Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Vibrational excitation in O_2 and Cl_2 inductively-coupled plasmas and DC discharges[1] JEAN-PAUL BOOTH, DANIIL MARINOV, MICKAEL FOUCHER, LPP, CNRS-Ecole Polytechnique-UPMC, ADRIANA ANNUSOVA, Comenius University, Bratislava, Slovakia, VASCO GUERRA, IST Lisbon, Portugal — Low-energy electrons can interact with molecules via resonances to cause vibrational excitation with large cross-sections. Such processes can absorb significant energy from the plasma electrons, affecting the electron energy distribution and potentially (via vibration-translation (VT) energy transfer) causing substantial gas heating. The presence of vibrationally excited molecules may significant increase the rates of collisional processes, including electron dissociative attachment and electron impact dissociation into neutral atoms. However, the cross-sections of these processes are often poorly known since they are extremely difficult to measure directly, and reliable theoretical calculations are only now appearing for simple diatomic molecules. We have measured the vibrational distributions in discharges in pure O_2 and pure Cl_2, using high-sensitivity ultra-broadband ultraviolet absorption spectroscopy. In O_2 plasmas significant vibrational excitation is observed, up to v"=18, with a tail temperature of around 8000K. In Cl_2 excitation is only observed up to v"=3, and the distribution appears to be in local equilibrium with the gas translational temperature (up to 1500K). We are developing a detailed self-consistent 0D global model of these systems including vibrational excitation.

[1]Work performed in the LABEX Plas@par project, with financial state aid (ANR-11-IDEX-0004-02 and ANR-13-BS09-0019).

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Date submitted: 10 Jun 2016 Electronic form version 1.4