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SPONTANEOUS FISSION OF 48

By

John Jungerman

Fission Physics

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SPONTANEOUS FISSION OF 48 *

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The spontaneous fission of 48 has been reinvestigated under the direction of Dr. E. Segre in an effort to redetermine more accurately the value of the spontaneous fission constant obtained at Los Alamos. A 0.25 microgram sample of 48 was obtained from Dr. J. G. Hamilton. This material was made from 37 in the Clinton pile by an $\eta - \gamma$ reaction followed by β decay. Mr. T. Morgan of Dr. Seaborg's chemistry group prepared two samples of about five million alpha disintegrations per minute.

The spontaneous fission chambers were of the Los Alamos type with battery operated linear amplifiers. Two such chambers and amplifiers were installed in an electrostatically shielded cabinet. Before the investigation was begun each chamber was operated continuously for about one week using 23 material with an activity comparable to 5 million alpha disintegrations per minute. During this period no counts were observed.

By slow neutron bombardment with a sample of 49 in the chambers their counting efficiency for fission was determined

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* Work was done at Berkeley as a continuation of work done at Los Alamos Scientific Laboratory.

and found to be 100 per cent and 97.6 per cent by extrapolating the curve of the counting rate versus bias of the discriminator from the operating region to zero bias. In the operating region the spurious counts due to alpha activity were obtained by extrapolation to be less than 10^{-6} counts per minute. Actually 407 spontaneous fission counts were recorded in a period of 710.9 hours. Correction for chamber efficiency raises this to 408.5 effective counts.

The mass of 48 present was determined by alpha count using two different types of low geometry counters. Results from the two counters agreed to 5 per cent. The samples were 5.17×10^6 disintegrations per minute and 4.93×10^6 disintegrations per minute.

The number of spontaneous fissions per gram x hour is then $4.79 \times 10^8 / T_{\frac{1}{2}}(48)$ where $T_{\frac{1}{2}}(48)$ is the half life of 48 in years, with a probable error of about 10 per cent. If the half life of 48 for alpha activity is taken as 60 years, then this gives 7.98×10^6 f/gr. hr. or 2.22×10^3 f/gr. sec.

This result agrees within the error of the experiment with the value obtained at Los Alamos which was

$$\frac{4.54 \times 10^8}{T_{\frac{1}{2}}(48)} \quad \frac{\text{fissions}}{\text{grams x hour}}$$ or 2.1×10^3 f/gr.sec. if $T_{\frac{1}{2}}(48)$ is 60 years.