The Korean Institute of Surface Engineering, Spring Meeting, Seoul, Korea, May, 2001/4/30

그리드 전압을 이용한 유도결합 플라즈마에서 전자 온도 및 이온 비율 제어

Control of electron temperature and ion ratios in inductively coupled plasma using grid bias voltage.

K. H. Bai, J. I. Hong*, S. J. Ryu, H. Y. Chang.
(Department of Physics, Korea Advanced Institute of Science and Technology. *Samsung electronics)

1. Introduction

There is many researches about the SiO_2 etching using fluorocarbon gases (CF_4, C_2F_6, C_4F_8) in inductively coupled plasma (ICP). Using ICP as an etching source makes it possible to obtain fast and high anisotropic etch, but there are still many problems to be solved. The most serious problem is a low etching selectivity of SiO_2 to Si underlayer. The main selectivity control parameter of is believed to be the ratio of the CFx radical density to the fluorine atom (F) density in the plasma[1]. Many methods for this problem have been suggested. Controlling the electron temperature to reduce the dissociation rate and to increase the etch selectivity is one of the solutions. Two methods for electron temperature control have been generally suggested. One is using pulse-modulated input power, and the other is using a coarse grid set biased with dc voltage in the Q-machine plasma[2]. Recently it has been shown that the electron temperature can be controlled from 2 to 0.5 eV by a grid also in ICP[3]. We apply the grid method to control the electron temperature in Ar/CF_4 plasma. We also measure the ratios of ions as a function of dc biased voltage using a Quadruple Mass Spectroscope (QMS) .

2. Experimental method.

A grid is placed in the middle of our chamber, so the grid divide the whole discharge chamber into region I and II. We bias DC voltage on the grid from -30 to 30 V. We measure plasma parameters and ion ratios using langmuir probe and QMS in Ar/CF_4.

3. Result.

Electron temperature is controlled from 2.5 to 0.5 eV and ion ratios are also controlled. The variaton of ion ratio and electron temperature have similar profile with each other. Electron temperature is also a function of a grid mesh size and pressure.

1-H. Kazumi, R. Hamasaki, and K. Tago, *Plasma Sources Sci. Technol.* **5** (1996) 200.

2- K. Kato, S. Lizuka, and N. Sato, *Appl. Phys. Lett.* **65** (1994) 816.

3- J. I. Hong, S. H. Seo, S. S. Kim, N. S. Yoon, C. S. Chang, and H. Y. Chang. *Phys. Plasma*. **6** (1999) 1017.