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High bias voltage plasma with electron beam INSHIK BAE, HONGYOUNG CHANG[1], Korea Adv Inst of Sci Tech — A deep trench with high aspect ratio is required in the etch process, and it is well known that ion flux and energy can be independently controlled by means of dual or triple frequency. However, multi frequency capacitively coupled plasma (CCP) has a few problems to achieve high aspect ratio, such as surface charging and power coupling to bias voltage as well as interference between the frequencies. In this study, a new type of CCP, which is modified by using electron beam, is introduced. Low frequency of 400 kHz is used to generate plasma and to achieve high bias voltage in CCP. Electron beam, which is generated by thermal tungsten filament, is used to provide excess electrons. Because of excess electrons, the bias voltage of the powered electrode becomes extremely high to balance between electron and ion fluxes at the electrode. The effects of pressure, electron beam current, beam energy, and RF power in this phenomenon are carefully examined. A bias voltage which is almost same as a voltage amplitude of the RF power is obtained when enough number of electrons are supplied. This method can be used to generate high energy ions in etching process, and provides a more convenient and independent control of ion energy.

[1]Academic advisor

Inshik Bae
Korea Adv Inst of Sci
Tech

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