Quantemol-D/HPEM example 5: Argon/NF_3 inductively-coupled plasma (ICP)

Dr. Brent Walker

September 7, 2011

In this example, we consider a capacitively-coupled plasma based on a mixture of Ar and NF_3. The details of the calculation are shown in Table 1. The version of HPEM underlying Quantemol-D is that of March 2011 (“mar11”).

Excitation type	Inductive
Pressure	10 mTorr
ICP Power	500 Watt
Electron treatment	Boltzmann
Flow rate	100 sccm
Gas mixture	NF3:Ar = 0.2:0.8

Table 1: Settings for Ar/NF_3 ICP example.

The reactor geometry is the same as for the plasma based on just Ar considered in Example 1, and for Argon/Cl_2 in Example 4, and is shown in Figure 1. A set of coils sits at the top of the chamber. The coils are separated from the plasma (black region in the figure) by a quartz window (coloured cyan). Gases flow into the chamber through the nozzle on the right, about 2/3 of the way up the reactor (coloured purple). The wafer (red) sits on a stage (yellow). Gases are removed through the pump port at the bottom right of the diagram (indigo).

The evolution of the concentrations of the nitrogen and fluorine containing positive ions (NF_3^+, NF_2^+, NF^+, F_2^+, F^+, N_2^+, and N^+) during the simulation are shown in Figure 2.

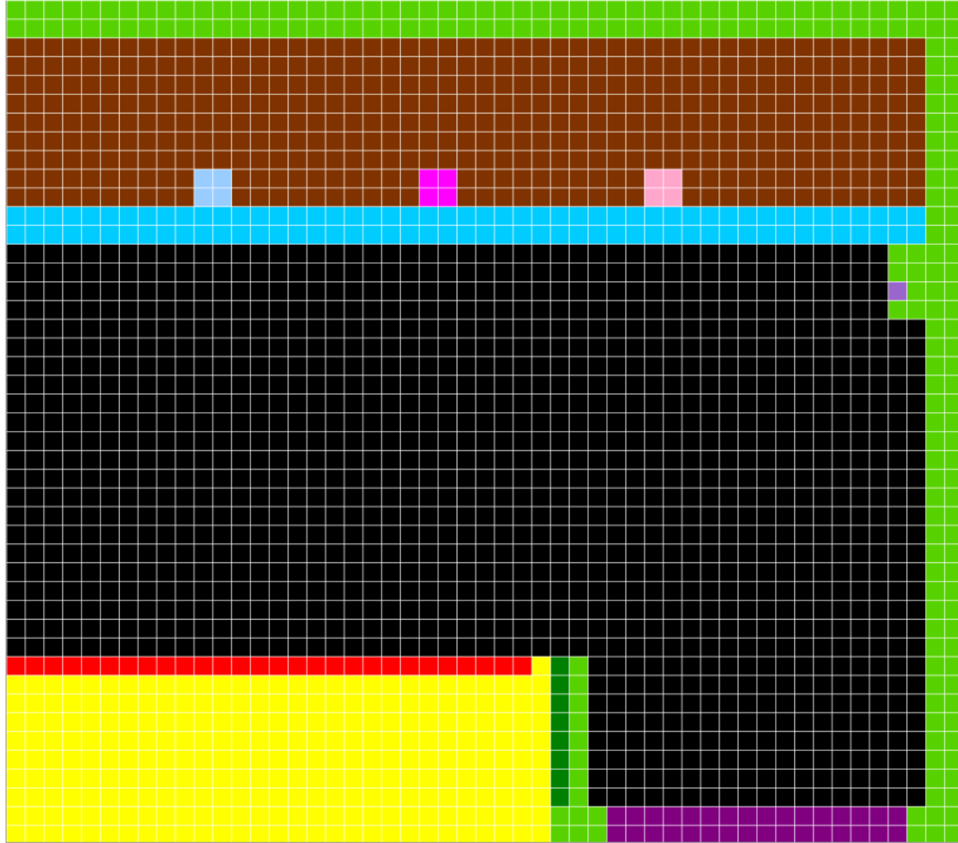

Figure 1: Model for Ar ICP plasma chamber.

