AEC-NASA TECH BRIEF

Daughter Growth in Freshly Separated Ra-226, Ac-227 and U-232

Computer-calculated curves and tables for the daughter buildup of Ra-226, Ac-227 and U-232 chains have been made available in a report by Argonne National Laboratory. The data are presented as a function of time beginning with pure samples of each parent.

Ra-226, Ac-227 and U-232 act as parent nuclides of decay series of predominantly alpha-emitting daughters. Ra-226 and Ac-227 are also the longest-lived isotopes of their respective elements, making them of prime importance to chemists desiring the least radioactive material when doing research on elemental properties.

In applied or research uses, it is often desirable to know the rate at which the radioactive daughters are regenerated into a freshly purified parent. The decay chains are complex for all three nuclides, however, so hand calculations have been impractical. The report presents the daughter buildup curves for these nuclides on a relative yield basis as calculated by computer techniques. The curves are also given in the form of radioactivity buildup with time. The buildup of the daughters in the period immediately after parent purification is also presented in tabular form.

The programs employed were modified from those previously used to determine transplutonium-element yields from heavy-element targets exposed to high neutron fluxes in a reactor. The presence of branching in decay chains, which occurs in the nuclides studied, breaks down the earlier programs; therefore additional programs based on numerical integration were developed.

To shorten calculation time, the original program was modified to allow the yield data to be accumulated on a CDC-3600 computer. The data were then put into a form usable by the IBM-1620 with a special "converter" program, and that machine was used to prepare the final data in graphical as well as tabular form.

The numerical-integration program cannot consider nuclides having half-lives shorter than the time increment used for the integration. Thus, two different time increments and time scales were used for each situation considered. The first scale was for 5 months with a 50-second increment to obtain information on short-time changes; the second a 50-year scale with a 2×10^4-second (5.56-hour) increment.

Notes:

1. The report, "Daughter Growth in Freshly Separated ^{226}Ra, ^{227}Ac, and ^{232}U," by D. C. Stewart, E. S. Macias, L. J. Basile, and M. Milstead, ANL-7205, May 1966, is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151; price: $3.00; microfiche copies, $0.65.
2. Since these chains are predominantly alpha emitters, this information may be of interest to those using the chains as isotopic alpha sources or neutron sources. The curves may also be of interest to chemists doing research on elemental properties.
3. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B69-10003

   Source: D. C. Stewart, E. S. Macias, L. J. Basile, and J. Milstead of Chemistry Division, Argonne National Laboratory (ARG-10226)

(continued overleaf)

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
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