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2D fluid simulations of acoustic waves in pulsed ICP discharges: Comparison with experiments EMILIE DESPIAU-PUJO, GILLES CUNGE, NADER SADEGHI, CNRS/UJF-Grenoble1/CEA LTM, N. ST. J. BRAITHWAITE, The Open University — Neutral depletion, which is mostly caused by gas heating under typical material processing conditions, is an important phenomenon in high-density plasmas. In low pressure pulsed discharges, experiments show that additional depletion due to electron pressure (Pe) may have a non-negligible influence on radical transport [1]. To evaluate this effect, comparisons between 2D fluid simulations and measurements of gas convection in Ar/Cl2 pulsed ICP plasmas are reported. In the afterglow, Pe drops rapidly by electron cooling which generates a neutral pressure gradient between the plasma bulk and the reactor walls. This in turn forces the cold surrounding gas to move rapidly towards the center, thus launching an acoustic wave in the reactor. Time-resolved measurements of atoms drift velocity and gas temperature by LIF and LAS in the early afterglow are consistent with gas drifting at acoustic wave velocity followed by rapid gas cooling. Similar results are predicted by the model. The ion flux at the reactor walls is also shown to oscillate in phase with the acoustic wave due to ion-neutral friction forces. Finally, during plasma ignition, experiments show opposite phenomena when Pe rises.

[1] Cunge et al, APL 96, 131501 (2010)

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