

correct the measured values of the correlation coefficients. The purpose of this paper is to suggest a quantitative method for this correction.

The triplet correlation contribution depends on the relative gamma ray intensities of the cascades and the detector's geometry. If a and b stand for relative gamma ray intensities of the cross-over and cascade, respectively, and ε_2 , ε_3 and ε_4 represent the respective photoefficiencies for the detection of γ_2 , γ_3 and γ_4 under the given experimental conditions, then the theoretical values of the correlation coefficients of the correlation $W(\gamma_1-\gamma_4)$ may be expressed as:

$$A_k(1, 4) = C \frac{A_k^{\text{meas.}}}{Q_k^{(1)} Q_k^{(4)}} - C_k; \quad k = 2, 4.$$

Here $A_k^{\text{meas.}}$ are the measured correlation coefficients and the $Q_k^{(i)}$ are finite solid angle corrections. The constants C and C_k are:

$$C = 1 + \frac{b\varepsilon_2\varepsilon_3\Omega_4}{a\Omega_4},$$

and

$$C_k = \frac{b\varepsilon_2\varepsilon_3\Omega_4}{a\Omega_4} A_k(1, 2+3); \quad k = 2, 4.$$

$A_k(k, 2+3)$, $k = 2, 4$, are the theoretical values of the correlation coefficients for triple correlation $W[\gamma_1-(\gamma_2+\gamma_3)]$.

These equations were applied to the correction of the correlation coefficients in correlation $\gamma_{308}-\gamma_{613}$ in ^{191}Pt . The contributing triple correlation is $\gamma_{308}-(\gamma_{296}+\gamma_{316})$. The values of the coefficients C and C_k , $k = 2, 4$ were calculated for source to detector distances of 5.7 and 10 cm and for the $1.5'' \times 2''$ NaI(Tl) crystal. The contribution of the triple correlation was about 10%.

E14 Internal Conversion Experiments with ^{239}Np Sources Prepared as Oxide and Hydroxide

T. NOVAKOV, R. STEPIĆ and P. JANIĆIJEVIĆ, *Institute "Boris Kidrič", Beograd*

In order to find out to what extent the chemical state of a radioactive isotope influences the internal conversion process, we have studied the part of the internal conversion spectrum of the transition of 7.85 keV in ^{239}Pu including lines N , O , P and higher electron valency shells. The measurements were made with a double-focussing spectrometer with high resolution and a GM counter with a thin window to detect electrons of energies exceeding 4 keV. The radioactive sources were prepared electrolytically in two chemical states: oxide and hydroxide. Preliminary results of our measurements are as follows:

In the case of internal conversion on N subshells, it has been noticed that the width of the N_1 line, for the hydroxide source, differs considerably from that of the N_2 and N_3 lines. The difference is larger than one should expect considering the larger natural width of the N_1 electron shell (Fig. 1).

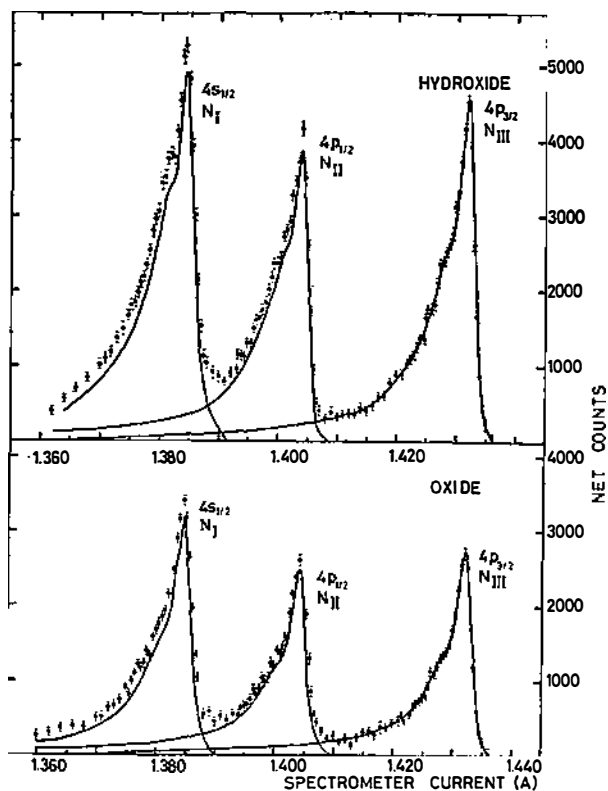


Fig. 1

This phenomenon was not observed in the case of the oxide source. Hence, it was interesting to measure and compare the intensity ratios of $N_1:N_2$, $N_1:N_3$, and $N_2:N_3$ for these two chemical states. Preliminary results show that the intensity ratios including the N_1 subshell are 15% higher in case of the hydroxide source, while the $N_2:N_3$ ratio is about the same, within experimental error (Table I).

