

Report of the Design Approval and the Safety Issues of the Ion Accelerator for Manufacturing

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1. Introduction

The application of ion implantation technology has been extended to the field of semiconductor, as well as of metals, ceramics and polymers. A change in the characteristics of the surface that is required in industries is various. To manufacture these devices which are by requirements of industrial, anyone must be licensed by nuclear law; producing permit. And that device must be certified to safety through the design approval.

For the first time in domestic, Korea Multipurpose Accelerator Complex (KOMAC) has finished the producing facility inspection as well as the producing permit in August 2012 that can produce four types of radiation generator(RG).[1]

In this paper, we report the status and issues about the design approval of third one of four types.

2. Design for the Type 3 of the Ion Implanter

2.1 Producing Permit

The licensed four types are different according their component as shown in Figure 1 below. The ion implanter of the type 3 consists of ion source, accelerator tube and beam diagnostic unit.

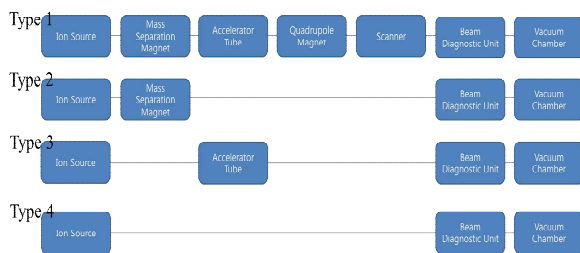


Fig. 1 The component of the 4 types producing permit

Type 1 and 2 are to be applied to a semiconductor production. Specially, type 2 is to be applied to a field which is needed a separated ion in low energy. Type 3 and 4 are consisted as simple as possible due to economy, is to be applied industrial application.

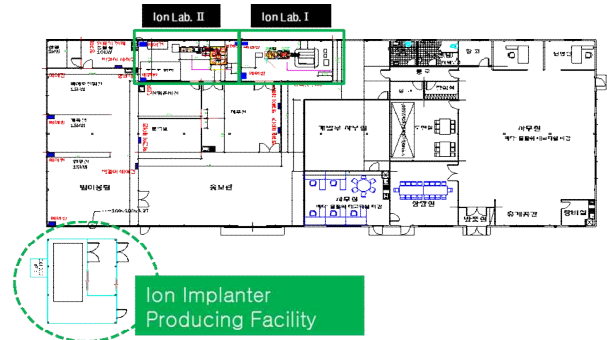


Fig. 2 The Facility for producing implanter

Table 1 Extracted Energy and Ion Source according to the Type

	Designed Energy and Current of the Ion	Ion Source Type
Type 1	300keV / ~10mA	Bernas / DuoPIGatron
Type 2	50keV / ~150mA	Bernas / Bucket
Type 3	200keV / ~100mA	DuoPIGatron
Type 4	50keV / ~1A	Bucket / DuoPIGatron

2.2 Overview of the design approval for the IMP03-01

The name of the implanter IMP03-01 means the first device that was licensed (design approval) as type 3. This industrial ion implanter (MP03-01) has been designed to improve the surface of non-semiconductor field with 30 mA / 90keV. To increase productivity, the vacuum chamber and the jig carrier were designed as inline system.

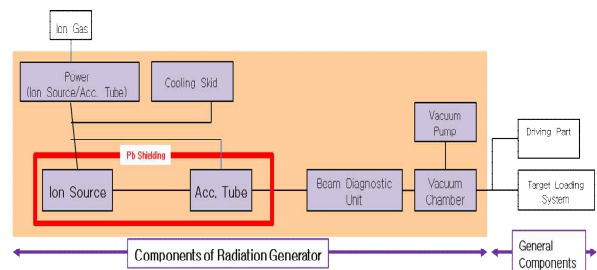


Fig. 3 Main components of IMP03-01

The main issues of design approval are to be about the design of interlock system for IMP03-01. If overcurrent occurs due to unexpected operation of IMP03-01, IMP03-01 has the system to block ion source power in order to prevent radiation exposure.

In addition, if all shielding components do not place in a normal position, the power of the IMP 03-01 is not to supply.

2.3 Inspection of Implanter for IMP03-01

The device fabrication inspection was mainly conducted as measure the cumulative dose and dose rate at each location as shown in Figure 5 below.

The ion source and acc. tube is fully sealed by Pb box to self-protection type. The faces of Pb box are consisted of that 4mm Pb surrounded with 1mm STS on both sides.

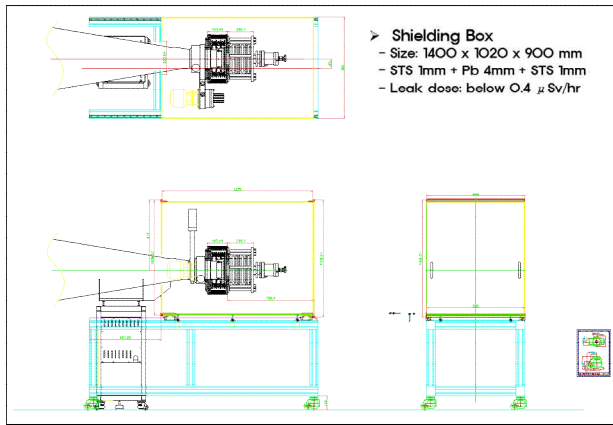


Fig. 4 Shielding layout

A cumulative dose (20 hours), as well as dose rate is below a background level at each position.

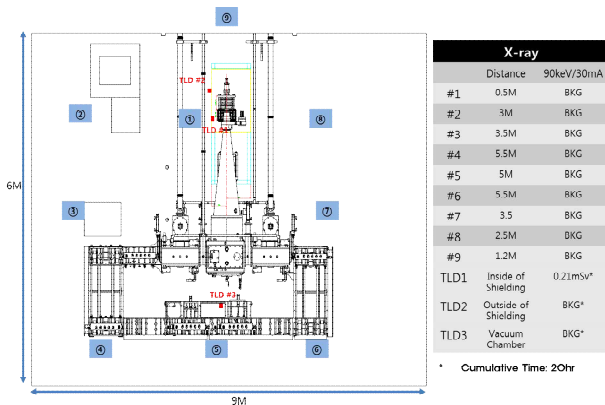


Fig. 5 Dose rate and cumulative dose at each position

3. Summary

Ion beam technology has been developed to improve properties of material surface over more than 4 decades.

To apply ion implanter at industrial field, it must have a big current and beam spread unit (technology). We have successfully developed 4 types of ion implanter. And then, by obtaining the design approval of RG, we prepared the basis of the technology transfer to industries. In this paper, the status of the design approval of RG was reported and was briefed on the first approved RG.

REFERENCES

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- [2] Enforcement Decree of the Act, Korea
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