Experimental Results from an IEC Device Employing a 5-stage High Voltage Feedthrough

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The length of ion trajectory in our extremely low pressure IEC device is much less than mean free path because ion recirculation is limited by the field asymmetry induced by the high-voltage feedthrough to the central cathode grid. In order to prevent arcing, the bore size of the feedthrough port needs to be larger for a higher voltage applied by a single-stage feedthrough. However this modification gives rise to asymmetry in the electric field.

In order to apply high bias voltage up to -200 kV and to improve the spherical symmetry in the electric field distribution, we designed a 5-stage high-voltage feedthrough to be employed in the IEC device. At this design, the potential difference is -40 kV for each stage. The design showed that the maximum electric field on each electrode surfaces is less than 9 MV/m, which is within the acceptable electric field limit. Numerical simulations of the ion trajectories shows that the averaged recirculation number of injected ions into cathode is 3 times as large as that in the present experimental device [1].

Followed by this design, we constructed an experimental IEC device employing a newly designed 5-stage high voltage feedthrough. We have conducted a high-voltage conditioning of the developed device under vacuum condition and we have successfully achieved a bias of -180 kV, which is much higher than the maximum limit of -80 kV by use of the original single-stage feedthrough. We have also applied high voltage under glow mode. We will discuss the relation between the applied voltage and the neutron production rate at high voltage.

[1]Kai Masuda et al., Fusion Science and Technology, vol.60, 2011, p.625