

Measurement of Electron-neutral Collision Frequency Using Wave-cutoff Method

유광호, 나병근, 김대웅, 이윤성, 박기정

Department of Physics, Korea Advanced Institute of Science And Technology

Electron-neutral collision frequency is one of the important parameters in the plasma physics and in industrial plasma engineering. We can understand the momentum, energy, and charge transport properties of the plasma using electron-neutral collision frequency.[1]

The wave-cutoff method is a diagnostic method for the electron density measurement, but the cut-off peak value depends on gas pressure. The wave-cutoff signal becomes unclear as increasing gas pressure. The reason of pressure dependence is that the electron-neutral collision disturbs electron motion so that microwave can propagate through plasma at plasma frequency.[2]

Using the pressure dependence of wave-cutoff method we can find the electron-neutral collision frequency. At first we tried to confirm this method using well known gas such as Ar. The cutoff signal decrease as increasing gas pressure (the simulation result). The wave-cutoff signal is unclear at a gas pressure of 500 mTorr. (electron density $1.0 \times 10^{10} /\text{cm}^3$, electron temperature 1.7 eV, electron -neutral collision frequency ~ 1 GHz). In this condition, the electron-neutral collision frequency is closed to the wave-cutoff frequency.

References

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- [2] H. S. Jun, Y. S. Lee, B. K. Na, H. Y. Chang, Phys. Plasmas 15, 124504 (2008).

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