrum of the radiation obtained by 1" × 1" NaI(Tl) spectrometer by correcting for : (*i*) absorption of the K-radiation in the air between target (source of K-radiation) and detector ; (*ii*) absorption in the front face of the crystal package through which radiation has to pass before reaching the crystal ; (*iii*) the escape of iodine X-rays in the crystal. These corrections were estimated from the data available in literature.[3-5] We have now measured the value of the effective photo-peak efficiency of the detector for the fluorescent X-radiation under our experimental arrangement and report the results in this letter.

The target in our experimental arrangements was replaced by radioactive sources of Hg-203, Au-198, Ce-141 and Cs-137 which have known K-shell internal conversion coefficients.[6,7] The photo-peak areas in the spectrum of gamma-rays and K-shell X-rays emitted from the source following internal conversion were measured with the detector. From the known values of the internal conversion coefficients, fluorescent yield[8] and photo-peak efficiency of the detector for gamma-rays[5,9] the photo-peak efficiency of fluorescent radiation was calculated from the relation

$$a_K = \frac{\epsilon_\gamma \, I_K \, A_\gamma}{\omega_K \, \epsilon_K \, I_\gamma \, A_K} \beta$$

where a_K is the K-shell internal conversion coefficient, I_K and I_γ are the measured intensities of K-radiation and γ-rays, respectively. A the attenuation factor due to absorption between yield of the daughter nucleus, ϵ the photo-source and the crystal, ω_K the K-shell fluorescent peak efficiency of the detector and β the correction due to iodine escape peak.

The results are tabulated in Table I for 1" × 1" Harshaw 4D4 crystal when the distance between source and detector is 18 cm.

TABLE I

Photo-peak efficiencies of K-radiation

Source	Energy in keV		$\epsilon_\gamma A_\gamma$	ω_K	$\epsilon_K A_K \beta$	
	γ-ray	X-ray			Calculated	Experimental
Hg-203	279	72·9	0·377	0·955	0·88	0·86 ± 0·04
Au-198	411	70·8	0·231	0·954	0·87	0·89 ± 0·04
Ce-141	145	36·0	0·737	0·900	0·64	0·63 ± 0·03
Cs-137	662	32·2	0·115	0·883	0·76	0·73 ± 0·04

An agreement between the experimental and calculated values confirms the validity of the corrections applied in our earlier measurements.

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