

Homework #8 — EE528
due 12/3/08)

1. Problem 10.6 from text.
2. Problem 10.11 from text.
3. Using Sentaurus, simulate the fabrication of the structure from problem 1 on exam 1.
4. Silicon is etched in a Cl_2/Ar_2 plasma. A simplified model of the plasma reactions includes the following reactions:



At the silicon surface, the atomic chlorine attaches to silicon dangling bonds (represented by asterisks):



The etch is complete upon desorption of the SiCl_2 .



The surface silicon atoms attached to two chlorine atoms are not very volatile (i.e., the final desorption reaction is normally slow), but they can be easily sputtered by incident argon ions with a sputtering yield equal to the fractional surface coverage of Cl-Si-Cl.

- (a) Assuming that the pump rate is high enough that there is no loading effect, determine expressions for the steady-state molecular and atomic chlorine concentrations in the plasma in terms of the Cl_2 input flow rate, the pump rate, the reactor volume, the electron concentration and the reaction rates.
- (b) If both of the chlorine attachment reactions are near equilibrium, determine an expression for the etch rate in the absence of argon ion bombardment. The density of surface Si atoms is N_{Si} .
- (c) If the incident argon ion flux is ϕ_{Ar^+} , what is the ratio of vertical to lateral etch rate?