Annexure I-B

Determination of Plasma Impedance for Coupling of RF Power to Plasma Using Voltage Standing Wave Ration (VSWR) Technique

Abstract

In RF heating or Current Drive or Pre-Ionisation, coupling of RF power to antenna has been a concern. Plasma impedance may change during the duration of plasma discharge. In order to effectively couple RF power, it is essential to know the impedance seen by the antenna during the plasma formation. VSWR curve technique is used to know this impedance. As the plasma duration is very small so the voltage probe cannot be moved mechanically during the plasma shot. Hence voltage probes are fixed on the transmission line. VSWR curve is drawn using these voltage signals. But these signals may carry error which may get introduced due to various reasons. Error may get introduced into the probe signal because of non-uniform probe penetration into the transmission line. Cables used for transferring the signal from probe to data acquisition rack may have different attenuation because of manufacturing variations. Connectors being used may have different insertion losses. All these contribute to variation in the signals received at the data acquisition rack for signal analysis. Non-linear least square fitting technique will used to minimise the total error. Non-linear technique will be used because of the non-linear nature of the VSWR curve. In this project, applicability of curve fitting technique will be studied using an RF source of few Watts of power and 3 1/8" transmission line and practical results will be analyzed. The load so calculated will be compared with the known load value to determine the capability of this technique for finding unknown load.

Relevant references [Publications, web links etc.]:

1. "Development of Novel Design of VSWR Section for SYMPLE", Jitendra Kumar, Arpit Baranwal, Rahul Jaiswal, Shreekant Patel, Raj Singh and Anitha V. P., Institute for Plasma Research (IPR), Gandhinagar, Gujarat-382428, India. Paper published in VEDA 2016 Conference, held at IPR in March 2017.
2. "Design and Analysis of Tuneable Waveguide Directional Coupler for Microwave Plasma Interaction Experiments", Jitendra Kumar, G. Sandhya Rani, Arpit Barnwal, Raj Singh and Anitha V.P., Paper published in 32nd National Symposium on Plasma Science and Technology, PLASMA-2017, held at IPR.

Eligibility: Only students of RF / Microwave / EC branch can submit their application at

Required number of student(s): One

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