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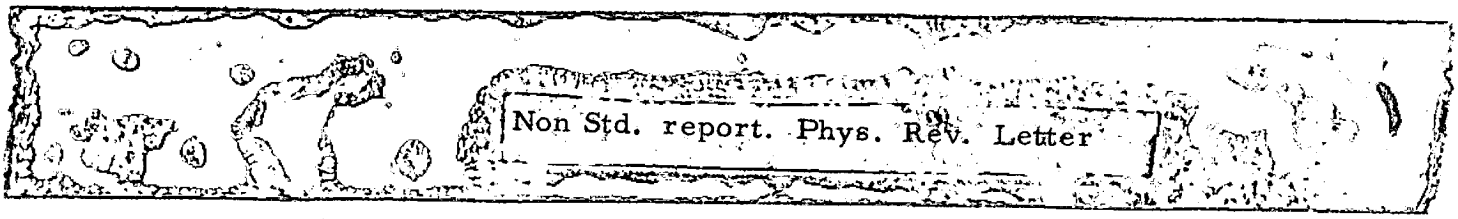

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Investigations of the electrical response of diffused p-n junctions in silicon to charged particles were made on detectors obtained from two sources.[1]

When used with electronic systems in a manner analogous to ionization chamber use, the silicon particle detectors produce output-current pulses linearly proportional to the amount of energy deposited in the sensitive volume of the detector by the charged particle. The proportionality appears to be independent of the mass of the charged particle.

Figure 1 shows a curve of output-pulse amplitude vs energy for a range of alpha particles from 3.2 Mev to 7.68 Mev. When the data are corrected for energy loss in the insensitive region, the curve goes through the origin.

Figure 2 shows a curve of output-pulse amplitude vs energy for eight values of C^{12}-ion energy from 33 to 121 Mev. The carbon ions were elastically-scattered by a thin gold target and observed at 30 deg to the beam. The energy was varied by placing aluminum absorber foils in the path of the full energy beam of the heavy ion linear accelerator. Energies were determined from the range-energy curves of J. R. Walton.[2]

Also plotted on the curve are points for the 6.1-Mev alpha-particle group and the light and heavy mass groups of fragments from spontaneous

fission of Cf^{252}. The energies corresponding to the fission-fragment peaks have been corrected for energy loss in the insensitive surface region of the detector. The fragment kinetic-energy data of Fraser and Milton,[3] and the range-energy data of Schmitt and Leachman[4] have been used in making the correction. The corrected points fall on the pulse-height vs energy curve determined for carbon particles. From this result it is inferred that there is very little or no "ionization defect" for fission fragments in the solid-state detector.

