Introduction to Materials Science
Appl 50
Tues/Thurs 12:30-1:45 Phillips 265

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Office Hours: 3:30-5:00 Tuesday

Text: **Materials Science and Engineering**, sixth edition, William D. Callister, Jr. CD included.

Materials Science: It easy to underestimate the general importance of materials science and engineering. Of course we are aware that it is advances in materials science that produce our lighter and stronger bike frames and golf clubs, and our thinner and brighter computer displays. But we can also step back and think a little about the bigger picture. An argument can be made that among the advances in knowledge directly affecting human culture as a whole, the advances of materials science are the ones that have had the most profound and long lasting effects. Advances in materials science are central to our understanding of history, from the origins of civilization in prehistory to the current information revolution. The "stone-age", "bronze-age", "iron-age", the industrial revolution (steel), and the computer revolution (silicon) are labels for different stages of human civilization, defined in part by the level of knowledge of materials.

We are living now in a time of dizzying scientific and technological advances and it is not yet clear how these discoveries will affect our future. Materials science, along with many other fields of science, is undergoing a rapid pace of discovery. Advances in microscopy and synthesis techniques have ushered in a completely new area of research known as nanomaterials. Working at the atomic and molecular scale, scientists and engineers are building materials "from the bottom up", tailoring materials with desired properties by manipulating the structure with unprecedented precision. Another area of activity is in biomaterials and biomimetics. Researchers are making huge advances in both creating synthetic materials for bio applications, as well as learning to imitate biological methods of materials synthesis (biomimetics) for advanced applications. It is an exciting time for materials science from both a basic science well as a technological perspective.

Course Description

This course is an introduction to materials science, and therefore we will start from the beginning. Before studying materials properties, we will first study the basic building blocks of materials (atoms), the various ways they interact (bonding), and how they arrange themselves (crystal systems). We will then go on to study the various ways that materials' behavior can be characterized (mechanical, electrical, magnetic, optical properties). In parallel to studying properties, we will learn about the different categories of materials: metals, ceramics, polymers, etc. On occasion I will introduce you to material outside the book on topics in current materials research (nanomaterials and biomaterials research going on here at Carolina).

Evaluation and Grading

Your graded course work will consist of homework, quizzes, a mid-term exam and a final. I've listed a breakdown of the grade percentages below:

Homework	20%
Quizzes	25%
Midterm	25%
Final	30%

Attendance

I hope that it goes without saying that I expect you all to attend each lecture and to arrive on time. We have a lot of material to cover and we will be proceeding at a very brisk pace (we will cover most of the 800 page text book during the semester). You cannot afford to miss class periods. Any conflicts you have with scheduled quizzes or exams must be discussed with me with well ahead of time so arrangements can be made for make up.

Homework

You will have homework due each week on Thursday. Homework will consist primarily of problems from the book. I will not be grading your homework in any detailed way. The homework will simply be checked for completeness. I encourage working together as far as sharing ideas, but I require that the homework you turn in is your own work. In other words if you turn in a completed homework problem, it should mean that you can work the problem **on your own** from scratch and understand all the steps and why you made each step. For tests and quizzes, you will have to rely on your abilities alone, so turning in homework that you don't understand will surely lead to disaster during a test. ***Homework assignments are listed on the course webpage***. You are responsible for referring to this schedule to determine when homework is due.

Quizzes

Quizzes will be given every other Thursday as indicated in the course schedule. The quizzes will be held at the beginning of class and will last 15 minutes or so. These quizzes will be similar to homework problems but will be answerable in the allotted time. They will require either very brief calculations or short answer. Completing and understanding the assigned homework thoroughly will be a good preparation for quizzes.

**** **Always bring calculators for quizzes and tests.*******

Midterm and Final

Tests will be similar to quizzes in their form and content. Like homework, the process of working the problem will be as important as the answer, so partial credit will be given.