[P-05]
Heating Mode Transition in the Capacitive Mode of Inductively Coupled Plasma and the Electron Temperature Change During the E-H transition

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The evolution of the electron energy distribution function (EEDF) against pressure is investigated in the capacitive mode and the inductive mode of inductively coupled plasma (ICP). In the capacitive mode, a significant change in the EEDFs is observed: a Bi-Maxwellian EEDF at low pressure (<10 mTorr) evolves into a Druyvestein-like EEDF at high pressure(>50 mTorr) in the capacitive mode (low-density mode) while the EEDFs in the inductive mode (high-density mode) does not evolve like in the capacitive mode due to high electron-electron collisions. This EEDF transition in the capacitive mode of ICP is similar to that in the capacitive coupled plasma (CCP) reported in Ref. [V. A. Godyak and R. B. Piejak, Phys. Rev. Lett. 65, 996(1990)] as pressure increases. This observation directly shows that the electron heating mechanism of the capacitive mode in the ICP is the same as that in the CCP, as expected.

We measured electron energy distribution functions (EEDFs) during the E-H transition at various pressures (2-100 mTorr). It was found that at low pressure (collisionless regime) the electron temperature from the EEDF increases about 3 times during the E-H transition while at high pressure (collisional regime) it slightly decreases. This electron temperature changes during the E-H transition seem to be related to the transition hysteresis. This electron temperature change during the transition should be considered in the models to be more realistic