Overview of Current and Past IEC Research in TITech

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IEC research in Tokyo Institute of Technology (TITech) started with a spherical device in 1997. Fundamental characteristics of electrical discharge and NPR were investigated. Energy (velocity) of charge exchanged neutral hydrogen atom was measured by Doppler shift and confirmed to be about 2/3 of applied voltage. From the Stark broadening electron density of core plasma was also estimated.

In the case of spherical device neutron flux density is inversely proportional to square of the distance from the device. To increase the neutron flux density near the device, we have made a cylindrical device with coaxial electrodes, by which the neutron flux density decreases linearly with increasing the distance from the device. The electric field distribution in the cylindrical device is axisymmetric even on the both ends and it can avoid the effect of feed through observed in a spherical device. The device was also installed with a line cusp magnetic field [1, 2], which acts as an ion source. This configuration contributed to increase the beam-beam reaction rate in low pressure operation. Pulsed operation with applied voltage of 80 kV and current o 15 A attained NPR of 7.4×10^9 n/s [3].

Then we have developed a double cylindrical device, which was intended to investigate the feasibility of being used for neutron transmutation doping to get high quality Si impurity semiconductor doped with phosphorus. The device can irradiate materials in its center hole with uniform neutron flux. Thus we have now 3 types of IEC devices.

Using cylindrical devices the effect of magnetic fields including a uniform [4] or an azimuthal cusp magnetic field [5] on the low pressure operation are recently investigated to confirm the beam-beam reaction.

The results obtained by using these devices will be presented at the workshop.

References

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