ECE 6450 Homework #7

1.) Explain why plasma etching trends have been moving toward lower pressures while deposit ion trends have been moving toward higher pressures.

2.) When dilute amounts of oxygen are introduced into a CF_4 plasma process, a scavenged byp roduct gas like CO (carbon monoxide) is produced. A.) If the gases are introduced to a large ch amber (infinite conductance) with an exit tube with a conductance of 100 liters/(sec-torr) to a roo ts blower pump at 50 millitorr (50e-3 torr), what is the maximum possible throughput (in sccm) o f CF_4 and CO respectively? (Assume the vapor pressure of CF_4 is 1 torr and the vapor pressure o f CO is 1000 torr at the process temperature). B.) If the chamber has a volume of 10 liters an d is maintained at 1 torr pressure, what (approximate) average time is required to purge the two g ases (this is effectively the speed for which a process change can be made and is why minimizati on of the volume of process chambers is important)? C.) How does this difference in the rate of removal of CO and CF_4 effect the average carbon content in the chamber for the cases where oxygen is not present verses when it is present? D.) What effect does the change in carbon co ntent have on the sidewall polymerization and why (Assume RIE conditions)? E.) What effec t does the oxygen have on the anisotropy?

3.) What percentage of gas molecules (assume 3 angstrom molecular diameter) traveling a dist ance of 50 cm has underwent a randomizing scattering event at 0.5 Pa (sputtering chamber) and a t 10^{-4} Pa (evaporator chamber)? You may use the expression for scattering probability,

$\frac{n}{n_o} = 1 - e^{\frac{-d}{\lambda}}$ where n is the number of molecules having been scattered, n_o is the total number o f molecules, d is the distance traveled and λ is the mean free path between collisions.

4.) Look over example 12.1 in your book (no need to turn it in).