

National Bureau of Standards

Certificate

Standard Reference Material 4334-B

Plutonium-242

Alpha-Particle Solution Standard

This Standard Reference Material consists of carrier-free plutonium-242 in approximately 4 milliliters of 5 M HNO₃ in a flame-sealed borosilicate-glass ampoule.

This standard was prepared from a quantitative dilution of a master solution that had been calibrated by liquid-scintillation counting. Confirmatory measurements were made using the NBS "0.8π" defined-solid-angle alpha-particle counter.

The radioactivity concentration of plutonium-242 plus alpha-particle-emitting impurities, on May 1, 1979, was

$$*27.2_{\text{g}} \text{ s}^{-1}\text{g}^{-1} \pm 0.8_{\text{5}}\%*$$

The uncertainty in the radioactivity concentration, 0.8₅ percent, is the linear sum of 0.1₅ percent, which is the limit of the random error of the liquid-scintillation-counter measurements at the 99-percent confidence level (3.707 S_m, where S_m is the standard error computed from 7 determinations), and 0.7 percent, which is the estimated upper limit of conceivable systematic errors.

Estimates of the impurities of the other plutonium isotopes are given in the supplement to this certificate.

This Standard Reference Material was prepared and calibrated in the Center for Radiation Research, Nuclear Radiation Division, Radioactivity Section, W. B. Mann, Chief.

Washington, D.C. 20234
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George A. Uriano, Chief
Office of Standard Reference Materials

SRM 4334B-

(over)

SUPPLEMENTAL INFORMATION

for

PLUTONIUM-242 SRM 4334B

Estimates of the impurities were provided by the supplier, Lawrence Livermore Laboratory, based on alpha-particle counting for plutonium-238, and mass-spectrometric measurements for plutonium-239, plutonium-240 and plutonium-241.⁽¹⁾ The activity ratios for the impurities, on May 1, 1979, were calculated using the half lives for the impurities shown in the table, and using a half life for plutonium-242 of $(3.763 \pm 0.020) \times 10^5$ years.⁽²⁾

In addition the radioactivity concentration of plutonium-241 was determined at NBS by comparative beta-particle measurements using liquid-scintillation counting. The standard used for comparison was a solution of plutonium-241 which had been previously standardized by in-growth measurements on the americium-241 daughter.

Impurity Isotope	Half Life (years)	LLL Mass Spectrometric Ratio to ^{242}Pu as of February 19, 1975	Computed Activity Ratio to ^{242}Pu May 1, 1979	NBS Measured Activity Ratio to ^{242}Pu May 1, 1979
^{238}Pu	87.74 ± 0.04 ⁽³⁾	---	$(1.74 \pm 0.05) \times 10^{-4}$	---
^{239}Pu	24119 ± 26 ⁽³⁾	$(0.33 \pm 0.05) \times 10^{-6}$	$(5.1 \pm 0.8) \times 10^{-6}$	---
^{240}Pu	6537 ± 10 ⁽⁵⁾	$(2.62 \pm 0.14) \times 10^{-6}$	$(1.51 \pm 0.09) \times 10^{-4}$	---
^{241}Pu	14.4 ± 0.2 ⁽⁶⁾	$(12.14 \pm 0.31) \times 10^{-6}$	0.259 ± 0.012	0.140 ± 0.007

(1) Johnson, P.D., Carver, R.D., and Dupzyk, R.J., Preparation of ^{242}Pu for Shipment, Lawrence Livermore Laboratory, private communication, February 19, 1975.

(2) *Nuclear Data Sheets*, Vol. 21 No. 4, August 1977.

(3) Strohm, W.W., *Int. J. Appl. Rad. and Isotopes*, 29, 481 (1978).

(4) LLL reported the activity ratio on February 19, 1975 of $(1.80 \pm 0.05) \times 10^{-4}$.

(5) *Nuclear Data Sheets*, Vol. 20 No. 2, February 1977.

(6) *Nuclear Data Sheets*, Vol. 23 No. 1, January 1978.