unity ($\gamma \approx 0.97$) than any albedo known.

Results and Examples

The evaluation of the relation (11) between critical radius and albedo has been carried out numerically for UF_6 containing concentrations of 20%, 50%, and 100% of 25 among the U nuclei. For small albedo ($\gamma \leq 0.5$) simple empirical formulas are obtainable.

$$\begin{aligned} x = 0.2 \quad & R = 34.8 - 4.25\,\gamma - 10.0\,\gamma^2 \text{ cm.} \\ x = 0.5 \quad & R = 28.0 - 4.8\,\gamma - 8.8\,\gamma^2 \text{ cm.} \\ x = 1.0 \quad & R = 22.0 - 2.7\,\gamma - 12.7\,\gamma^2 \text{ cm.} \end{aligned} \qquad (UF_6\ \gamma \leq .5)$$

We have used a "fast" neutron reflection half as great ($\epsilon = 1/2$) as for the slow neutrons. The radius does not depend sensitively on ϵ because "fast" neutrons are always in a minority. The density of UF_6 was taken to be 4.68 gm/cm^3.

More interesting than the critical sizes are perhaps the critical masses,

$$M = \frac{4\pi}{3} R^3 \rho$$

Now $R \sim 1/k' \sim 1/N$ (see (2) and (4)), so that $R \sim \mu/\rho$ (μ = molecular weight, ρ = density), and $M \sim (\mu/\rho)^3 \rho$, so that the quantity $\rho^2 M/\mu^3$ is independent of the density and the molecular weight of the substance. This quantity is plotted as a function of γ for UF_6 in the accompanying graph, for the 25 concentrations x = 0.2, x = 0.5, and x = 1.0. The ordinates given are for M in grams and ρ in grams per cm^3.

For concreteness, we list the critical masses of UF_6 for $\gamma = 0$ and $\gamma = 0.3$:

	$\gamma = 0$	$\gamma = 0.3$
x = 0.2	835 kg.	700 kg.
x = 0.5	435 kg.	340 kg.
x = 1.0	215 kg.	160 kg.

We see that a reflection of 30% of the neutrons decreases the critical mass by about 25%.

The cross sections of UF_4 are about 25% smaller than those of UF_6. This means that $k' \sim \sqrt{\sigma t}$ will be some 12% smaller and $R \sim 1/k'$ about that much larger. A deviation of 12% is not large compared to the uncertainties in our choices of the various nuclear constants. It is sufficient, therefore, to use the UF_6 curves in the figure also for UF_4, and to keep in mind that the masses obtained from the curves are most probably some 40% smaller than the actual critical masses of UF_4. The explicit dependence of M on ρ obtainable from the curves, is useful in this instance since the bulk density of UF_4 (or other solids that may be formed) varies according to the way the solid is obtained. For U_3O_8, the cross sections are smaller than for UF_6 by some 30%. The curves will thus give critical masses for this substance about 50% too small. The finding for UO_3 will be about the same.