Seminar

Institute for Plasma Research

Title : Studies of magnetically constricted anode plasma source

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Time : 11.00 AM

Venue : Seminar Hall, IPR

Abstract :

Plasma is quasi-neutral medium, generally bounded by negatively charged boundaries due to highly mobile electrons. These boundaries usually have ion sheaths, however in certain circumstances the electron sheath do form near an electrode. Such electrode is subject to very large flux of electrons, consequently draws large electron saturation current, for this reason they are smaller in dimension. It has been observed that these electron sheaths near small electrode can transform in to a so called fireball. The fireball is formed by the ionization which neutralizes the negative space charge. The experimental studies of this fireball is difficult partly because small size of the structure, typically 1-2 cm which makes probing difficult. We have devised an experiment to create fireball on relatively large anode of DC discharge. The magnetic field is used to constrict the effective area of the anode, the device is similar to conventional magnetron sputtering unit. We have found that a large fireball 4-7 cm forms near the anode in mainly magnetic field free region. The fireball is separated by a potential double layer of about the ionization potential from the bulk plasma. The plasma density inside the fireball is 1×10^{10} cm^{-3} , which is about an order of magnitude higher than average bulk plasma density. The inside of fireball has two temperature electron population typical of such fireball. The device however is stable only in low pressure regime. In pressure above 0.05 mbar it shows the mode transition to another stable regime. The two mode are defined as C-Mode and P-Mode, respectively. The high pressure P-Mode shows low frequency oscillations in the range of few kHz. This device in C-Mode can be potentially used as miniature broad beam ion source for various materials processing application. An experiment was carried out to demonstrate formation of structured nanodots on the GaSb substrate with excellent hydrophobicity.