The fluxes of the positive ions NF_3^+, NF_2^+, NF^+, F_2^+, F^+, and N_2^+, onto the wafer are shown in Fig. 3.

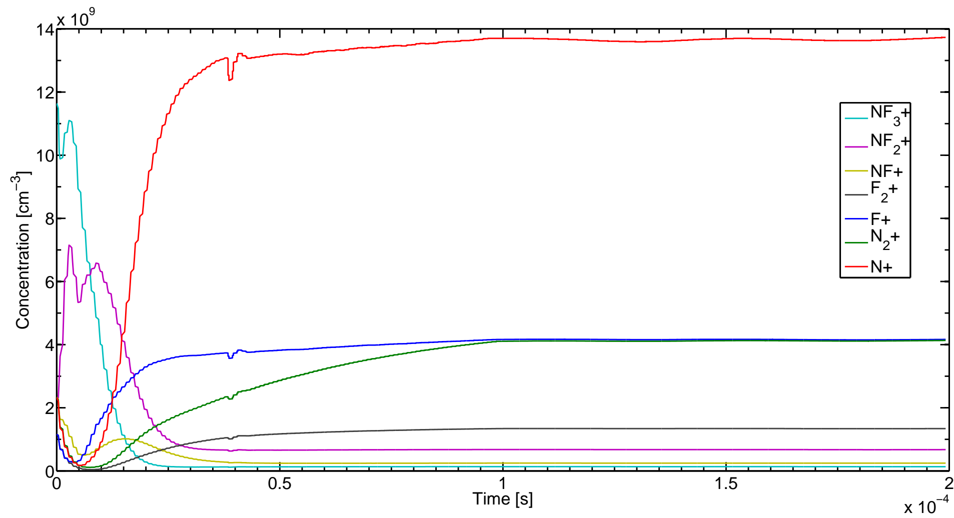

Figure 2: Concentrations of nitrogen and fluorine containing positive ions during simulation of Ar/NF_3 mixed gas ICP simulation.

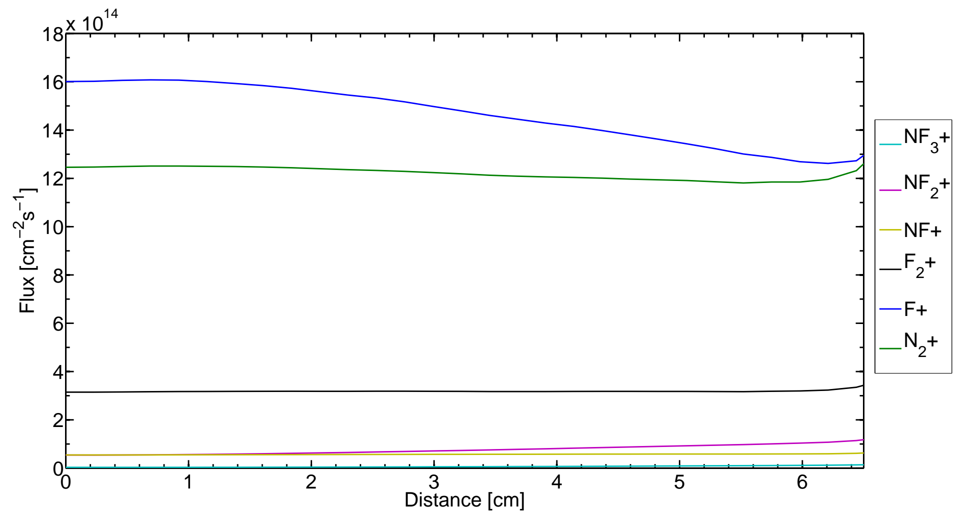

Figure 3: Fluxes of positive ions arriving at the wafer in Ar/NF_3 mixed gas ICP simulation.