Discharge Simulation on Miniaturization of IECF Device

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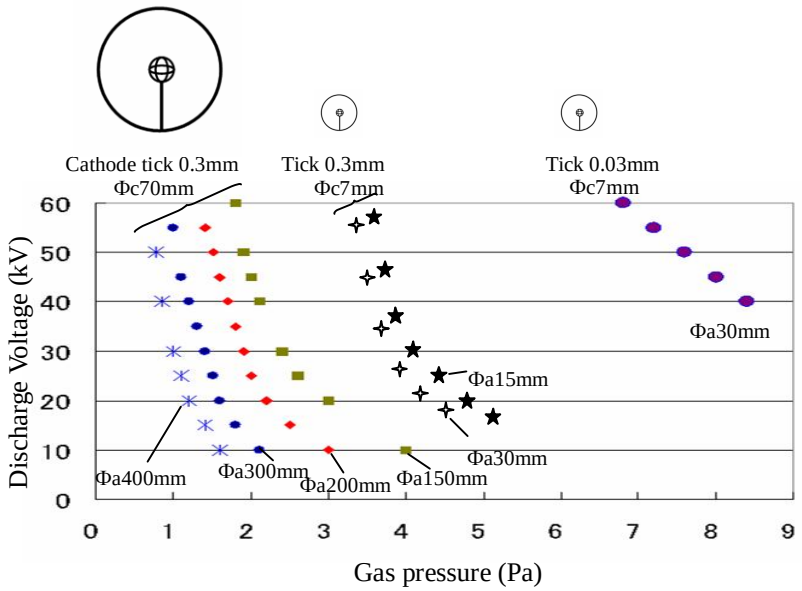
IECF researchers have been studied to get more neutron production rate, using more expensive and more powerful power supply and larger vacuum chamber. The larger anode of IEC device makes possible of lower gas pressure and higher voltage operation. On the other hand, the research of downsizing about IECF device has not been studied. The glow discharge in small sized IECF device has been recognized very difficult because of transition to arc discharge.

The discharge characteristic of miniaturized IECF device is investigated by the particle simulation. The three-dimensional Monte Carlo particle in cell code including the atomic processes is used for investigation of the discharge. The finite difference method with the 1 mm spatial mesh is used for the calculation. Deuterium ions (D^+, D_2^+, D_3^+), fast neutrals (D^0, D_2^0) and electrons (e^-) are taken as tracking particles. The initially 1000 particles of each kind of ion species and 3000 electrons are distributed uniformly within the anode. After pushing each particle, the atomic and molecular collisions and the elastic collisions are taken into account by Monte Carlo method. When the total number of ions becomes more than 60000, it is recognized that'discharge' is occurred in this discharge simulation.

Following figure shows the calculation results of discharge characteristics comparing with device's different size. Even in 1/10 scale of IECF device (30mm anode) can be discharged. The neutron production rate of compact IECF device is almost same or slightly large.



[1] H. Osawa, T. Tabata, M. Ohnishi: Fusion Sci. Technol.**47**(2005) p.1270-1273