

Development of a linear-shape microwave plasma source

長尺マイクロ波プラズマ源の開発

Yusuke Kuwata, Shu Ito, Toshiro Kasuya and Motoi Wada

鎌田雄介, 伊藤修, 粕谷俊郎, 和田元

Doshisha University Faculty of Science and Engineering

1-3, Tataradani, Kyoutanabe-city, Kyoto 610-0394, Japan

同志社大学理工学部 〒610-0394 京都府京田辺市多々羅谷1-3

A microwave plasma excitation structure to realize homogeneous particle flux in one dimension has been designed out of a single straight antenna coupled to a magnetic field. The antenna is isolated to the plasma exposure with an alumina ceramic sleeve, and the microwave electric field formed between the antenna and the chamber wall crosses the magnetic field produced by permanent magnets nearly perpendicularly. The system is capable of producing a plasma over 50 cm length and 10 cm width, and the uniformity of the plasma produced by 2.45 GHz microwave power is being investigated.

1. Research outline

Ionized Plasmas are utilized by many industrial machines in modern high-technology society. Especially, semiconductor and flat panel display production machines use many plasma processes. These machines requires plasma source characteristics more suitable to mass production of commodities. These include, for example, large plasma process area, long life time and stability.

In this study, development of a microwave plasma device capable of producing several tens centimeter long, over 50 cm length and 10 cm width, is attempted. The study aims to establish uniform plasma generation with enough plasma flux commercial products.

A long version plasma source has been already developed [1], but a plasma source of this type is not directly applicable to a semiconductor production line, because of the structures that requires complexity at the time of maintenance. Besides, the required mean time for maintenance is not long enough for customers' need.

We are developing a smaller size liner-shaped microwave plasma source and doing research on plasma parameters to prepare much larger size plasma source. The performance will be investigated and compared with other types of multi-cusp liner-shape plasma source [2,3] to identify the merits and demerits of the present system.

2. Plasma source development

Fig. 1 show a cross sectional view the developed of the 20 cm linear-shape microwave plasma source being developed. The plasma source has two microwave input attached to antennas and rows of permanent magnets for plasma generation. Two

antennas are set parallel to the long side of the plasma source across plasma generation area and the direction of microwave propagator are opposite.

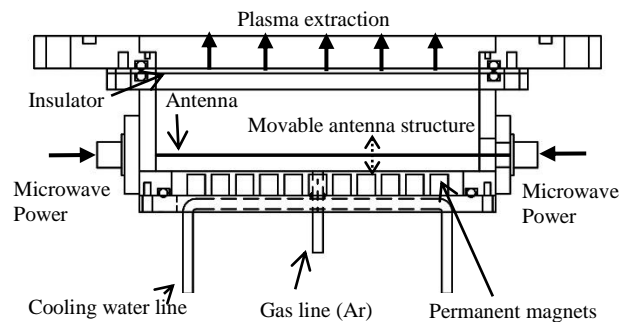


Fig.1. Cross section of the linear-shape plasma source.

Those antenna can move in vertical direction so as to research plasma characteristics at each vertical antenna position. Microwave generator supplies power to both antennas.

A single permanent magnets are arranged parallel to the antenna, with the shape of 3 mm diameter and 10 mm height. Two magnetic materials, Nd-Fe and Sm-Co, are tested for their different magnetic field intensity at the surface of an antenna.

References

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