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Determination of K-L_i Sub-Shell, Total K-L and Total K-M shell Vacancy Transfer Probabilities for Europium, Gadolinium and Terbium

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There are different ways to produce a vacancy in an atom such as photoelectric effect, Compton scattering, triplet production, charged particle Coulomb interaction, internal conversion, electron capture, positron annihilation and Auger effect. If an atom is bombarded with photons, electrons or protons which have enough energy for the ionization, the shell electron leaves the electronic cloud and the atom loses an electron through creation of a vacancy. The vacancy is filled either by emission of an X-ray, by Auger transition or Coster-Kronig transition which is special case of the Auger transition. These transitions are called radiative and non-radiative processes, respectively.

In this work, to obtain the K-Li (i=2,3), total K-L and total K-M shell vacancy transfer probabilities for Europium, Gadolinium and Terbium elements, the experimental values of Kα1, Kα2, Kβ'1 and Kβ'2 X-ray production cross sections, K shell fluorescence yields and Kβ/Kα, Kα2/Kα1 and Kβ'1/ Kα1 intensity ratios were determined at 59.54 keV photon energy from a 100 mCi Am241 annular source using excitation geometry and a Si(Li) detector system. The experimental results were compared with theoretical values of Hartree-Slater and Hartree-Fock and other available experimental results.