Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Rapid Formation of Distributed Plasma Discharges using X-Band Microwaves XUN XIANG, JOHN BOOSKE, JOHN SCHARER, University of Wisconsin - Madison — Observations of rapidly formed (<50-300 ns) distributed plasma discharges using X-band microwaves are presented. A cylindrical stainless steel chamber enclosed with polycarbonate windows is used to observe microwave breakdown in Ar and Ne gas mixtures from 10 to 760 torr. The chamber is illuminated by the output of 25 kW, 0.8 μs pulse-width, 9.382 GHz magnetron through an X-band waveguide pressed against the polycarbonate window. Measured incident and reflected microwave power is used to detect the discharge and absorption and transmission characteristics as the pressure is varied. Measurements show 70% reflected power once plasma is formed and a small amount of Argon in Neon shortens the breakdown time. An E-plane tapered waveguide is designed to enhance the electric field at the breakdown surface so that breakdown condition is improved. Additionally, an ICCD provides fast (<50 ns) time-scale optical images of the plasma, revealing the plasma formation and decay processes. Optical emission spectroscopy branching ratio measurements provide plasma breakdown characteristics including electron temperatures and the electron energy distribution functions for different Ne/Ar gas mixture plasmas formed at 10-200 torr. Experiments show that inclusion of both red and blue argon lines significantly enhances the effective electron temperature and the distribution function solutions, compared with using only red lines.

John Scharer
University of Wisconsin - Madison

Date submitted: 24 Jul 2015 Electronic form version 1.4