

## Nanoscale Materials

**Instructor:** Yaowu Hao

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**Office Hours:** Wednesday 1:30-2:30pm

**Section Information:** MSE 4320-001 and MSE 5390-001

**Time and Place of Class Meetings:** Wednesday 3:00-5:50pm, WH 308

**Description of Course Content:** Introduction to the synthesis, properties and applications of inorganic thin films and nanoparticles.

**Experiment-Oriented Just-in-Time Teaching:** Before each lab demonstration several lectures will be given that are specifically arranged for this particular experiment, including reviews of all necessary basic knowledge and introductions to new concepts, especially nanoscale size effects. Through such know-how/know-why approach students are expected to learn how all basic knowledge bonds together to apply to nanotechnology.

**Student Learning Outcomes:** Students become familiar with the size effect of magnetic and optical properties, general fabrication process of nanoparticles and thin films and characterization of nanostructures.

### **Required Textbooks and Other Course Materials:**

Recommended Textbook:

Nanoscale Materials in Chemistry

By Kenneth J. Klabunde

ISBN 0-471-38395-3

Introduction to Nanoscience

by Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, Anil Rao

ISBN-10: 1420048058, ISBN-13: 978-1420048056

Fundamentals of Nanotechnology

by Gabor L. Hornyak, John J. Moore, H.F. Tibbals, Joydeep Dutta

ISBN-10: 1420048031, ISBN-13: 978-1420048032

### **Descriptions of major assignments and examinations:**

Undergraduate Students:

Lab reports	60%
Final	40%

Graduate Students:

Lab reports	30%
Final	40%
Term paper and presentation	30%

**Attendance:**

Attendance is required. If a student misses more than three lectures, she/he cannot get an A final grade.

**Drop Policy:**

Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/ao/fao/>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Academic Integrity:** Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to [resources@uta.edu](mailto:resources@uta.edu), or view the information at [www.uta.edu/resources](http://www.uta.edu/resources).

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as “lecture,” “seminar,” or “laboratory” shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, [which is located on the right side of the hallway when you get out of the room](#). When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

## **Course Schedule.**

Week 1 (Jan 21)  
Overview and Introduction to Nanoscale Materials  
Review of Materials Science

### **Experiment 1: Magnetic Nanoparticles**

Week 2 (January 28)  
Review of Magnetic Properties of Materials  
**Lab: Synthesis of Iron Oxide Nanoparticles (ELB 341)**

Week 3 (Feb. 4)  
Superparamagnetism and Applications  
**Lab: Magnetic Characterization (ELB 341)**

Week 4 (Feb. 11)  
Transmission Electron Microscopy  
**Lab: TEM (CCMB)**

### **Experiment 2: Colloidal Gold**

Week 5 (Feb. 18)  
Review of Electrochemistry  
**Lab: Synthesis of colloidal gold through electroless deposition (ELB 341)**

Week 6 (Feb. 25)  
Optical Properties of Metal and Plasmonics  
**Lab: UV-Vis spectroscopy (ELB 341)**

Week 7 (March 4)  
Applications and Scanning Electron Microscopy  
Lab: SEM (CCMB)

### **Experiment 3: Gold Nanostructures and Surface Enhanced Raman Scattering**

Week 8 (March 18)  
Lithography and Nanosphere Lithography  
Lab: Self-assembly of polystyrene nanoparticles (ELB 341)

Week 9 (March 25)  
Raman Scattering and Surface Enhanced Raman Scattering  
Lab: Fabrication of Au nanovoid arrays (ELB 341)

Week 10 (April 1)  
Raman Scattering and Surface Enhanced Raman Scattering  
Lab: Raman spectroscopy (CCMB)

### **Experiment 4: Porous Anodic Aluminum Oxide**

Week 11 (April 8)  
Vacuum Science and Technology  
Physical Vapor Deposition  
Lab: Sputtering of Al film (ELB 326)

Week 12 (April 15)  
Anodization  
Lab: Anodization (ELB 341)

Week 13 (April 22)  
Electrodeposition and Atomic Force Microscopy  
Lab: AFM (CCMB)

Week 14 (April 29)                      Student presentations

Week 15 (May 6)                        Summary

*“As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –Yaowu Hao.”*