Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Modelling the influence of neutral gas heating mechanisms on particle densities in inductively coupled chlorine discharges[1] ANDREW GIBSON, LPP-CNRS and University of York, TIMO GANS, University of York, MICKAEL FOUCHER, DANIIL MARINOV, PASCAL CHABERT, LPP-CNRS, VASCO GUERRA, IPFN/IST-UTL, MARK KUSHNER, University of Michigan, JEAN-PAUL BOOTH, LPP-CNRS — Inductively coupled plasmas produced in reactive electronegative gases, such as chlorine (Cl2), are commonly used for the etching of nanometre scale structures in the semiconductor industry. However, despite their widespread usage, the dominant energy transport mechanisms in these systems are often not well known. In particular, neutral gas heating is an important factor in determining many plasma parameters, such as the densities of electrons or atomic chlorine radicals (Cl). In this context the dissipation of electron energy by collisions with neutral species, for example through Franck-Condon heating or indirectly by vibrational excitation followed by v-t transfer, is of key importance. In this study the influence of such heating mechanisms on important species densities has been investigated using the Hybrid Plasma Equipment Model (HPEM). By comparison with experimental data, it is found that the electron density can be underestimated and its radial profile poorly reproduced if the proper heat transfer mechanisms are not included in the model. This in turn has important effects on other plasma parameters, such as the charged and neutral particle densities. The inclusion of both Franck-Condon heating and v-t transfer significantly improves agreement with experimental data.

[1]This work received funding from UK EPSRC Grant (EP/K018388/1) and financial state aid managed by the laboratory of excellence Plas@Par (ANR-11-IDEX-0004-02).

Andrew Gibson
LPP-CNRS and University of York

Date submitted: 19 Jun 2015 Electronic form version 1.4