Seminar

Institute for Plasma Research

Title : Development of Cost-Effective High-Efficient Magnetron based Microwave Source for Plasma Interaction Applications

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Date : 13th January 2020 (Monday)

Time : 03:30 PM

Venue : Committee Room No.1, IPR

Abstract :

This work presents the development and testing of 1 kW microwave power extraction system with more than 90% duty cycle (efficiency) and other RF and Microwave related activities undertaken by me during past one year. A commercially available magnetron is used for microwave generation, which is the part of the domestic microwave oven. In a microwave oven, the maximum power released from the magnetron is of the order of 1 kW. Two types of DC power supplies in the range of 4 kV are used to extract the microwave: (1) Power supply available in the conventional microwave oven, (2) In-house developed high voltage power supply. The output voltage of the in-house developed power supply for 1 kW magnetron tube is 4.21 kV.

The prototype setup consists of the components such as a magnetron, WR-340 waveguide launcher, high voltage DC power supply, cooling fan, directional coupler, RF-load, etc. The measured RF-output power of magnetron is 1288 W at ~2.47 GHz with 50% duty cycle, when employed the conventional supply with 236 V input. However, the measured RF-output power of magnetron is 1000 W at ~2.46 GHz with more than 90% duty cycle, when employed the in-house developed high voltage power supply with 160 V input only. This RFoutput level of the magnetron can be controlled up to 1.3 kW by varying the input of developed power supply.

This source has been installed and operated in ADITYA-U Tokamak to conduct the experiments for ECR based wall conditioning of plasma vacuum vessel.

The total average costing of the developed source is ~60% lesser than a market-based source for the same specification. Thus, the proposed microwave source is suitable for plasma interaction application as well as others like food-processing, agriculture (waste & soil treatment), medical etc

Major emphasis of the work being presented has been on design aspects of this microwave power extraction system for various applications considering critical requirements such as uniformity, minimization of multi-pactor effect, microwave leakage suppression etc.