NUCLEAR DETECTORS AND PHOTODETECTORS USING AMORPHOUS-CRYSTALLINE HETEROSTRUCTURES

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Heterostructures consisting of crystalline and amorphous semiconductors possess properties that are of interest from a nuclear detectors and photodetectors application point of view. On the one hand due to high resistivity of crystalline material one can obtain a deep depletion region with good generated charge collection. On the other hand use of amorphous layer gives the possibility of obtaining rectifying contact with simultaneous protection and stabilization surface. The important advantage in using amorphous layers is also thin window of structures.

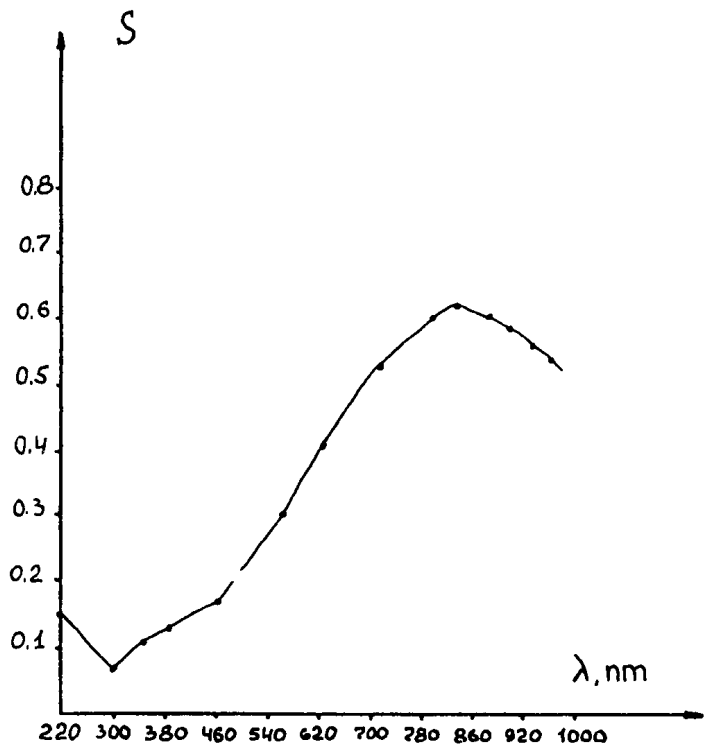

Fig.1.

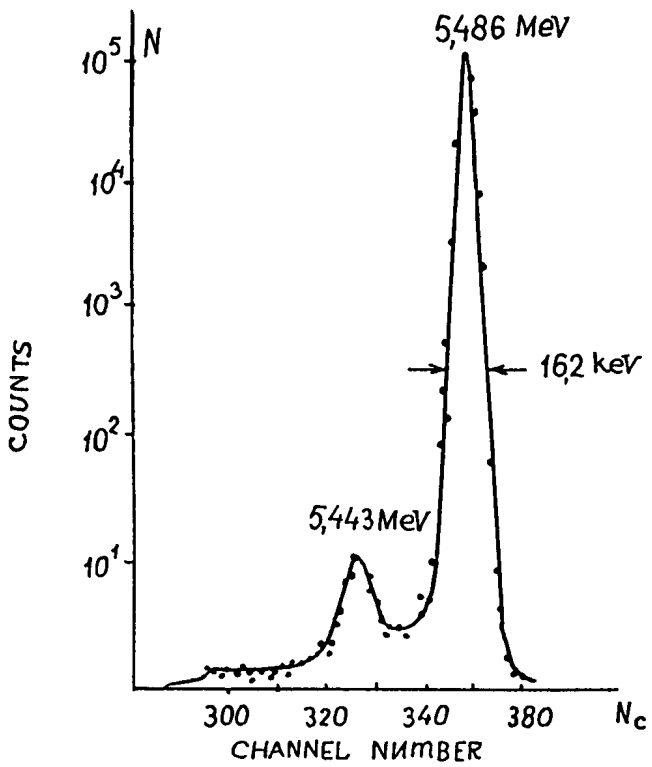

Fig.2.

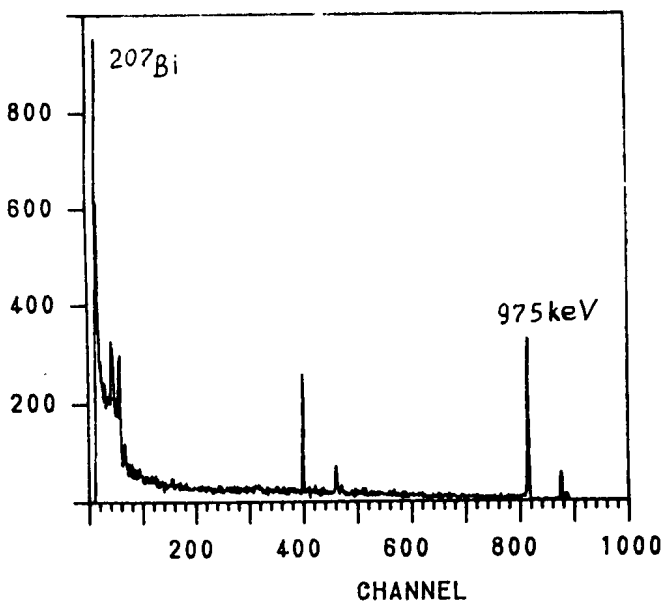

Fig.3.

