Improvement of the Neutron Production Rate of IEC Fusion Device by the Fusion Reaction on the Inner Surface of the IEC Chamber

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Abstract:

Neutrons are generated in the inertial electrostatic confinement (IEC) device through different types of fusion reactions of the fuel gas such as deuterium (D) and tritium (T). Fusion in the IEC device takes place via various kinds of collisions like beam-beam collision, beam-background gas collision, and beam-target collision on the electrode surfaces. Two identical anodes for the IEC chamber made from titanium (Ti) and SUS-316L stainless steel (SS) are used to study the effect of the anode material on the neutron production rate (NPR). The NPRs from the chambers are measured at different applied powers. The achieved NPRs, so far, for Ti and SS are $8.9 \times 10^7$ n/s at 5.25 kW (75 kV, 70 mA) and $2.8 \times 10^7$ n/s at 10.5 kW (70 kV, 150 mA), respectively. The normalized NPR (NPR rated to the cathode current) from the Ti chamber is three to four times higher than that from the SS chamber. We observed a better NPR for the Ti chamber compared with the SS chamber. This is explained by the fusion reaction occurring between the neutrals and D atoms adsorbed/embedded on the inner surface of the anode. Moreover, the Ti chamber shows an improvement of the NPR as a function of the operating time ranging from 1.5 to 1.75 after 25 h from the first discharge.

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