ヘリコンプラズマ放電の数値シミュレーション

諫山 翔伍 [1]; 羽田 亨 [1]; 篠原 俊二郎 [2]
[1] 九大総理工; [2] 東京農工大・工

Numerical simulation of helicon plasma discharge

Shogo Isayama[1]; Tohru Hada[1]; Shunjiro Shinohara[2]
[1] ESST, Kyushu Univ; [2] Inst. Eng, TUAT

Helicon plasma is a high-density and low-temperature plasma generated by the electromagnetic (helicon) wave excited in the plasma. The helicon plasma is expected to be useful for various applications. On the other hand, there still remain a number of unsolved important physical issues on the helicon plasma. One of them is the abrupt transition of the plasma density (the helicon jump) from the low -density (~10^{17} /m^3) to the high - density (~10^{19} /m^3) regime as the input power is gradually increased.

Some theoretical models (K. P. Shamrai, 1997, F. F. Chen, 2007) predict that the transition of discharge modes is closely related to the stability of the steady state, in which the power absorbed and lost by the electrons is balanced. However, the physical mechanism behind the mode transition needs to be further investigated, since in previous models, such seemingly important effects are neglected as the plasma transport, spatial inhomogeneity of the plasma density and the electron temperature. In the present research, we study the mode transition process of the helicon discharge by constructing a fluid discharge model which includes the wave excitation, electron heating, the power balance between the absorbed energy and the energy loss, and the effects of plasma transport.