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Rapid Formation of Distributed Plasma Discharges using X-Band Microwaves[1] XUN XIANG, BRIAN KUPCZYK, 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 is used to observe microwave breakdown in Ar and Ne gas from 10 to 760 torr. The chamber is illuminated by the output of 25 kW, 0.8 μs pulse-width, 9.382 GHz magnetron. Measured incident and reflected microwave power is used to detect the discharge and attenuation characteristics as the pressure is varied. Reflected power experiments show over 70% power is reflected once plasma is formed and a small amount of Argon in Neon shortens the breakdown time. Additionally, an ICCD provides fast ($<$ 50 ns) time-scale optical images of the plasma, revealing the plasma formation and decay processes. Optical emission spectroscopy measurements provide plasma breakdown characteristics including gas temperature, electron temperature, and plasma density. Mixers are used to compare both the amplitude and phase of the reflected signals before and after 90 degrees shift. Together with a 1D plasma model, plasma parameters including the plasma density, collision frequency and electron temperature are estimated.

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