

150 kHz帯大電力バーストパルスICPによるシリコンウエハエッチング Silicon wafer etching by burst-mode high-power ICP with 150 kHz frequency band

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Introduction

Inductively-coupled plasma (ICP) has been widely used for plasma processing of materials such as deposition of thin film and etching because of its various advantages [1]. A low-pressure high-density ICP source was developed using a several kV-order power source operated by a burst mode [2]. In this study, a performance of a silicon wafer etching using a burst pulse high-power ICP plasma source was investigated.

Experimental setup

Fig. 1 shows a schematic of the experimental setup. The vacuum chamber consists of two cross glass tubes. A solenoid coil (36 turn, length 30 mm, 91 μ H) is wound on the glass tube. The capacitor of 12 nF is connected to the coil in parallel and used as a resonance circuit with the inductor. A 200 μ s wide burst of 152 kHz power supply is employed to generate ICP with repetition rate of 50 Hz. Ar and CF₄ gases are supplied through a mass flow controller into the chamber with gas flow rate of 11.3 and 5.0 sccm, respectively. The gas pressure inside the chamber is fixed at 1.5 Pa. A 200 μ s wide pulsed negative voltage is applied to the target electrode containing Si wafer with repetition rate of 50 Hz.

Results

Fig. 2 shows the etching rate as a function of bias voltage. The processing time of the Si wafer is 20 minutes. The etching rate increases linearly with increasing the bias voltage. The maximum value of etching rate was 0.23 μ m/min.

References

- [1] J.Hoopwood, Plasma Sources Sci. T. **1**, 109 (1992)
[2] K. Yukimura *et al.*, IEEE Trans. Plasma Sci., **39**, 3085 (2011)

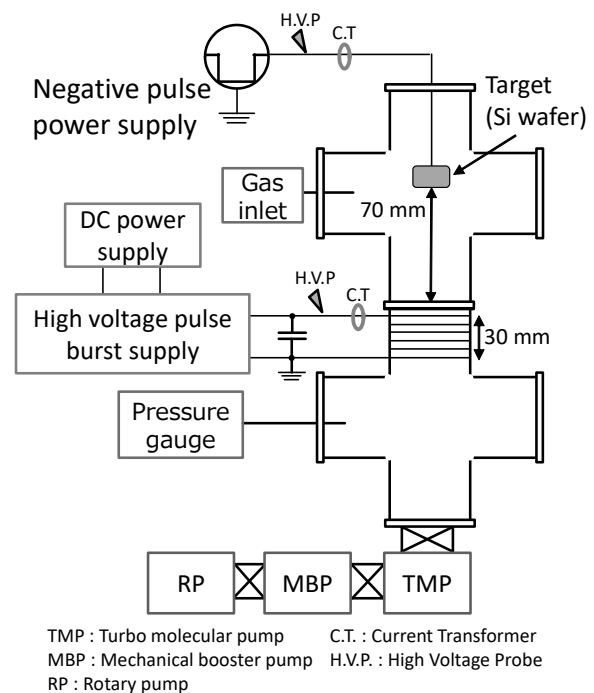


Fig. 1 Schematic of the experimental apparatus.

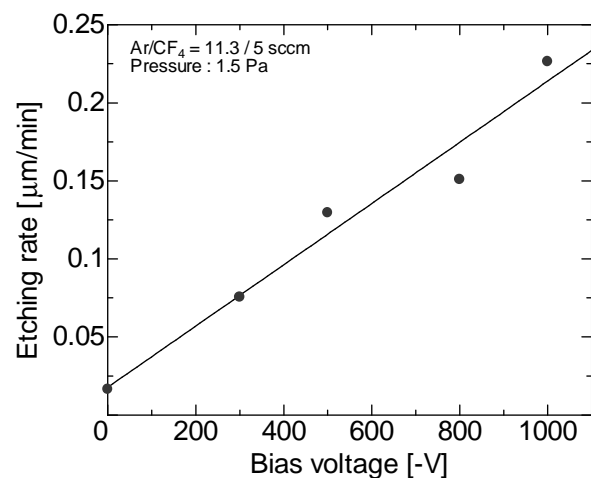


Fig. 2 Etching rate as a function of bias voltage.