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Research on Small IEC Device and Parallel Discharge
IEC 装置の小型化および並列放電の研究

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IEC deice serves as simple and low-cost neutron source. The production rate of neutron is not sufficient for the practical application of the radiation therapy or the neutron irradiation experiment. To enhance the ability of neutron production of this device, the miniaturization of electrodes and parallel operation are researched. This study is based on the results of original simulation.

1. IEC device

IEC device produces neutron by Inertial Electrostatic Confinement (IEC) fusion. This device generates the plasma of deuterium gas using glow discharge at about 1 Pa. The spherical electrodes which are applied 50kV of voltage enclose the plasma electrostatically. High energy deuterium ion can collide with neutral deuterium gas, neutron is produced by nuclear fusion of D-D. The IEC device serves as a simple and low-cost neutron source.

2. This Study

According to the previous particle simulation of this IEC device, the discharge characteristic is improved by miniaturization of anode and cathode. Typical size of anode is about 250mm in diameter and one of cathode is about 65mm in diameter. In this study, 80mm anode and 20mm cathode are used. These seizes are the optimal size from the simulation. Anode is constructed by stainless wire. Cross point of stainless wires are connected each other by spot welding. Cathode is constructed by winding molybdenum wire. At beginning of this experiment, the voltage of more than 30kV could not be applied. IEC device could not produce much neutron to measure by 3He counter. After the improvement of electrode structure near the feed through, over the 30kV voltage can be applied. The detailed results of neutron production rate with 80mm anode will be presented at the workshop.

Figure 2 is the photo of parallel discharge with two small IEC devices. Double spherical anode is piled vertically. The discharge current is 10mA, the applied voltage is 5.6kV. The production rate of neutron with this double anode is almost twice of single small anode. The neutron will be increased easily by the adding the more small IEC device.

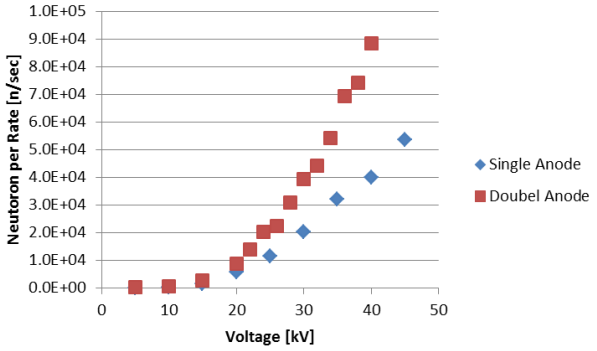

Fig.1. Neutron production Rate

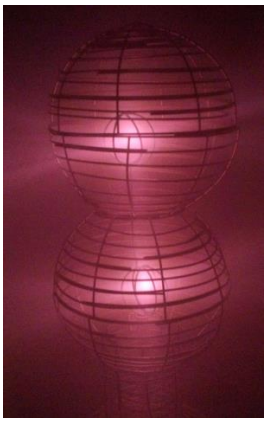

Fig.2. A photo of paralle discharge