Contribution ID: **274** Type: **Poster presentation**

Development of a Large RF Bucket Ion Source for Large Area Ion Beam Milling Processes to Fabricate Micro-structures

Wednesday 18 October 2017 18:45 (15 minutes)

Bucket ion sources for neutral beam injectors [1] have been applied to industrial applications such as ion beam milling processes [2] for fabrication of micro-structures of hard disk drives, semiconductor devices, piezoelectric devices etc. Large area ion beams (maximum diameter of 580 mm) by the sources could enable high-throughput commercial processes in factories [3]. However, lifetime of the filaments limits the longest available operation time between maintenances to as much as several tens hours.
A novel RF bucket ion source was developed for higher availability without filaments and active ion species like oxygen. Conventional RF inductively coupled plasma sources have no magnet to confine plasma on the side wall inside the RF coil and it can cause plasma loss on the side wall and sputtering of the side wall, which lead to lower plasma production efficiency and shorter life time due to the sputtering.
In the developed RF bucket ion source, multi-cusp magnets are set inside the RF coil between slits on the Faraday shield around the discharge chamber to confine plasma [4]. The RF discharge chamber is an insulator cylinder with the surrounding Faraday shield, the magnets and the RF coil. This configuration reduces plasma loss and sputtering of the side wall. It enables high throughput process with long available operation time between maintenances and does not cause any disturbance on inductive coupling of RF power to plasma.
The RF bucket sources produced large area ion beams with beam extraction area of 300 mm diameter. Ar ion beam current density is more than 1 mA/cm^2 and beam current is around 1 A. The RF bucket ion sorces have been installed in the ion beam milling systems, which are continuously operating for 24 hours per day without stop at commercial industrial factories for fabrication of micro-structures. It could also produce active ion species such as O, F and others, which are expected to contribute to other novel application processes.

Acknowledgement

The authors would like to thank Hitachi, Ltd. for author's original ion source development done when they are working in Hitachi, Ltd.

References

[1] Y. Okumura, et. al., Rev. Sci. Instrum., 55 (1984) 1.

[2] Y. Ono, et. al., J. Vac. Sci. Technol. A4 (1986) 788.

[3] http://www.hitachi-hightech.com/hsl/product_detail/?pn=hsl_ind_man_ion_002

[4] Masanobu Tanaka, et. al., Japan Patent, JPA 2008-128887.

Primary authors: Dr TANAKA, Masanobu (Kumamoto University); Mr HIROO, Ookawa (Y.A.C. BEAM Co. , Ltd.)

Presenter: Dr TANAKA, Masanobu (Kumamoto University)

Session Classification: Poster Session 3

Track Classification: Applications and related technologies