Lithium-Drifted Silicon Detector*

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A lithium-drifted silicon detector was constructed with a single crystal of 1.2 K\(\Omega\)-cm, p-type silicon. The energy resolution was estimated to be 3.7\% of 6.9 MeV proton.

\(T\) was the first time that the lithium-drifted detector was tried to construct in this laboratory. The detector was prepared as same as the methods of Ishii and Dearnaley et al.\(^\text{(1)}\). A single crystal of P-type silicon, of resistivity of

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\(1\) Dearnaley and Lewis, Nuclear Instruments and Methods 25, 239-243 (1964); Ishii, JAERI-M500.

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Fig. 2. Photograph of a completed detector.

Fig. 3. The characteristic curve of the detector.

Fig. 4. The spectrum of protons by means of $^{27}$Al($d,p)^{28}$Al reaction.
1.2 \text{K}\Omega \text{-cm} \text{ and minority carrier lifetime of } 1000 \mu \text{sec} \text{ was cut and lapped in the form of disk, of 5 mm in thickness and 20 mm in diameter. The crystal was cleaned and put in a vacuum evaporator (as shown in Fig. 1), the lithium was then evaporated so as to form an opaque film over the surface. In order to bring about diffusion of lithium into the silicon, the temperature of silicon wafer was raised slowly up to 400°C and was kept for ten minutes, then the heater supply was slowly turned down. By means of the electroless method, the crystal was then nickel-plated. After the two faces of the silicon wafer were maked with the pitch, the crystal was etched with CP-4 solution, then removed the pitch on the faces. With this crystal, the process of the lithium ion-drift was carried out. The crystal was kept in the silicon oil at the temperature of 130°C and the drifting voltage of about 400 volts. When the process of ion drift was completed, one of the faces was etched in CP-4 solution to remove the nickel-electrode and then standing for 2-3 days in a clean covered box. A gold electrode was deposited by vacuum evaporation on to the etched face. The detector was then completed and finally mounted as shown in Fig. 2. The characteristic curve of the detector is shown in Fig. 3. The energy resolution of the detector was tested by using the $^{28}\text{Al}(d,p)^{29}\text{Al}$ reaction which was induced by 1.9 MeV deuterons. The resolution was estimated to be about 3.756 of the 6.9 MeV proton. Fig. 4 shows the spectrum of protons.

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\item[(2)] Bridgers et al. \textit{Transistor Technology} 1 354 (1958).
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