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CHE323/CHE384
Chemical Processes for Micro- and Nanofabrication
www.lithoguru.com/scientist/CHE323

Review Questions by Lecture (20-37)

Chris A. Mack
Adjunct Associate Professor

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Lecture 20: Evaporation, part 1

- What are the three common deposition methods used in semiconductor manufacturing?
- What are the different methods for melting the charge, and their advantages and disadvantages?
- Explain how e-beam evaporation works
- How is film thickness controlled in evaporation systems?

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Lecture 21: Evaporation, part 2

- How can we control the mean free path of the vapor?
- Explain the view factor, $1/r^2$ deposition rate dependence, and their impact on across-wafer uniformity
- Why is shadowing/step coverage a problem, and what can we do about it?
- Explain the advantages and disadvantages of evaporation

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Lecture 22: Sputtering, part 1

- Describe the basic components of a sputter system
- How is good step coverage achieved in a sputtering system?
- Define “sputter yield”
- Explain the operation and effects of magnetron sputtering

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Lecture 23: Sputtering, part 2

- How is step coverage controlled in sputter deposition systems?
- What step coverage is needed for the via fill application?
- What causes stress in deposited films, and how is it measured?
- How many aspects of film quality can you name?

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Lecture 24: Chemical Vapor Deposition, part 1

- Why is heterogeneous CVD preferred over homogeneous CVD?
- What are the two steps in our very simplified mechanism for CVD?
- Explain diffusion-controlled vs. reaction-controlled regimes for CVD?

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Lecture 25: Chemical Vapor Deposition, part 2

- How does one switch between reaction-controlled and diffusion-controlled regimes?
- How does the regime (reaction- vs. diffusion-controlled) affect CVD system design?
- How does pressure affect deposition rate?
- Explain the advantages and disadvantages of atmospheric CVD, LPCVD, and PECVD

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Lecture 26: Deposition Processes

- Name four common methods of depositing thin films on a wafer.
- What is epitaxial silicon?
- What important metal is commonly deposited using CVD?
- How is CVD oxide different from thermally grown oxide?

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Lecture 27: Device Isolation

- Why is device isolation needed?
- What are the two most common device isolation processes?
- Why is STI the more common today?

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Lecture 28: Device Interconnect, part 1

- Define FEOL and BEOL
- What are the goals of place and route?
- What limits the use of single level metal?
- What are the trade-offs of using more metal levels?

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Lecture 29: Device Interconnect, part 2

- Why is interconnect such a big problem today?
- What gives rise to interconnect delay?
- What are five ways to reduce interconnect delay?

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Lecture 30: Chemical Mechanical Polishing (CMP)

- Name three planarization techniques. Which technique is better, and why?
- What two adjustable polishing parameters control the polish rate?
- Name three CMOS process steps that require CMP
- What are the two biggest problems associated with CMP?

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Lecture 31: Copper Dual Damascene

- Why must an additive process be used to pattern copper versus the more common subtractive process?
- What are the steps involved in copper deposition?
- Where does the term “damascene” come from?
- Why must copper be kept away from the silicon device?

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Lecture 32: Semiconductor Manufacturing: Yield and Defects

- What are the two major types of die yield loss?
- What are the two parameters in our simple yield model?
- What is “DFM”?

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Lecture 33: Semiconductor Manufacturing: Statistical Process Control (SPC)

- What is the guiding principle of SPC?
- What are the Western Electric rules?
- What do you do when there is an SPC alarm?
- What is the difference between C_p and C_{pk}?
- What constitutes mediocre, good, and great capability?

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Lecture 34: Etch, part 1

- Define etch selectivity
- Define anisotropy
- What common style of etch produces isotropic results?
- What are typical etch goals in semiconductor processing?

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Lecture 35: Etch, part 2

- Describe the components of a sputter etch system
- How does sputter etching achieve high anisotropy, and why is its selectivity low?
- How is plasma etching different from sputter etching?
- How does plasma etching achieve high selectivity, and why is its anisotropy low?

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Lecture 36: Etch, part 3

- What problem is reactive ion etching trying to solve?
- How does RIE work?
- What is sidewall passivation?
- What are the characteristics of barrel etchers and why are they used?
- Why are high density plasma systems popular?

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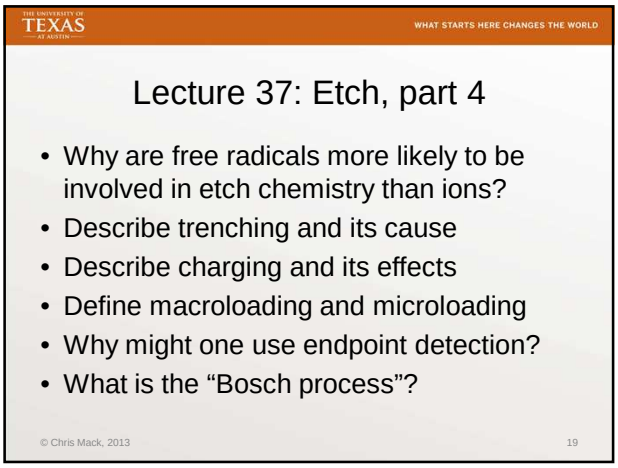
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WHAT STARTS HERE CHANGES THE WORLD
Lecture 37: Etch, part 4
• Why are free radicals more likely to be involved in etch chemistry than ions?
• Describe trenching and its cause
• Describe charging and its effects
• Define macroloading and microloading
• Why might one use endpoint detection?
• What is the “Bosch process”?
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