TABLE I

Conversion ratio	Hydroxide	Oxide	Hydr/Oxide
$N_1:N_2$	1.42 ± 0.08	1.20 ± 0.07	1.18
$N_1:N_3$	1.29 ± 0.05	1.15 ± 0.05	1.12
$N_2:N_3$	0.92 ± 0.04	0.96 ± 0.04	0.95

In the case of internal conversion on O subshells, for both the oxide and hydroxide sources, a satellite peak on the low-energy side of the O_3 line was observed and is assumed to be due to the change in the binding energy of the O_3 subshell induced by the local electric field gradient of the source. This is similar to the appearance of the satellite peak on the L_3 subshell in the same element when a strong external electric field is applied to the source. It was also found that the O_1 line is considerably wider with the hydroxide source (Fig. 2).

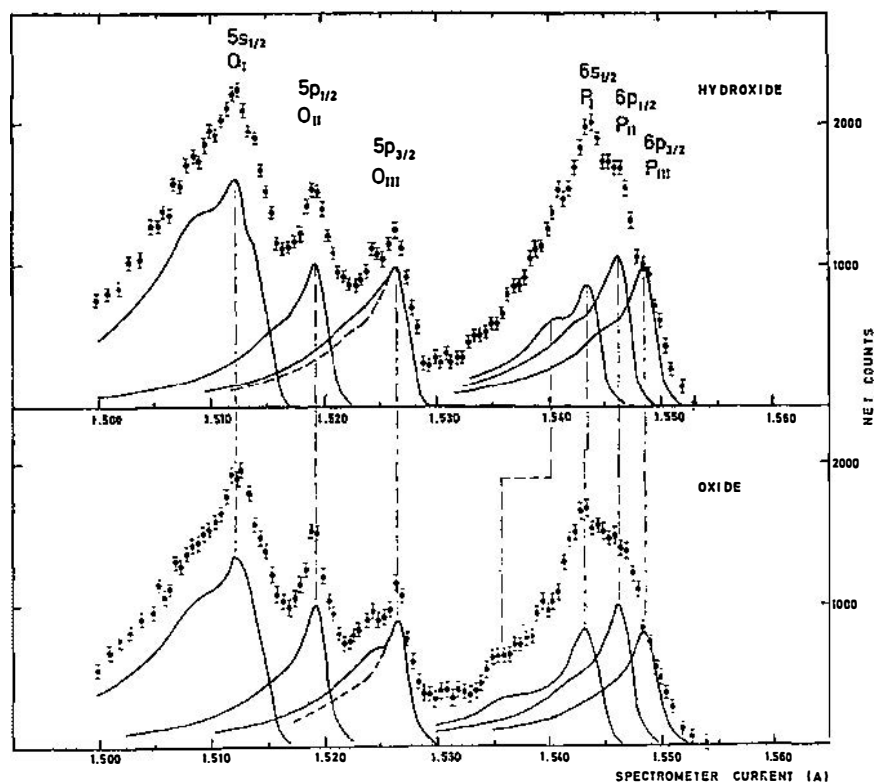


Fig. 2

As distinct from N and O , the internal conversion lines in P subshells could not be separated energetically. This part of the spectrum is geometrically resolved into components by means of distinctly visible peaks P_1 , P_2 and P_3 and by the standard form of the line (Fig. 2). Resolved in this way the spectrum allowed reestimation of the binding energies for plutonium, $BE(P_1) = 54 \pm 30$ eV; $BE(P_2) = 25 \pm 30$ eV; $BE(P_3) = 30$ eV.

Also, it was found that a group of conversion lines including close lines O_4 and higher subshells is shifted towards higher energies in the case of the hydroxide source. At present, it is not quite clear whether this is a shift of the O_4 and higher conversion lines as the result of the internal electric field gradient, or, more probably, a satellite peak of the P_1 conversion line whose appearance is similar to that of the satellite peak of the O_3 line.

E15 Gamma-Rays from Thermal Neutron Capture in Lanthanum

J. SIMIĆ, I. SLAVIĆ, V. AJDAČIĆ and B. LALOVIĆ, *Institute "Boris Kidrič", Beograd*

Capture gamma-rays from a spectroscopically pure lanthanum target were measured with Ge(Li) single and coincidence spectrometers. The detectors had effective volumes of 25 and 30 cm³, respectively, and resolutions of 3.3 keV for 1332 keV, and 6 keV for 5100 keV. A filtered reactor neutron beam was used as the source.

Seventy gamma-lines were found, 33 of them for the first time¹⁾. In coincidence measurements a number of cascade transitions were identified to facilitate construction of the decay scheme for ¹⁴⁰La. Notwithstanding existing data about the levels in ¹⁴⁰La from (d, p) reaction²⁾, only about 50% of the transitions could be fitted into the level scheme, including the capture state and levels to about 1500 keV.

Further experiments on the La (n, γ) reaction are in progress, primarily with the aim of getting a better gamma-ray energy resolution than the present one.

Fig. 1 shows the low energy part of the La (n, γ) spectrum as well as the corresponding spectra from the decay of the ¹⁴⁰La and the background. Fig. 2 presents the single spectrum, the corresponding coincidence spectrum with the selected 4846 keV line, and the chance coincidence spectrum.

References

- 1) L. B. Hughes, T. J. Kennett and W. V. Prestvich, Nucl. Phys. **89** (1966) 241;
- 2) Jean Kern, G. L. Struble and R. K. Sheline, Phys. Rev. **153** (1967) 1331.