The new Half-life value of ^{209}Po

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Proton Cross Sections of Bi^{209}†

C. G. ANDRE,* J. R. HUIZENGA, J. F. MECH, W. J. RAMLER, E. G. RAUH, AND S. R. ROCKLIN
Chemistry Division, Argonne National Laboratory, Lemont, Illinois
(Received October 4, 1955)

- ✓ in metrology: tracer for ^{210}Po in geophysical & environmental studies – remember also the "Russian tea"
- ✓ nuclear waste

$$T_{1/2}(n) = T_{1/2}(ref) \times \frac{A(ref)}{A(n)} \times \frac{N(n)}{N(ref)}$$

n=^{209}Po
ref=^{208}Po

$T_{1/2}$(^{208}Po)=2.93(3) *y* → **$T_{1/2}$(^{209}Po)=103(5)** *y*

if corrected for the present $T_{1/2}$(^{208}Po):

$T_{1/2}$(^{208}Po)=2.898(2) *y* → **$T_{1/2}$(^{209}Po)=102(5) *y***

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A new determination of the ^{209}Po half-life

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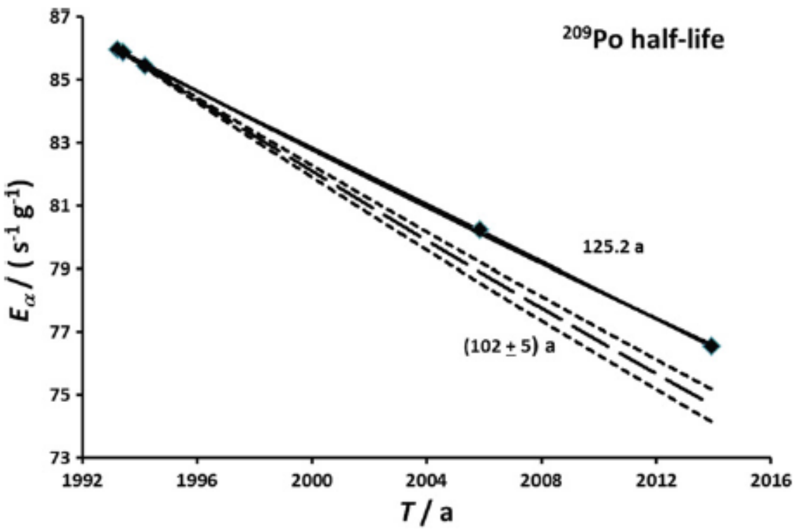

- ✓ 30 different data sets over 20.7 y liquid-scintillation measurements with nearly 50 sources prepared from the same solution

$T_{1/2}(^{209}Po)$=125.2(33) *y* → $T_{1/2}(^{209}Po)$=102(5) *y* → *~20% difference*

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Technical note

Confirmation of 20% error in the ^{209}Po half-life

CrossMark

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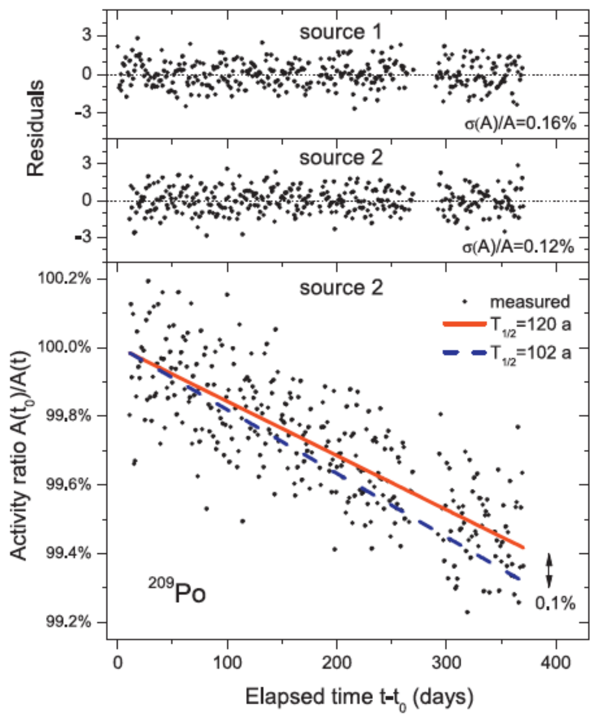

