RADIOACTIVE ION IMPLANTATION SYSTEM

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A radioactive ion implantation system was designed and manufactured to inverstigate the annealing behavior of implanted semiconductors; By the radioactive ion implantation by the system, the distribution of the implanted radioisotopes can easily be obtained by the measurement of the radioactivity in each removed layer which is repeated by the successive anodic oxidation and oxide-layer removal process by hydrofluoric acid. This procedure can, for example ,avoid uncertainty in the measurement by an ion mass analyser of implanted atom distributions,which is caused by a knock-on effect and a variation of ionization efficiency of the implanted atoms.

To minimize radiation exposure and contamination by radioactive materials, the radioactive ion implantation system must satisfy the followings; 1) radioactive contamination by the ion implantation system must be localized in limited part, 2) charge of radioisotopes into the ion gun must easily safely be performed and 3) the ion gun must be shielded to reduce radiation level around the system as low as possible. A schematic drawing of the system is shown in Fig.1. The system is different from commercial ion implantation systems; 1) an evacuation system was constructed from two oil diffusion pumps with a sorption vacuum pump to prevent radioactive materials from contaminating the laboratory atmospher, 2) Nielsen type ion gun with a larger dimension than the commercial ion gun was manufactured, as shown in Fig.2, for the purpose of easier cleaning, 3) a boat for charging the radioactive materials, as shown in Fig.3, was inserted into the oven in

the ion gun through the central hole of the back frange by aid of a rod with a lead radiation shield and 4) the ion source was surrounded by a lead shield of 5.0 cm in thickness.

The radiation dose rates at various parts around the system at 2 and 34 hrs after the radioactive arsenic of 0.6 Ci was charged into the ion gun were shown by the numbers with underline and double underline in Fig.1, respectively. Beam current measured on the target was 16 uA for Cd^+ and 11 uA for As^+ at 51 KeV.

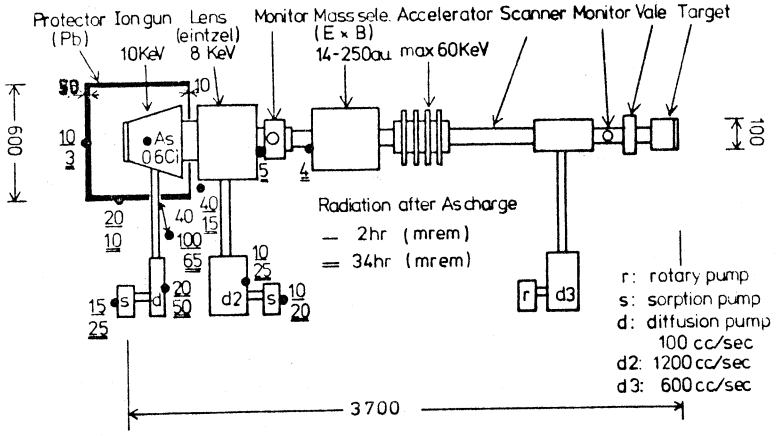

Fig.1 Radioactive-ion Implantation system.

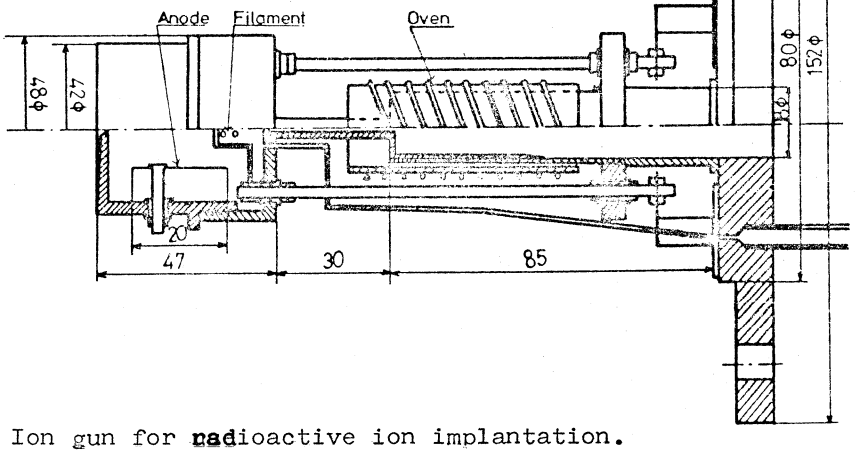

Fig.2 Ion gun for radioactive ion implantation.

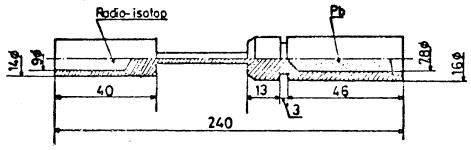

Fig.3 Boat for charging the radioactive materials.