

Quantemol-D/HPEM example 4: Argon/Cl₂ inductively-coupled plasma (ICP)

Dr. Brent Walker

September 7, 2011

In this example, we consider an inductively-coupled plasma formed from a mixture of Ar and Cl₂. The version of HPEM underlying Quantemol-D is that of March 2011 (“mar11”).

The details of the calculation are shown in Table 1.

Excitation type	Inductive
Pressure	15 mTorr
ICP Power	300 Watt
Electron treatment	Boltzmann
Flow rate	100 sccm
Gas mixture	Cl ₂ :Ar = 0.2:0.8

Table 1: Settings for ArCl₂ ICP example.

The reactor geometry is the same as for the plasma based on just Ar considered in Example 1, 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 positive ions (Ar⁺, Cl⁺, and Cl₂⁺) during the simulation are shown in Figure 2.



Figure 1: Model for Ar ICP plasma chamber.

The positive ion fluxes onto the wafer are shown in Fig. 3.

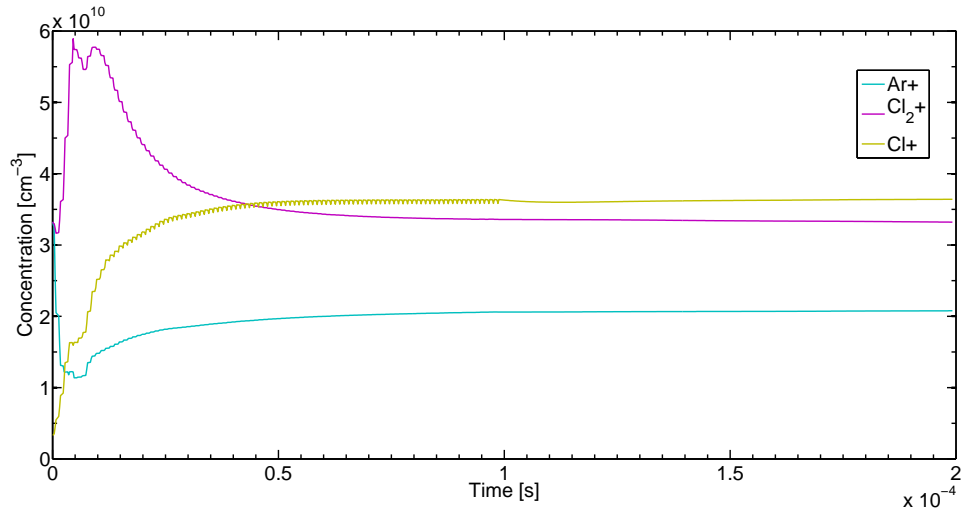


Figure 2: Concentrations of positive ions during simulation of Ar/Cl₂ mixed gas ICP simulation.

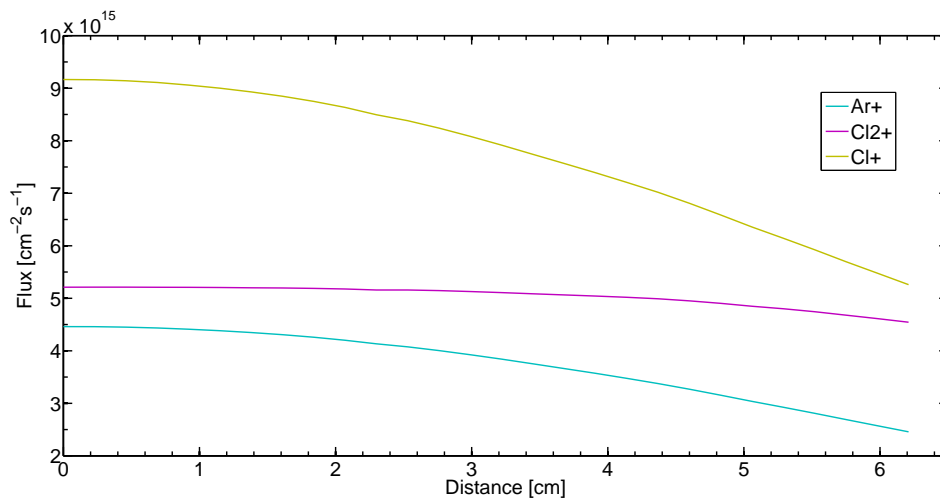


Figure 3: Fluxes of positive ions arriving at the wafer in Ar/Cl₂ mixed gas ICP simulation.