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Cutoff Probe Analysis and Improvement

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Microwave diagnostics method for plasma science and engineering is vigorous research area for its good characteristics such as high sensitivity, reliability, and broad measurement spectrum from low density plasma to high density.

We investigate mechanism of microwave probes (hairpin, impedance and absorption probe) and apply it for interpretation of full transmitted spectrum of cutoff probe. Mechanism of the spectrum having same key roles of I-V curve of Langmuir probe is not exactly revealed yet in spite of its importance. This study elucidates physics behind it using a circuit model and E/M wave simulation. Circuit model reveals exact cut-off peak frequency taking account of a collision frequency and a plasma frequency and it enable precise diagnostics of plasma density from low pressure to high pressure. Cut-off like peaks have been obstacle for choosing cut-off peak is analyzed by E/M simulation and one of cutoff like peaks made by probe holder used for acquire plasma density with cutoff peak applying the hairpin relation. Furthermore, phase difference method for plasma density is conducted. This method uses a single microwave frequency source and it is low-priced.

Keywords: cutoff probe, plasma density