GEC09-2009-000150

Abstract for an Invited Paper
for the GEC09 Meeting of
the American Physical Society

Incorporating swarm data into plasma models and plasma surface interactions

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Since the mid-1980s, modeling of non-equilibrium plasmas in a collisional region driven at radio frequency has been developed at pressure greater than ∼Pa. The collisional plasma has distinct characteristics induced by a quantum property of each of feed gas molecules through collisions with electrons or heavy particles. That is, there exists a proper function caused by chemically active radicals, negative-ions, and radiations based on a molecular quantum structure through short-range interactions mainly with electrons. This differs from high-density, collisionless plasma controlled by the long-range Coulomb interaction. The quantum property in the form of the collision cross section is the first essential through swarm parameters in order to investigate the collisional plasma structure and to predict the function. These structure and function, of course, appear under a self- organized spatiotemporal distribution of electrons and positive ions subject to electromagnetic theory, i.e., bulk-plasma and ion-sheath. In a plasma interacting with a surface, the flux, energy and angle of particles incident on a surface are basic quantities. It will be helpful to learn the limits of the swarm data in a quasi-equilibrium situation and to find a way out of the difficulty, when we predict the collisional plasma, the function, and related surface processes. In this talk we will discuss some of these experiences in the case of space and time varying radiofrequency plasma and the micro/nano-surface processes. This work is partly supported by Global-COE program in Keio University, granted by MEXT Japan.