

Fast Measurement using Wave-Cutoff Method

서상훈, 나병근, 유광호, 장홍영

KAIST

The wave-cutoff tool is a new diagnostic method to measure electron density and electron temperature. Most of the plasma diagnostic tools have the disadvantage that their application to processing plasma where toxic and reactive gases are used gives rise to many problems such as contamination, perturbation, precision of measurement, and so on. We can minimize these problems by using the wave-cutoff method. Here, we will present the results obtained through the development of the wave-cutoff diagnostic method. The frequency spectrum characteristics of the wave-cutoff probe will be obtained experimentally and analyzed through the microwave field simulation by using the CST-MW studio simulator. The plasma parameters are measured with the wave-cutoff method in various discharge conditions and its results will be compared with the results of Langmuir probe.

Another disadvantage is that other diagnostic methods spend a long time (\sim a few seconds) to measure plasma parameters. In this presentation, a fast measurement method will be also introduced. The wave-cutoff probe system consists of two antennas and a network analyzer. The network analyzer provides the transmission spectrum and the reflection spectrum by frequency sweeping. The plasma parameters such as electron density and electron temperature are obtained through these spectra. The frequency sweeping time, the time resolution of the wave-cutoff method, is about 1 second. A short pulse with a broad band spectrum of a few GHz is used with an oscilloscope to acquire the spectra data in a short time. The data acquisition time can be reduced with this method. Here, the plasma parameter measurement methods, Langmuir probe, pulsed wave-cutoff method and frequency sweeping wave-cutoff method, are compared. The measurement results are well matched. The real time resolution is less than 1 μ sec. The pulsed wave-cutoff technique is found to be very useful in the transient plasmas such as pulsed plasma and tokamak edge plasma.

Keywords: Fast measurement, Wave-cutoff method, broad band spectrum pulse