EECS 243 Midterm Exam Review for 10/26/00 exam during class.

Scope, Emphasis, and Style

The scope of the exam covers the topics from the first 8 weeks and is described in the list below. The emphasis will be on quantitative estimates rather than the survey nature found in the test PDG. The style of the exam will be problem solving and thus quite similar to the homework.

Reading

[PDG00] "Silicon VLSI Technology Fundamentals, practice and Modeling," James D. Plummer, Michael Deal, Peter B. Griffin.

Chapter 1 Modern CMOS Technology, pp. 49-92 (media for applying what learned)
Chapter 5 Lithography, pp. 201-285 (248-269)
Chapter 9 Thin Film Deposition, 509-608 (515-518, 525-527, 506, 542, 574-575, 583, Some 590-597, Skip 523-525)
Chapter 10 Etching, 609-680 (628-629, 637, 660-662)

[ARNL] Notes provided by Professor Neureuther

ARNL1 The Lithography Process and Basis Simulation Models, pp. 117-155 (All except 123-124)
ARNL2 Electron-Beam, X-Ray and Ion-Beam Lithography, pp. 123-152 (127-132, 136-139, 149-152)
ARNL3 Topography Effects in Deposition and Etching, pp. 55-83 (66-70)
ARNL4 Characterization of Deposition and Etching, pp. 83-105 (88-89)

Croffie, et al. Moving boundary transport model for acid diffusion in chemically amplified resists, pp 3339-3344. Section II and IV.A.

Topic List

1) An overview of modern CMOS process flow and process technology – well/iso; gate stack; S/D, local interconnect and multi-level interconnect; includes shallow trench isolation.
2) Projection printing models – rules of thumb resolution, contrast, DoF; plane-wave model
3) Advanced models – aberrations, energy through pupil, small feature limit, defect-feature interaction, phase-shifting masks
4) Resists – optical models for half space; mutiple-reflections, standing waves, vertical contrast, energy coupling; exposure-bleaching, dissolution-etching; chemically-amplified resists – reaction, diffusion, shrinkage.
5) Non-optical lithography – NGL approaches; e-beam spot-size; beam interaction with matter; resist dissolution; exposure shot-noise.
6) Deposition – basic vacuum properties; CVD rate models; physical vapor deposition models; profile time-evolution.
7) Etching – volatility of halogens, plasma dissociation of gases; basic and advanced profile level phenomena; profile time-evolution.

Problem Sets

Don't worry about how the detailed results came out (overlap of E-D trees, location of dead-zones, and image spread with aberrations) on the length problem sets such as Homework #2. Do look at the big picture and the usefulness of the techniques (E-D trees help design sizing so print on size for different feature types, resolution enhancement may help some feature sizes and types but degrade others, and Strehl shows that it is the rms wavefront deviation that degrades peak intensities).