**Chemistry 463L**

**Spring 2018**

# Chemical Nanotechnology Laboratory Syllabus

**Course Overview:**

CHEM 463 is intended for upper division chemistry majors in the Chemical Nanoscience track. It is a laboratory course that explores the principles of chemical nanotechnology through experiments that demonstrate the techniques used in the synthesis and characterization of nanoscale materials. Special emphasis will be placed on examining the size-dependent properties of various nanoscale materials using spectroscopic instrumentation.

**Instructor:**

Dr. Ralf Haiges

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Office Hours: TBA

**Laboratory:** SGM 142

**Laboratory, Lecture & Discussion:**

Eight 4-hour laboratories

Eight 1-hour lectures

**Prerequisite:**

CHEM 322A or CHEM 325A

**Required Reading:**

1. Chemical Nanotechnology Laboratory Manual, USC Department of Chemistry.

2. You should read the primary literature as indicated below prior to starting each lab:

Lab 1: G. P.Smestad and M. Grätzel, *J. Chem. Edu.* **1998**, *75*, 752-756. B. Forslund, *J. Chem. Edu.* **1997**, *74*,962-963. J. Tanaka and S. Suib, *J. Chem. Edu.* **1984**, *61*, 1104-1106.

Lab 2: Jin-HuaLiu et al., *Langmuir* **2008**, *24*, 5241-5244. J. Jasieniak et al., *J. Phys. Chem. C* **2009**, *113*, 19468-19474.

Lab 3: R. P.Bagwe et al., *Langmuir* **2004**, *20*, 8336-8342. Y. Jin et al., *Chem. Mater.* **2008**, *20*, 4411-4419. C. Chang and H.S. Fogler, *Langmuir* **1997**, *13*, 3295-3307.

Lab 4: K. G. Shields and C. H. L. Kennard, *J. Chem. Edu.* **1974**, *51*, 265.

**Laboratory Assignments:**

Nanoparticles, which typically have diameters in the range of 1 to 100 nanometers, are currently the focus of intense scientific research due to a wide variety of potential applications in the optical, electronic, and biomedical fields. The laboratories in this course will utilize a set of diverse experimental techniques to synthesize various types of nanostructures (e.g. CdSe quantum dots and silica nanoparticles). They will also employ some of the common techniques that are used to characterize these nanomaterials. In addition, they will demonstrate a practical application of chemical nanotechnology (i.e. the conversion of solar energy to electrical energy). The goal is to introduce students to some of the core concepts of chemical nanotechnology, using a very practical “hands on” approach.

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| **Lab** | **Experiment** | **Report Due** |
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| 1 | Preparation of Dye-Sensitized TiO2 Solar Cells. | TBA |
| 2 | Synthesis of CdSe Nanocrystals of Various Diameters and their Optical Characterization. | TBA |
| 3 | Preparation of spherical SilicaNanoparticles of varying size using water-in-oil microemulsion. | TBA |
| 4 | Identification of unknown crystals by X-ray diffraction and SEM/EDX analysis. | TBA |
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**Grading:**

* A laboratory report is due one week after each of the experiments.
* A term paper, discussing in more detail a topic in nanochemistry (topic to be announced later). The topic will be directly related to one or more of the experiments performed this semester. The term paper is due two weeks after the last experiment.

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| **Assignments** | **Points** |
| 4 Laboratory Reports | 100 each |
| Term Paper | 250 |
| **Total** | **650** |

**Statement for Students with Disabilities:**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to Dr. Haiges as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

**Statement on Academic Integrity:**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. *Scampus,* the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/scampus/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

The Trojan Integrity Guide can be found at

http://www.usc.edu/student-affairs/SJACS/forms/tio.pdf.

The Undergraduate Guide for Avoiding Plagiarism can be found at

http://www.usc.edu/student-affairs/SJACS/forms/tig.pdf.

**REQUIRED MATERIALS:**

The following items should be brought to the lab at **every** lab meeting:

* Laboratory Manual
* Laboratory Notebook
* Pencil and pen
* Locker combination
* Scientific Calculator
* Metric Ruler
* Safety Goggles (**OSHA approved**) **must be worn at all times in the lab**
* Laboratory Coat
* Permanent Marker (dark color)

**LAB NOTEBOOKS:**

You will need to keep a Lab Notebook. The Lab Notebook is an extremely important part of any laboratory since it is the permanent record of what was done and what was observed. Thus, you will be graded on the quality of maintenance of your Lab Notebook. Your Notebook must be examined by the TA and signed by him/her at the end of every lab session. It must have carbon pages and you must turn in the carbons *from every period* when you leave.

Lab Notebooks will periodically be checked. All primary data and observations (this includes all measured quantities such as masses, volumes, temperatures, times of observed changes in appearance, etc.) are to be recorded directly in a laboratory notebook with a **carbon copy** at the time they are determined or measured. It is not acceptable to record the data on pieces of scratch paper or paper towels and copy them over later to the notebook. If a mistake is made in recording data, the erroneous data should be lined out using a *single* line (not erased, written over, scribbled out or whited-out) so that it may still be read, and the correct data written alongside or above it. Figures or writing that are illegible will not be graded. Any attached spectra must be neatly folded (if needed) and attached firmly with tape. *Please see guidelines for written laboratory reports for additional information.*

**Safety is always the first priority in any laboratory**. Your Teaching Assistants will fill you in on how to comply with the requirements for maintaining a safe environment and using safe laboratory techniques. Failure to comply with these procedures will result in a student’s immediate expulsion from the laboratory.

**SAFETY GOGGLES AND PROTECTIVE CLOTHING:**

Eye protection must be worn in all laboratories whenever any laboratory work is in progress. A lab coat, closed-toe shoes, and long pants must be worn when doing experimental work. Shorts and sandals are NOT allowed in the laboratory. You will not be allowed to participate in the experiment if you are not wearing the appropriate protective clothing.

**LAB REPORTS:**

Lab reports are due on the dates listed in the syllabus at the beginning of the lab period. All written materials must be typed. See laboratory report guidelines for more information on lab reports. Late lab reports will be accepted up to 1 week late. 10 points per day will be deducted from late reports for the first 4 days, and 45 points total will be deducted from the total score for days 5-7. Late lab reports will not be accepted after 1 week past the due date. There are no regrades for lab reports. If you have an issue with the grading of lab reports, please submit it in writing directly to Dr. Haiges within 3 days of the report being returned. No lab reports will be looked at after this time.

**Attendance: *This is a laboratory course and attendance at all lab periods is mandatory. No make-up labs can be given in this course***. Absences will be excused only for medical reasons or in the case of extreme necessity. Written excuses or student health center slips must be presented to Dr. Haiges for approval and should be secured in advance whenever possible. In the case of an excused absence, a grade will be assigned which is based on the average of the student’s class rank. Any unexcused absence will result in a grade of zero for that laboratory. The instructor reserves the right to drop any student for excessive absences from laboratory. Students who miss **two or more experiments** will automatically fail the course.

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