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# Equivalence Factors for $D_2O$[1]

In reference (*1*), R. W. Deutsch presented a table of equivalence factors for a variety of materials with respect to $H_2O$. These factors have the property that if material $x$ has the equivalence factors $\alpha$, $\beta$, then the age in a mixture of $H_2O$ and $x$ is:

$$\tau_{\text{mix}} = \frac{\tau_{H_2O}}{v_{H_2O}^2} \frac{1}{[1 + (\alpha v(x)/v_{H_2O})]} \frac{1}{[1 + (\beta v(x)/v_{H_2O})]}.$$

Also

$$D_{\text{mix}} = \frac{D_{H_2O}}{v_{H_2O}} \frac{1}{[1 + (\beta v(x)/v_{H_2O})]}$$

where $v(x)$, $v(H_2O)$ are the volume fractions of the elements of the mixture and $D$ is the diffusion coefficient.

TABLE I
$D_2O$ CONSTANTS

| Group | $\tau(\text{cm}^2)$ | $D(\text{cm})$ |
|---|---|---|
| I | 48 | 1.27 |
| II | 79 | 1.24 |

We have calculated equivalence factors with respect to $D_2O$ for Mg, Al, Zr, and stainless steel (SS). These equivalence factors are given for two groups. Group I covers neutron energies from 10 Mev to 180 kev, Group II from 180 kev to 1.4 ev. The $D_2O$ constants for these groups are given in Table I, the equivalence factors in Table II.

To collapse the two groups to one, the age is the sum of the two ages. Denoting the con-

[1] Work performed under auspices of the U.S. Atomic Energy Commission.

TABLE II

EQUIVALENCE FACTORS

| Material | Group | $\alpha$ | $\beta$ |
|---|---|---|---|
| Mg | I | 0.06668 | 0.48005 |
| | II | 0.05690 | 0.44468 |
| Al | I | 0.05785 | 0.47881 |
| | II | 0.02131 | 0.17223 |
| Zr | I | 0.03299 | 1.10895 |
| | II | 0.02837 | 0.79863 |
| SS | I | 0.02767 | 0.47270 |
| | II | 0.05106 | 0.88713 |

stants of the combined group by the subscript $f$,

$$\tau_f = \tau_{\text{I}} + \tau_{\text{II}}$$

$$\Sigma_f^{-1} = \Sigma_{\text{I}}^{-1} + \Sigma_{\text{II}}^{-1}; \qquad \Sigma_{\text{I}} = D_{\text{I}}/\tau_{\text{I}}, \text{ etc.}$$

The latter prescription preserves the slowing-down density.

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