

GENERAL ELECTRIC COMPANY

RICHLAND, WASHINGTON HANFORD ATOMIC PRODUCTS OPERATION

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AGE CALCULATIONS FOR LATTICES WITH ALUMINUM-MATRIX SLUGS

Age calculations have been carried out for several Hanford exponential lattices containing aluminum-matrix (e.g., C, J, or N) slugs, using the expression

$$\frac{1}{\tau} = \frac{3}{V_{\text{cell}}^2} \left[\sum_i \left\{ \frac{\xi_i \Sigma_{s_i} V_i}{\left(\ln \frac{E_{\text{fiss}}}{E_{\text{th}}} \right)_i} \right\} \right] \left[\sum_i \left\{ \Sigma_{s_i} (1 - \mu_0)_i \right\} \right]$$

where the sums run over the several materials of the lattice cell. Standard definitions for all parameters in the formula are used.

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The following values are taken

Material	ξ	$1-\mu_0$	Density	Σ_B	V
Graphite	0.158	0.9445	1.647 gm/cm ³	0.39646 cm ⁻¹	($V_{\text{cell}} - 15.413$) cm ²
Water	1	1/3	1 gm/cm ³	1.4049 cm ⁻¹	2.3095 cm ²
Aluminum	0.072	0.9753	2.7 gm/cm ³	0.08132 cm ⁻¹	13.104 cm ²

With these values for graphite, it must be assumed that $\ln \frac{E_{\text{fiss}}}{E_{\text{th}}} = 24.40$, where

$E_{\text{th}} = 0.025$ ev, in order to obtain agreement with the experimental determination of the age in graphite to indium resonance.* Similarly, one must take $\ln E_{\text{fiss}}/E_{\text{th}} = 65.1$ for water, to force agreement with the experimental value for the age to thermal.**

Of course, these very large values for $\ln E_{\text{fiss}}/E_{\text{th}}$ arise from the insistence upon use of one-group parameters only.

Computations were performed for four lattices both wet and dry. Any streaming corrections are neglected.

Lattice	V_{cell}	τ_{dry}	τ_{wet}	$\tau_{\text{dry}} - \tau_{\text{wet}}$
8-3/8"	453.6 cm ²	368.2 cm ²	350.4 cm ²	17.8 cm ²
7-1/2"	362.9 cm ²	373.8 cm ²	351.2 cm ²	22.6 cm ²
5-3/16"	173.6 cm ²	407.3 cm ²	356.8 cm ²	50.5 cm ²
4-3/16"	113.1 cm ²	446.4 cm ²	362.8 cm ²	83.6 cm ²

Using the formula $\frac{V_{\text{cell}}}{\sqrt{\tau}} = \sum_1 \left(\frac{V_1}{\sqrt{\tau_1}} \right)$, D. D. Lanning obtained (prior to the time that the work reported here was performed) values for τ_{dry} which agree with those above.

Acknowledgement is made to D. E. Davenport and D. D. Lanning for discussions concerning calculations of this type.

* 309 cm² in graphite of density 1.60 gm/cm³.

** 33 cm²

Herschel Neumann
Physics Unit
Technical Section
ENGINEERING DEPARTMENT

H Neumann:as

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