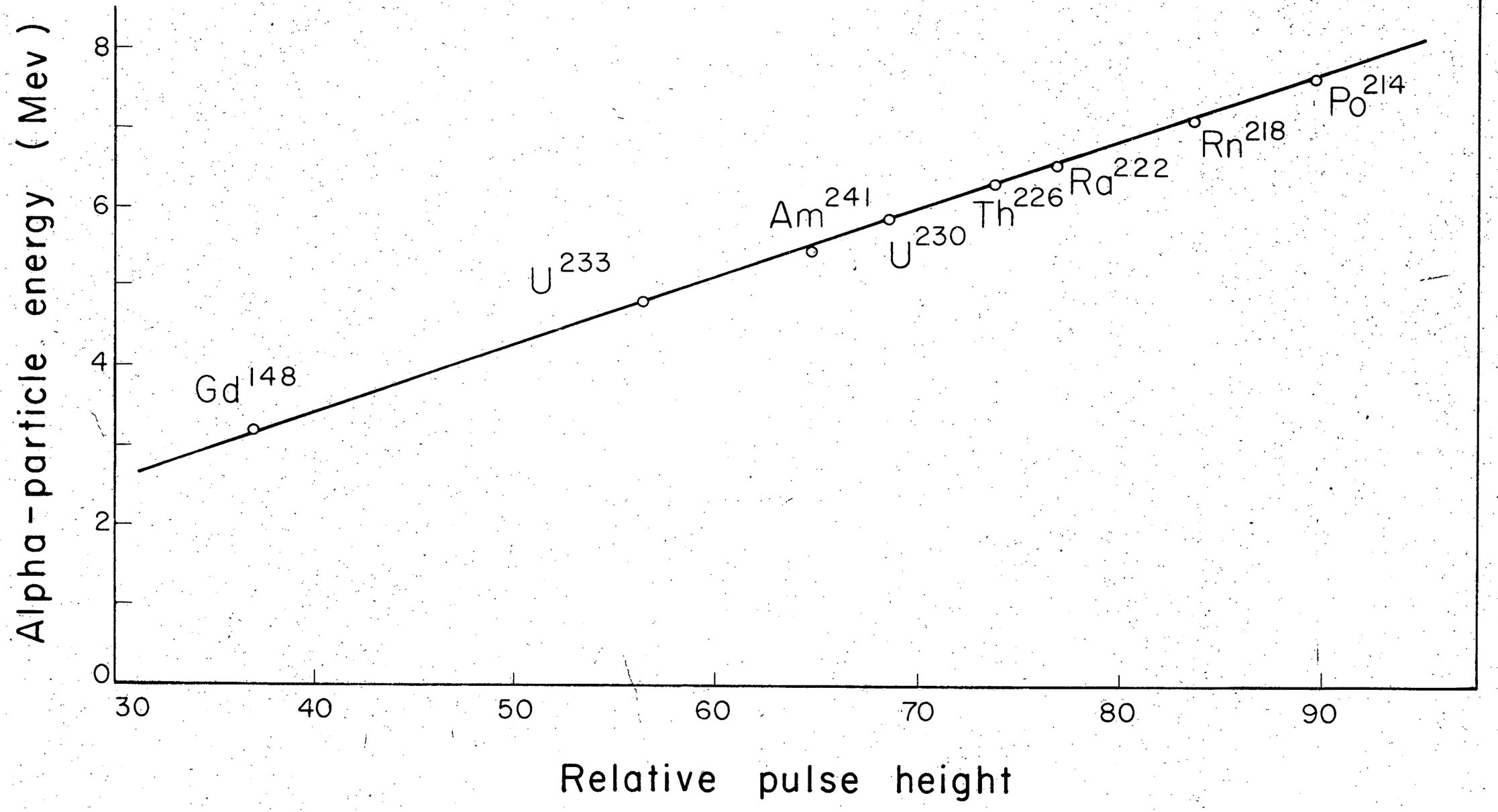
References

1. N. L. Hansen, Lawrence Radiation Laboratory, and S. S. Friedland, Hughes Aircraft Corp., Los Angeles, Calif.

2. J. R. Walton, Lawrence Radiation Laboratory, private communication.

3. J. S. Fraser and J. C. D. Milton, Proceedings of the Second International Conference on the Peaceful Uses of Atomic Energy (United Nations, Geneva, 1958) Vol. 15, p. 216.

4. H. W. Schmitt and R. B. Leachman, Phys. Rev. 102, 183 (1956).


Alpha-particle energy (Mev)
8
6
4
2
0
30
40
50
60
70
80
90
Relative pulse height
U233
Am241
U230
Th226
Ra222
Rn218
Po214
Gd148

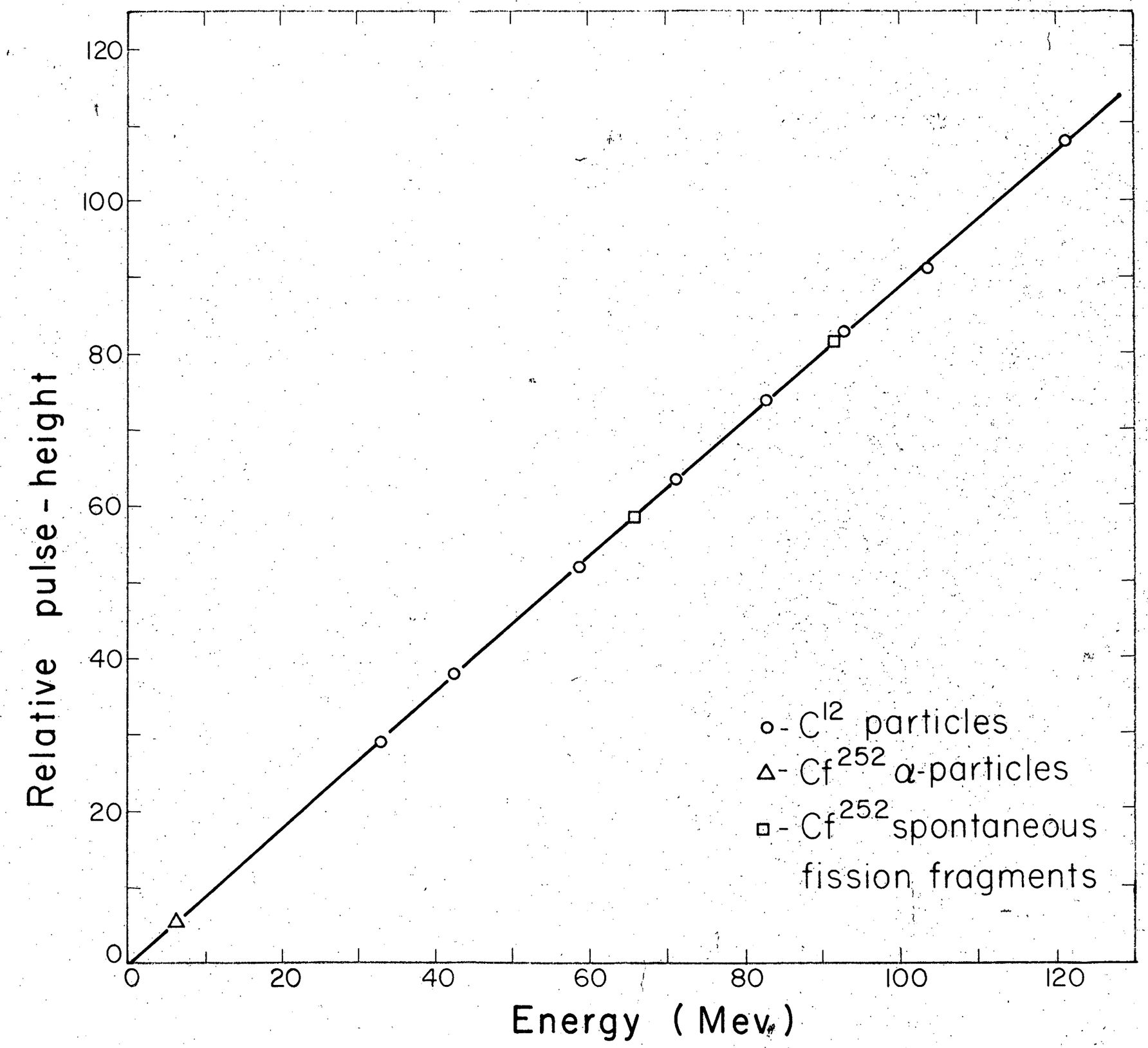

Relative pulse-height
0
20
40
60
80
100
120
Energy (Mev)
o - C12 particles
Δ - Cf252 α-particles
□ - Cf252 spontaneous fission fragments

Fig 2