Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Experimental studies and modeling of microwave plasmas in argon M. ANDRASCH, M. BAEVA, J. EHLBECK, D. LOFFHAGEN, K.-D. WELTMANN, INP Greifswald, Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany — A microwave (MW) induced plasma in argon at pressures from 5 to 100 hPa has been studied by experiments and modeling. The plasma source is placed inside a vacuum vessel and is operated with a TEM supply at a field frequency of 2.45 GHz provided by a 2 kW magnetron. To provoke the discharge, a resonant structure has been used which is integrated at the end of the inner conductor. The gas flow rate is 30 to 1000 sccm and the absorbed power derived from the incoming and reflected power is between 20 and 125 W. The temporally resolved electron density in the plasma afterglow has been determined by a heterodyne MW interferometer working at 45.5 GHz. In addition, a two-dimensional fluid model describing in a self-consistent manner the gas flow and heat transfer, the energy in-coupling, and the reaction kinetics has been utilized to obtain the gas and electron temperature, the electron, ion, and excited state densities, and the power deposited into the plasma for given gas flow rate and temperature at the inlet and input power of the incoming TEM microwave. A maximum electron density above 1×10^{20} m^{-3} and gas temperature above 600 K have been determined in front of the resonant structure. Modeling and experimental results demonstrate good agreement.

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Date submitted: 11 Jun 2012 Electronic form version 1.4