

Seminar

Institute for Plasma Research

Title : Development of Microwave Coupling System for SYMPLE

Speaker : Dr. Jitendra Kumar

Institute for Plasma Research, Gandhinagar

Date : 24th January 2018 (Wednesday)

Time : 11.30 AM

Venue : Committee Room 4, (New Building), IPR

Abstract :

SYstem for Microwave PLasma Experiments (SYMPLE) is an experimental set up at the Institute for Plasma Research (IPR), Gandhinagar, India, to investigate the physics of linear and nonlinear interaction of high-power microwave (HPM) with plasma. The said studies form a frequency scaled down investigation of laser-plasma interactions. The main focus of work assigned and undertaken for the last one year has been on addressing issues related to HPM and plasma coupling. As the HPM electric field should be along the plasma gradient direction, the mode should be TM₀₁ and the coupling components need to be compatible with circular waveguides. A slow wave structure based HPM source, proposed to be used for these studies, generates pulsed (~50 ns) microwave power of ~500MW at 3GHz frequency in TM₀₁ mode. The HPM output power is extracted via an oversized circular waveguide of radius 15 cm. This circular waveguide has also been verified with simulation and theoretical calculations. A coupling system is required between the HPM source and the plasma in order to couple the HPM power to plasma and to carry out measurements of forward and reflected microwave power. As circular waveguide based HPM components are not available conventionally R&D efforts are required to have the Directional Couplers, Mode launcher, Terminator, Mode measurement setup etc. compatible with circular waveguide. In the present work, some of the configurations of mode launcher have been designed, fabricated and tested with 100 watt microwave power at 3GHz. Study is mainly focused on design and development of circular waveguide terminator, mode launcher and mode measurement setup at 3GHz operating frequency.

Tuneable directional couplers have also been developed using WR-340 rectangular waveguide and tested by MATLAB programme to verify the concept. Further, development of 1.0 KW magnetron source from conventional microwave oven is carried out for diagnostic calibration set-up and for different societal and industrial applications. In order to carry out prototype testing of the components developed, a set-up has been made which includes a 100W microwave source, waveguide adaptor, VNA, power meter, signal generator, antenna etc. An account of the above work will be presented in the talk.
