Chemical Engineering 234
Fundamentals of Plasma Processing

Guideline for Term Paper

1. One page executive summary describing the topic due June 3rd, 2004 at noon.
2. Term paper due June 17th, 2004 at 3pm.

The format of term paper should contain the following: title page, table of contents, abstract, introduction, method of approach, description of the chemistry and physics of plasma processing, analysis of results, and conclusion. A comprehensive list of references should be included, using the standard format adopted by Journal of Applied Physics. The report, excluding the title page, table of contents, references, and figures, must be no more than 20 pages. The report should be printed using 12-point fonts with 1-½ line spacing.

There are seven projects you can choose from. Each of you will submit a list of two of your preference and the final project will be assigned to you based on a matching of the available projects and your preference.

Project description on ChemKin Simulation:

There are four projects available based on ChemKin Simulation:
(1) O_2 chemistry
(2) F_2 chemistry
(3) H_2 chemistry
(4) BCl_3 chemistry

Your report should contain:

1. Abstract: Summary of your key findings.

2. Introduction: Outline your problem with details of your reactor and base condition for your plasma (including reactor volume, wall material, operating parameters, etc.). Use the ChemKin Simulator with the continuous stirred tank reactor (CSTR) approximations to investigate the dependence of plasma chemistry on various plasma parameters and the reaction kinetics. First, assume Maxwell-Boltzmann distribution function for the electron distribution function and estimate the reaction rate constants of gas-phase reactions. Next, input the thermodynamic properties and reaction rate constants into CHEMKIN to investigate the properties of a plasma.

3. Reactions to be considered (a minimal set), including the threshold energy, rate constants, etc.:
(1) Dissociation
(2) Ionization
(3) Dissociative attachement
(4) Polar dissociation
(5) Surface reactions (consider only recombination loss)
**Note: Need to show how to derive the rate constant from σ for at least one reaction.

4. Results (minimal requirements):
First use the base line condition and determine:
(1) Electron temperature
(2) Total ion density
(3) Total neutral density
(4) Ions (select a couple dominant ions)
(5) Neutrals (select a few dominant neutrals)

Then determine the changes in the above parameters as a function of:
(1) The effect of reactor volume
(2) The effect of power
(3) The effect of pressure
(4) The effect of surface sticking coefficient
(5) The effect of surface recombination coefficient

5. Discussions
6. Conclusions
7. References
8. Appendix (figures and detailed analysis of simulation results)
9. One CD with the three input files for your baseline condition