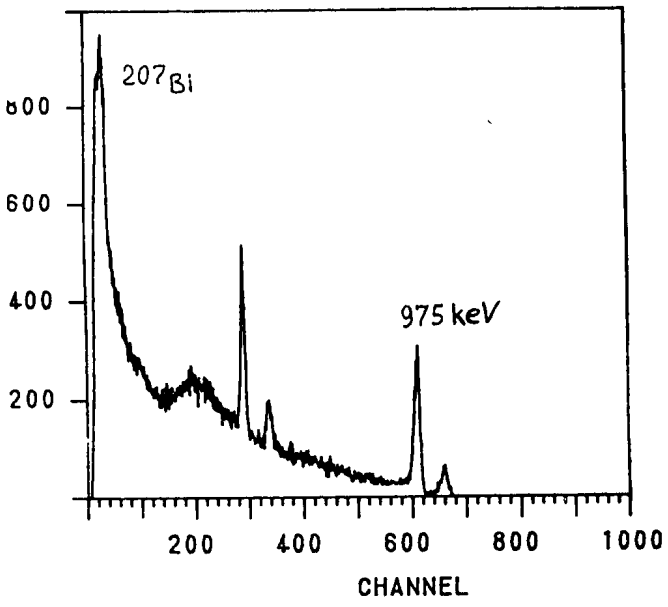

Fig.4.

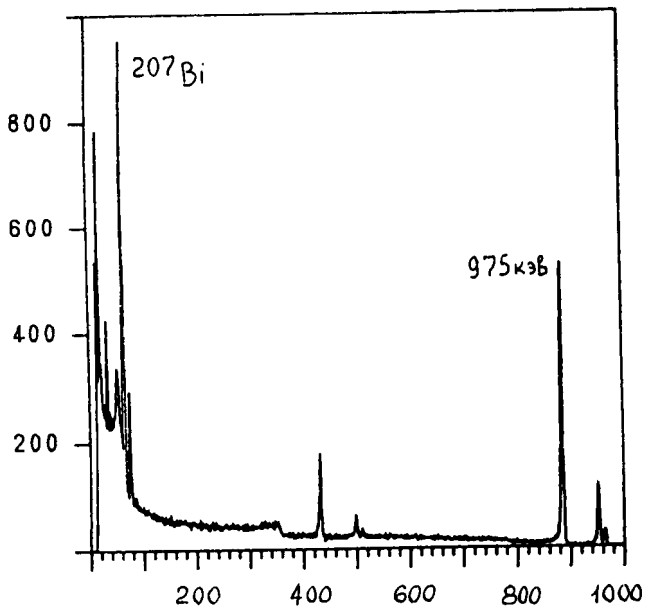

Fig.5.

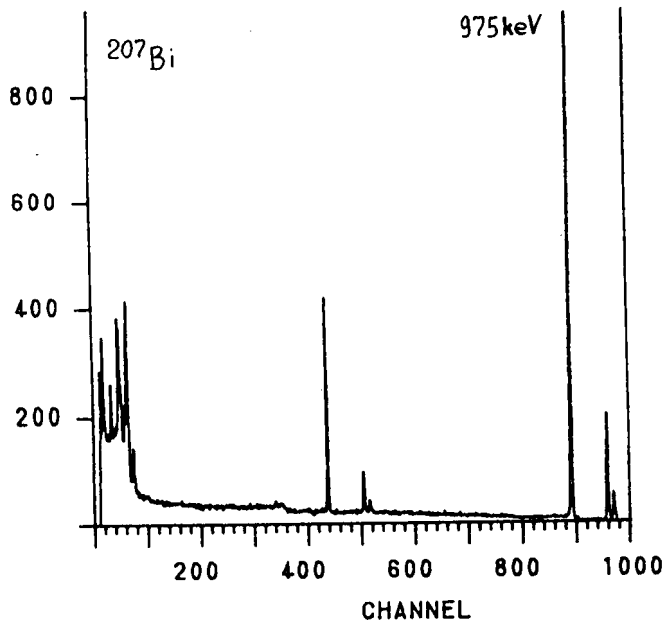

Fig.6.

Some type heterostructures consisting of high resistivity *n*- or *p*-crystalline silicon (c-Si) and hydrogenated amorphous silicon (a—Si:H) were fabricated. a—C:H films were deposited by means rf glow discharge decomposition of 25% SiH + 75% Ar gas mixture on substrate temperature 250° *C* with a deposition rate of 1.5 Å/*c* or by magnetron sputtering. A capacitively coupled of rf glow discharge decomposition process was used to produce a—C: H films from a 10% methane-argon gas mixture. All films were deposited at a power *P* = 15 *W* and substrate temperature of 226° *C*. Noninjecting contacts were formed by Au or Al evaporation [1].

Fig.1 shows spectral dependence ot the photocurrent of heterostructure a—Si: H / c—Si. It is clearly seen that the photosensivity in the 200—300 *nm* range is high enough. This range is very interesung for the work with scintillators.

Fig.2 shows typical energy spectrum of alpha-particles (^{241}Am) obtained at room temperature using a—Si: H/c—Si heterosructure

Fig.3—4 show detection possibility of conversion electrons at room and liquid nitrogen temperatures.

Fig.5—6 show the possibility of improving of conventional Si(Li) nuclear detectors by creating thin front and back windows. This is especially important for their use in $\Delta E - E$ telescope.

References

1. Aphanasyeva N.P., Derbin A.V., Kotina I.M. et al. Preprint LNPI-1759. Leningrad. 1991. P.35.