

## MSE 5345

### CERAMIC MATERIALS

2010-2011 Semester 1

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- Course Content**      The first half of the course will concentrate on understanding fundamental issues related to the processing of ceramics. Methods examined include molding, sintering, HIP, Hot Pressing, Sol-Gel, Hydrothermal Reaction sintering etc. The second half of the course is devoted to developing a fundamental understanding of the mechanical, physical, electrical and biological properties of ceramics.
- Learning Obj**      This course has the goal of introducing students to the field of technical ceramics. Specific objectives of the course include:
- To develop a broad understanding of the structure, chemistry and bonding in ceramics.
  - Explore in detail the different approaches by which engineering ceramics are made with special emphasis on some of the newer techniques of synthesis.
  - Examine the relationship between the structure and properties of ceramics with emphasis placed on mechanical, electrical, magnetic and biological properties of ceramics.
- Text Book**      Notes will be provided that may be electronically uploaded at a location where students can download them. Details will be forthcoming soon.
- Lectures**      Tuesday and Thursday between 11:00 and 12:20 in Rm 210 WH. In addition due to the instructor's travel schedule, make up classes will be conducted at a time that is mutually acceptable for the students and the instructor.
- Homework**      As assigned
- Office Hours**      Tuesdays 1:00 to 3:00 in Rm 302 ELB or by appointment

**Examinations**

Exam I	October 26 <sup>th</sup> , 2010
Exam II	November 30 <sup>th</sup> , 2010
Final	Dec. 14 <sup>th</sup> 2010, 11:00 to 1:30 pm

**Grading**

HW	5%
Exam I	20%
Exam II	20 %
Term Paper I	10% (Processing of Ceramics)
Term Paper II	10% (Properties of Ceramics)
Presentation	10%
Final (Comprehensive)	25%

**Grading:**

<b>&gt; 85</b>	<b>A Grade</b>
<b>75-84</b>	<b>B Grade</b>
<b>65-74</b>	<b>C Grade</b>
<b>55-64</b>	<b>D Grade</b>
<b>&lt; 55</b>	<b>F</b>

## **American With Disabilities Act**

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112 - The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act (ADA), pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide “*reasonable accommodation*” to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with **informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels**. If you require an accommodation based on disability, I would like to meet with you in the privacy of my office during the first week of the semester to make sure that you are properly accommodated.

## **Academic Dishonesty**

It is the philosophy of the University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University.

**“Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.” (Regents’ Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)**

# SYLLABUS

## MATERIAL COVERED

### **Introduction to Ceramics**

### **Types of Ceramics-Overview**

### **Ceramic Crystallography**

### **Ceramic Processing**

Overview

Raw Materials

Typical Molding Methods

Solid State Sintering

Reaction Bonding

Hot Pressing

Hot Isostatic Pressing

Sol-Gel Processing

Polymer Pyrolysis

Hydrothermal Synthesis and Hydrothermal Reaction Sintering

Gas Phase Reaction

Microwave Sintering

Self Propagating High temperature Synthesis

DIMOX Process

Some New and Advanced Techniques

Glass fibers

Glass materials.

### **Machining of Ceramics**

Cutting

Grinding

Polishing

Laser Machining

Ultrasonic Machining

Abrasive Water Jet Cutting

### **Ceramic Coating**

CVD Coatings

Plasma Spray

## **Mechanical Properties**

Tensile Properties

Impact Properties

Fatigue of Ceramics

Fracture Behavior---Toughening Mechanisms in Ceramics

Creep of Ceramics

## **Electrical Properties**

Insulating Properties

Semiconductors

Dielectric Properties

Piezo Properties

## **Bio Ceramics**

Optimization of Biological Implants

Case studies of different implants and materials used

## **High Temperature Composites**

Creep of Fibers

Creep and Fracture of Ceramic Matrix Composites.