University of Poona,

S. P. SWAMI


EFFECTIVE ATOMIC NUMBER FOR DIFFERENTIAL K-SHELL PHOTOELECTRIC EFFECT IN Pt-Rh ALLOY

Hine\textsuperscript{1} pointed out that the effective atomic number for partial gamma-ray interactions cannot be represented by a unique number and the number for each partial process has to be computed separately. In a previous investigation\textsuperscript{2} Hine's predictions for total atomic photoelectric effect has been verified and showed that the number can be defined uniquely down to the gamma energy where occurs the K-edge of the highest atomic number element involved in each alloy. The present investigations deal with a study of the uniqueness of the number for differential K-shell effect in a typical alloy, Pt-Rh (Pt, 80\%; Rh, 20\%) at three gamma energies 100, 145 and 280 keV above K-edge energy of Pt where the number for total effect can be defined uniquely. This can be studied by comparing the differential K-shell photoelectric cross-sections in the alloy with those in the element of equivalent atomic number.

In view of the general agreement of the differential K-shell photoelectric cross-sections of Nagel\textsuperscript{3} with that of the experiment\textsuperscript{4, 5} within the limits of experimental errors and difficulties the differential K-shell photoelectric cross-sections in Pt-Rh alloy are estimated from the theoretical differential cross-sections based on Nagel's expressions in Pt and Rh at three gamma energies 100, 145 and 280 keV. The effective atomic number for Pt-Rh alloy is found to be 72 ± 1. So the obtained angular distributions in the alloy are compared with those in Ta whose atomic number is 73. However, in actual comparison the differential cross-sections in Ta are normalised to that of the alloy. The comparison of the differential cross-sections are shown in Fig. 1.

It can be seen from the figure that the two distributions differ\textsuperscript{1} in angle of maximum cross-section,\textsuperscript{2} in maximum cross-section and\textsuperscript{3} in spread. However, the differences become more and more as the energy decreases. Thus

\begin{figure}[h]
\centering
\includegraphics[width=0.8\textwidth]{fig1.png}
\caption{Differential cross-sections. X-axis: angle in degrees; Y-axis: cross-section in barns per atom; × × × × cross-section in equivalent atomic number element as in alloy; × × × × × × cross-section in alloy (Pt-Rh).}
\end{figure}

It can be concluded that, as far as total effect is concerned even though the alloy behaves like the element of respective effective atomic number, it differs in respect of differential effect. Hence, the effective atomic number for differential photoelectric effect cannot be defined uniquely, especially at lower and lower gamma energies, except at the angles where the two distributions intersect each other.

The authors are thankful to Dr. S. Hultberg for kindly arranging the computations of the differential cross-sections using Nagel's expressions at Nobel Institute of Physics, Sweden.

The Laboratories for Nuclear Research, K. P. PARThASARADHY.
Andhra University, Waltair, August 28, 1969.

A. S. RAJU.