EFFECT OF AMBIENT PLASMA PROPERTIES ON ANODE SPOT IN AN INDUCTIVELY COUPLED PLASMA

Yeong-Shin Park, Yuna Lee, Da-Hye Choi, Kyung-Jae Chung and Y.S. Hwang

Department of Nuclear Engineering, Seoul National University, Seoul 151-742, Korea

Anode spot in front of a positively biased electrode immersed in an inductively coupled plasma has been investigated in terms of ambient plasma properties. As varying operating conditions of the ambient inductively coupled plasma, the anode spot properties are measured by retarding field energy analyzer and Langmuir probe, and compared with numerical simulation based on the double layer theory. Diagnostic results show that the anode spot contains two groups of electrons: thermal electrons generated in the anode spot and drifted electrons from the ambient plasma. The drift electrons have the same thermal electron temperature with electrons in the ambient plasma while their drift energies are analogous to the potential difference between the anode spot and the ambient plasma. Both electrons are observed to contribute to the current flowing to the positively biased electrode, showing measured electron energy distribution with drifting components. The electron density of the anode spot as well as the bias electrode follows the ambient plasma density. Measured density of the anode spot is always higher than that of the ambient plasma, which has not been explained by double layer theory with Langmuir condition considering drift electrons and drift ions. However, numerical simulation including the thermal electrons in the anode spot shows that the density ratio of the anode spot to the ambient plasma could be higher than unity. The present study describing the anode spot properties and its correlation with ambient plasma will contribute to utilize the anode spot in various applications.

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