L shell x-ray fluorescence cross-sections for elements with $33 \leq Z \leq 50$

Veena Sharma, Nirmal Singh, and Sanjeev Kumar

Department of Physics, Panjab University, Chandigarh 160 014, India

Accurate experimental data regarding the X-ray fluorescence (XRF) cross sections and fluorescence yields are important in basic studies of nuclear and atomic processes leading to the emission of X-ray and Auger electrons. The data is also required for many practical applications like elemental analysis by x-ray emission technique, dosimetric computation for medical physics and irradiation processes [1]. A systematic study of the L_i (i =1-3) subshell x-ray fluorescence cross sections at the 5.89 keV photon energy has been undertaken for the elements in the atomic region $33 \leq Z \leq 50$. The measurements have been performed under vacuum ~10^{-2} torr using energy-dispersive spectrometer involving an LEGe (FWHM 150 eV at 5.895 keV) detector. The cross sections for the possible resolved L x-ray components were deduced and compared with those evaluated using the most reliable theoretical values of L_i (i = 1, 2, 3) subshell photoionization cross sections, fluorescence yields, x-ray emission rates and Coster-Kronig transition probabilities [2]. For the $L\alpha$, $L\beta$ and $L\gamma_{1,5}$ groups of x rays, the measured cross sections for all the elements are in agreement with theoretical cross sections. The measured $L\gamma_{2,3}$ cross sections in the atomic region $39 \leq Z \leq 46$ are in general agreement within ~10% except for $_{39}$Y, where the difference ~25% was observed. The comparison provides the insight regarding the cutoff energy of the L_1-$L_2M_{4,5}$ and L_1-$L_3M_{4,5}$ CK transitions at Z~39, and L_1-$L_3M_{4,5}$ and L_2-$L_3M_{4,5}$ CK transitions at Z ~50 as predicted by the RDHS model [2].

References:

[1] J. H. Hubbell, National Institute of Standards and Technology, Report no. NISTIR (1989) 89-4144.

[2] J. L. Campbell, At. Data Nucl. Data Tables 95, (2009) 115 and references therein.