**Syllabus for Chemistry of Materials, Williams College, Fall 2010**

**(T, Th 75 minute classes)**

**I. Structures of Materials**

A. Hard materials 6 lectures

crystalline solids ionic, covalent, metallic

3-D structures, polymorphism, determination (XRD)

importance of defects, effect of nanoscale

phase diagrams, transformations, effect of thermal history

glasses, composites

B. Soft materials 4 lectures

Polymers, synthesis, processing

liquid crystals, gels

ordering, self-assembly

**II. Properties of Materials**

A. Mechanical properties, thermal properties 2 lectures

stress, strain

effect of/types of deformation, strengthening mechanisms

thermal properties

B. Electrical properties 8 lectures

MO 🡪 band theory

Free electron model, tight binding model

Applications of conductors, semiconductors, devices

C. Optical properties 3 lectures

Absorption, emission

Lasers, quantum confined materials, LEDs, solar cells, non-linear optical,

Optical transmission…

D. Magnetic Properties ~ 2 lectures

hard, soft, magnetic domains

applications (data storage…)

**III. Techniques in Nanofabrication, assembly, analysis (Lab)**

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| --- | --- | --- | --- |
| **Experiment** | **Date** | **Experiment** | **Date** |
| A. SAMs and mCP | 9/13 | **Lit presentation** | **10/25, 11/1** |
| B. Soft Lithography | 9/20 | F. Silver Nanoprisms | 11/8 |
| B. Soft Lithography | 9/27 | G. Nanowire Synthesis | 11/15 |
| C. Nanosphere Synthesis | 10/4 | H. Organic Photovoltaics | 11/22 |
| D. Nanosphere lithography | 10/18 | **Lit presentation** | **11/29** |
| E. Inverse Opals | 10/25, 11/1 | **Lit presentation** | **12/6** |

Some techniques/approaches covered in lab: microcontact printing, self-assembled monolayers (contact angle measurements), metal evaporation, emulsion polymerization, AAO templated synthesis of nanowires, nanocrystal synthesis, diblock copolymer lithography/templating

Some instrumental techniques used: SEM, AFM, ellipsometry, GPC, DSC.