MatE/ ChE 166: Advanced Thin Film Processes
Learning Objectives for Midterm

Physical Vapor Deposition/Sputtering

1. Explain the thermodynamics of evaporation.
2. Describe the diffusion properties of alloys
3. Describe the general mechanics of a PVD process
4. Calculate the evaporation rate of a pure metal.
5. Calculate the diffusional flux of material in a PVD process.
6. Identify the critical mass transport paths in a PVD process.
7. Describe physics of a DC and rf plasmas

Chemical Vapor Deposition

8. Explain the steps involved in chemical vapor deposition.
9. Describe the influence of Gibb's free energy on temperature, pressure, phase, and composition.
10. Calculate if a CVD deposition reaction from a single chemical reaction is thermodynamically predicted.
11. Utilize given tables of partial pressures to calculate whether deposition or etching occurs with a complex set of chemistries in CVD.
12. Determine the effect of non-equilibrium partial pressures on the predicted deposition or etching of a process.
13. Calculate the critical size nuclei and barrier for nucleation in homogeneous and heterogenous nucleation in a CVD process.
14. Define a boundary layer and explain why the width of the boundary layer is important to CVD deposition.
15. Calculate whether a deposition reaction is reaction rate or mass transport limited.
16. Calculate the film growth rate based on the limiting mechanism.
17. Describe the influence of temperature, pressure, and chemistry on the limiting mechanism.
18. Design a deposition process to result in deposition of a thin film within a desired controlling growth regime.
19. Discuss different APCVD reactors and why they are designed that way.
20. State examples of processes that use APCVD deposition and why APCVD is chosen.
21. Discuss different LPCVD reactors and why they are designed that way.
22. State examples of processes that use LPCVD deposition and why LPCVD is chosen.
23. Discuss different PECVD reactors and why they are designed that way.
24. State examples of processes that use PECVD deposition and why PECVD is chosen.

Statistics & Experimental Design

25. Calculate the mean, median, and mode from data.
26. Calculate the standard deviation and variance of the data.
27. Use a t-test to determine if a process is on target within a certain value.
28. Evaluate the P-value to determine the statistical validity of the results.
29. Describe the difference between accuracy and precision of a measurement technique.
30. Measure a film's thickness using a spectrophotometer, 4 pt probe, or profilometer.

31. Develop a standard operating procedure for a piece of equipment.
32. Compare the variances between two measurement techniques and also between two users by utilizing the F-test.
33. Compare the mean between two measurement techniques and also between two users by utilizing the paired t-test.
34. Quantify the variation of each run.
35. Evaluate the variations between two runs (run to run within a process) by using an F-test.
36. Evaluate the means within two runs (run to run within a process) by using a two-sample t-test.