Fall 2016
Optical Sciences 576
9:30–10:45 a.m., Tuesday & Thursday
OSC Building, Room 305

SYLLABUS

THIN FILM OPTICS

Charles M. Falco

I. OVERVIEW

Optical systems for wavelengths from the IR to beyond the Vacuum Ultra-Violet (VUV) require thin film coatings of various kinds to function properly. In the visible, for example, acceptable performance of multilayer lenses would not be possible without thin-film antireflection coatings. In the VUV or soft-x-ray regime, focusing optics are now possible using multilayer thin film coatings. Thin films also are essential for many other optical applications, such as Schottky-barrier IR detectors, media for magneto-optical data storage, and diode lasers.

This course will provide an understanding of some of the significant physical mechanisms involved in the growth, structure and optical properties of thin films for use in the wavelength range ~1 nm–1 µm. The basic electromagnetic theory of multilayer thin films will be covered, with application to coatings including reflection, antireflection, beam splitters, dichroic filters, and bandpass filters. Examples ranging from the IR to the soft-x-ray will be discussed.

II. COURSE OUTLINE

GROWTH OF THIN FILMS

- Physical Mechanisms Involved in the Most Common Techniques:
- Sputtering
- Evaporation (with emphasis on Molecular Beam Epitaxy)
- Nucleation and Growth Phenomena

STRUCTURE OF THIN FILMS

- Physical Structure:
  - Diffraction Theory
  - Application of diffraction theory to x-rays, high and low energy electrons, etc.
- Chemical (Compositional) Structure:
  - Physical principles of specific probes, including RBS, XPS, Auger, etc.

OPTICAL THIN FILMS

- Theory: Maxwell's equations; reflectance, transmittance and absorptance; Smith Chart, etc.
- Optical Coatings: reflection, antireflection, beam splitters, dichroic filters, bandpass filters, etc.
- Optical Data Storage: magneto-optical media, phase-change media, etc.
- Active Optical Thin Films: diode lasers

Each of the above three major sections will make up approximately one-third of the lectures.

III. TEXT

-- optional --
Optical Coating Technology
Philip W. Baumeister
SPIE Press (Bellingham, Washington, 2004)
ISBN 0-8194-5313-7

Although you will find this text useful, it is optional for the course. Also, supplemental material will be drawn from a variety of sources, including review papers in E-journals that can be accessed remotely through the UA library web site. Also, copies of the visuals I use in class will be available to students through the UA's web-based D2L course management system.

IV. GRADING

Three homework assignments and a take-home final exam each will be given equal weight. An overall score >85% = A; >75% = B; >60% = C; and <60% = D. Homework turned in after the end of class on the day it is due will be dropped one grade. If it is more than 24 hours late it will be dropped two grades.

V. OTHER POLICIES

1. "Incompletes" will only be given under very special circumstances, especially if no prior agreement with me has been made. Note: by "prior" I mean you should see me as soon as some situation arises which you feel might keep you from completing the course.

2. Office hours: Since experience shows that rigid office hours do not fit everyone's schedule, I have an "open door" policy where you can drop by any time you want to discuss something. However, since my office is located in a building that's a 10–15 minute walk from OSC, if you want to make sure I'll be there at a specific time, either call (621-6771) or e-mail (falco@u.arizona.edu) to schedule a mutually convenient time. My office is on the 10th floor of Gould-Simpson, room 1021.