Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Electrical and optical diagnostics of CO2 microwave plasmas produced by a radial-line slot antenna SE YOUN MOON, DEMETRE J. ECONOMOU, VINCENT M. DONNELLY, Department of Chemical and Biomolecular Engineering, University of Houston, JIANPING ZHAO, LEE CHEN, RADHA SUNDARARAJAN, YOSHIO SUSA, TOSHIHISA NOZAWA, Tokyo Electron America — CO2 plasmas generated by microwave power supplied to a radial-line slot antenna were studied by Langmuir probe and optical spectroscopic methods. At a distance of 190 mm from the slot antenna, the electron temperature and electron density were 2.4 eV and 8.5E10 cm^{-3}, respectively, at 10 mTorr with 3 kW microwave power. At a pressure of 150 mTorr, the electron temperature decreased to below 1 eV while the electron density dropped to 8.6E9 cm^{-3} because the plasma was then localized near the antenna. Low electron temperature is advantageous for reducing some forms of device damage. In addition, the gas temperature, obtained from the rovibrational spectra of added N2 gas, increased from 650 K at 10 mTorr to 1160 K at 50 mTorr. Further increase in gas pressure up to 150 mTorr resulted in a slight decrease of the gas temperature, again due to plasma localization near the antenna. The atomic oxygen density, derived using actinometry, was 5.7E1012 cm^{-3} at 10mTorr and 5.6E13 cm^{-3} at 150 mTorr with 3kW. Results using trace rare gas optical emission spectroscopy (TRG-OES) and vacuum ultra-violet absorption spectroscopy will also be presented and compared with Langmuir probe measurements and actinometry.

Se Youn Moon
Dept of Chemical and Biomolecular Engineering, University of Houston

Date submitted: 18 Jun 2012 Electronic form version 1.4