

Generation of Micro Plasma Surrounded by Solid Wall for Sub-ECR Condition

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Abstract

Microsize plasma sources for the sub ECR condition have been investigated at low-pressure range less than 0.1Torr. It is found that the 2.45GHz microwave discharge could easily occurred by the minimum ignition power at just below of ECR magnetic flux density in narrow space surrounded by solid wall.

Keywords Microplasma, Sub-ECR, Minimum Ignition Power

Introduction

Low-pressure microplasma generation has been attempted to perform the inner coating of narrow tube by the sputtering process. We are developing the low-pressure microplasma to realize the inner coating of narrow tube by the sputter processing. In the present paper, we will report on the results of minimum Ignition power between the 2nd harmonic ECR and ECR conditions

Experiments

Figure 1 shows the experimental setup. The Microwave source of 2.45GHz is emitted in the TEM mode. so that the microwave can propagate through metallic tube of any size.

The diameter of an inner electrode is 5mm, and the gap length has been kept by outer electrode of 16~9mm of diameter. And the plasma generation point is located about 25mm from

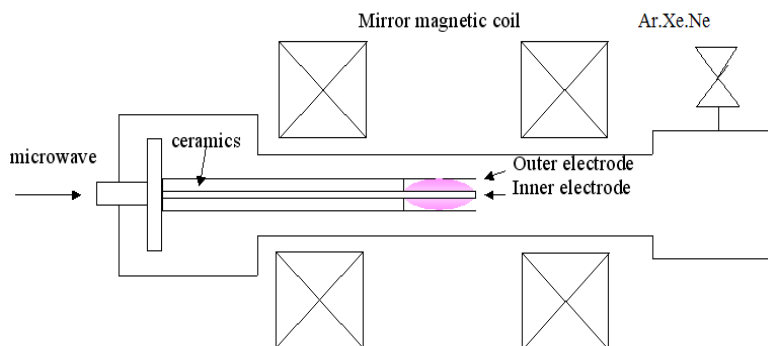


Fig1 experimental setup

the edge of the electrodes. It is located in the center of the mirror magnetic coil. A ceramics is inserted other than the portion of the plasma generation. The minimum ignition power was determined by plasma discharge measurements

Results and Discussions

As a result of experiments, we succeeded the microplasma generation for the low pressure conditions of 10mTorr. Figure 2 shows that the magnetic field dependence of the minimum ignition power in Ar, Xe and Ne gases. The plasma has been mainly generated for the condition of Sub- ECR ($\omega_c/\omega=0.8\sim0.9$). In the figure, it is found that the minimum ignition power is less than 5W in Sub-ECR condition. It seems that the determination of minimum ignition power was inferred the collision cross-section of each gas for high pressure condition, and the ionization energy of gas in low pressure condition.

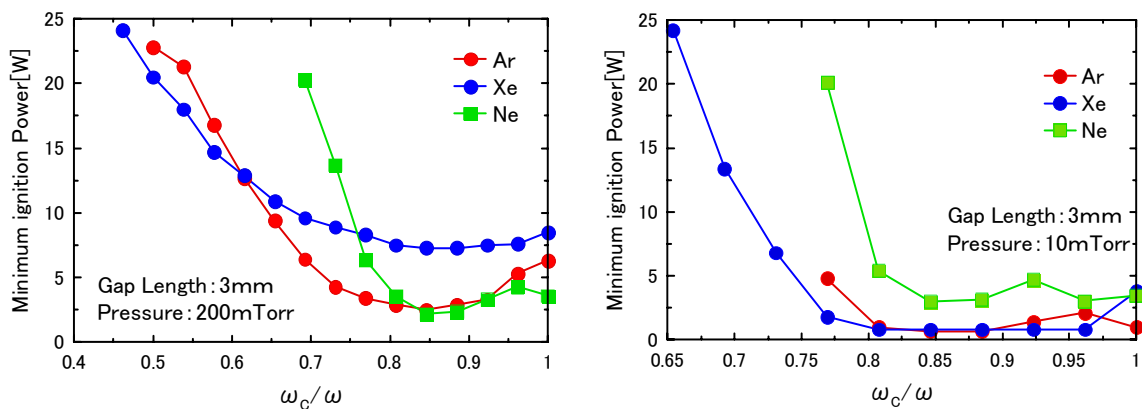


Fig.2 Magnetic flux density dependence of minimum Ignition in Ar, Xe and Ne gases for 200mTorr and 10mTorr.

Conclusions

The purpose of this research is the low-pressure micro plasma generation for the inner coating of narrow tubes. As the result of the minimum ignition power measurement, for the gap length of 5.5~2.0mm, the minimum ignition power for plasma generation has been confirmed at Sub-ECR conditions ($\omega_c/\omega=0.8\sim0.9$), rather than the second harmonic ECR or ECR conditions.