$T_{1/2}(^{209}Po)=120(6)\ y \rightarrow T_{1/2}(^{209}Po)=125.2(33)\ y$

CEA - LNHB /V. Chisté, M. M. Bé 29/09/2009 – 22/2/2010

DDEP

1 Decay Scheme

Po-209 disintegrates by alpha emissions (99,546 (7) %) to excited levels and to the ground state level in Pb-205 and by electron capture (0,454 (7) %) to the excited level of 896,3 keV in Bi-209.

Le polonium 209 se désintègre par émission alpha (99,546 (7) %) vers des niveaux excités et le niveau fondamental du plomb 205 et par capture électronique (0,454 (7) %) vers le premier niveau excité du bismuth 209.

2 Nuclear Data

$T_{1/2}(^{209}\mathrm{Po})$	:	115	(13)	a
$T_{1/2}$(Bi)	:	1,9	(2)	10 a
$T_{1/2}(^{205}\mathrm{Pb})$	:	17,3	(7)	10^6 a
$Q^{\alpha}(^{209}\mathrm{Po})$	:	4979,2	(14)	keV
$Q^{+}(^{209}\mathrm{Po})$	:	1892,5	(16)	keV

Reference	Experimental value (a)	Comments
C. G. Andre (1956An05)	102 (5)	From ^{209}Po/^{208}Po mass and activity ratios and $T_{1/2}(^{208}\mathrm{Po})$ = 2.898 (2) a (see 1991Ma16).
R. Collé (2007Co07)	128 (7)	Decay data from two separate primary standardizations of a ^{209}Po solution standard, carried out ~ 12 years apart.
Recommended value	115 (13)	$\chi^2 = 6.9$

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Despite the above assertion and recognition that the result was not a direct determination, recent data compilers nevertheless chose to incorporate the value in an evaluation of the ^{209}Po half-life. Chisté and Bé [9] quoted a personal communication by Collé: '… *the value* 128 *a was not a new determination. The whole point was to show that there was evidence to suggest and support that the extant* 102 *a value is very wrong, perhaps by 25%*' [9]. In deciding '*to take into account all scarce information available*' [9], they took the expedient of adopting '*the simple mean of the two existing values … with an uncertainty covering them*'; *viz.*, (115 ± 13) a [9]. One must wonder why the data evaluators didn't also include the lower uncertainty bound for the 102 a value and an upper bound on the 128 a value in their uncertainty estimate!

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Nuclear Data Sheets

Nuclear Data Sheets 126 (2015) 373–546

www.elsevier.com/locate/nds

Nuclear Data Sheets for A = 209*

J. CHEN # AND F.G. KONDEV

E(level)	Jπ†	XREF	$T_{1/2}$	Comments
0.0	1/2–	ABCDE GH	124 *y* 3	%α=99.546 *7*; %ε+%β^+=0.454 *7*. Jπ: optical spectroscopy (1976Fu06), L(d,t)=1. $T_{1/2}$: Weighted average of 125.2 y *33* in 2014Co16, based on 30 datasets measured over a period of 20.7 years using a liquid scintillator technique (superseded 128 y *7* by the same collaboration (2007Co07)) and 120 y *6* in 2015Po03, based on measurements of two sources measured for 359 and 369 days. Other: 102 y *5* from $^{209}Po/^{208}Po$ mass and activity ratios in 1956An05 and the presently adopted $T_{1/2}(^{208}Po)$=2.898 y *2*. Authors in 1956An05 obtained $T_{1/2}$=103 y using $T_{1/2}(^{208}Po)$=2.93 y *3*. %α,%ε+%β^+: from measured %I(ε)=0.454 *7* and %I(ε+β)+%I(α)=100 (1996Sc24). Others: %α=99.52 *4* (1989Ma05) and 99.74 (1966Ha29).

a good evaluation is not just averaging all measured values …