

EMA 4144 Physical Ceramics
Fall, 2014
Section 1113

1. Catalog Description:

This course covers the structure of complex ceramic compounds and glasses. The influence of structural imperfections and stoichiometry on physical characteristics, surface, and interfacial phenomena, diffusion, and phase transformations in ceramic systems are also discussed. (3 credit hours)

2. Prerequisites and Co-requisites:

The prerequisite for the course is EMA 3050: Introduction to Inorganic Materials.

3. Course Objectives:

In this course the student is introduced to modern ceramic materials, their structure, properties, applications, potential uses and limitations. The specific objectives are to:

- Appreciate the factors that render ceramics unique and different from other materials
- Comprehend the bonding/property relationships in ceramics
- Understand the fundamental role of point defects and stoichiometry on the electric, dielectric, and diffusional properties of ceramics
- Gain knowledge of optical, magnetic and dielectric properties of ceramics
- Discover the critical role of flaws, surfaces and interfaces on mechanical properties

4. Contribution of course to meeting the professional component:

This course provides 3 credits towards Engineering Sciences.

5. Relationship of course to program outcomes:

This course addresses the following MSE Program outcomes:

- Ability to apply knowledge of mathematics, science, and engineering to materials systems (High coverage). Students demonstrate this knowledge on homework problems and exams.
- Understanding of professional and ethical responsibility (Medium coverage). During discussions of new concepts, examples of real-world engineering problems involving both technical and ethical issues are included whenever possible and then evaluated during testing.
- Understanding of the global, societal, and environmental impact of engineering solutions, including safety, the environment, the global economy, and intellectual property (Low coverage). As part of the lectures and class discussions, students are asked to consider economic, societal and environmental factors, such as production costs, recycling and marketing.

6. Instructor:

Prof. Susan B. Sinnott

- Office: 164 Rhines Hall
- Telephone: 846-3778
- E-mail address: ssinn@mse.ufl.edu
- Web site: <http://sinnott.mse.ufl.edu>
- Office hours: Monday and Wednesday 10:30-11:30 AM, Thursday 1:30-2:30 PM

7. Meeting Times:

3rd period on Monday, Wednesday, and Friday

5th period on selected Thursdays

8. Meeting Location:

LAR310

9. Textbooks Required:

- Title: Fundamentals of Ceramics
- Authors: M.W. Barsoum
- Publisher: Institute of Physics
- Publication date and edition: 2003, second
- ISBN number: 0-7503-0902-4

10. Attendance:

Class discussion and participation is part of the course grade, so regular attendance is strongly encouraged.

11. Grading:

The course grade is based on numerical scores that include homework, a class paper, and exams according to the following weighting system:

Homework	6%
Class discussion and participation	6%
Term paper	22%
3 Exams	(22% each)

12. Grading Scale:

Letter grades will be assigned as follows:

92-100= A; 91-88 = A-; 87-84 = B+; 83-80 = B; 79-76= B-; 75-72 = C+; 71-68 = C; 67-65 = C-; 64-62 = D+; 61-59 = D; 58-56 = D-; Less than 56 = E. Grades may be curved up at the end of the course at the discretion of the instructor.

13. Make-up Exam Policy:

No makeup exams will be given without an excused absence supported by written documentation.

14. Course Outline:

Class Date	Topic	Relevant Information or Reading Assignment	Homework Problems (shown on due date)
8/25	Introduction – Dr. Phillpot substituting		
8/27	Chemical forces - physical properties	4.1, 4.2	
8/29	Chemical forces - physical properties	4.3, 4.4	
9/1	Labor Day – no class		
9/3	Chemical forces - physical properties	4.5	
9/5	Chemical forces - physical properties	Case study discussion	#1: 4.1, 4.3, 4.4, 4.6, 4.7
9/8	Thermo and kinetics	5.1, 5.2	
9/10	Thermo and kinetics	5.3, 5.4	
9/11	Class – Thermo and kinetics	5.6, 5.7	
9/12	Thermo and kinetics	5.8 + case study discussion	#2: 5.2, 5.3, 5.6
9/15	Defects	6.1 up to 6.2.3	
9/17	Defects	6.2.3 up to 6.2.5	Term paper topics due by email
9/19	No class		
9/22	Defects	6.2.5 up to 6.3	
9/24	Defects	6.3, 6.4	#3: 6.2a, 6.3b(ii),(iii),(v), 6.6, 6.12
9/25	Class - Review for the exam		
9/26	Exam 1		
9/29	Diffusion and electrical cond.	7.2.1 up to 7.3	
10/1	Diffusion and electrical cond.	7.3, 7.4	
10/2	Class – Diffusion and electrical cond.	7.4, 7.5	
10/3	Diffusion and electrical cond.	Case study discussion	#4: 7/3, 7.6, 7.13, 7.15
10/6	No class		
10/8	No class		
10/10	Dielectric properties	14.1, 14.2, 14.3	
10/13	No class		
10/15	Dielectric properties	14.4	
10/16	Class - Dielectric properties	14.5, 14.6, 14.7	
10/17	UF Homecoming – no class		
10/20	Dielectric properties	Case study discussion	#5: 14.4, 14.8, 14.11, 14.13b
10/22	Nonlinear dielectric properties	15.7	
10/23	Class – Nonlinear dielectric properties	Case study discussion	
10/24	Optical properties	16.1, 16.2	#6: 15.14, 15.15
10/27	Optical properties	16.3	
10/29	Optical properties	16.4, 16.5	
10/30	Class – Optical properties	Case study discussion	#7: 16.2, 16.7, 16.12, 16.15
10/31	Review for the exam		
11/3	Exam 2		
11/5	Glass	9.1, 9.2.1	
11/6	Class – Glass	9.22, 9.2.3, 9.2.4	
11/7	Glass	9.3, 9.4	
11/10	No class		
11/12	No class		
11/14	No class		
11/17	Glass	9.5	Term paper due by email
11/19	Glass	Case study discussion	#8: 9.2, 9.4, 9.11
11/20	Thermal properties	13.1-13.3	
11/21	Thermal properties	13.4-13.6	
11/24	Thermal properties	13.6 + case study discussion	#9: 13.1, 13.3d, 13.5, 13.8, 13.11, 13.12
11/26	Thanksgiving Holiday – no class		
11/28	Thanksgiving Holiday – no class		

<i>12/1</i>	<i>No class</i>		
<i>12/3</i>	<i>No class</i>		
12/5	Review for the exam, class evaluations		
<i>12/8</i>	<i>Exam 3</i>		
12/10	Class wrap-up		

15. Assignments:

- Homework problems are given on their due dates in the table above. No late homework will be accepted but handing in homework early is always okay. Group problem solving and teamwork is encouraged but all homework that is turned in should be your own work.
- The 15-page term paper is due by email in PDF format by 11:59 PM on November 17. It should focus on an aspect of ceramic engineering that is of interest to you. The paper should be double spaced with 1 inch margins on all sides and use a Times New Roman 12 pt font. It can focus on a particular material, a process, properties, applications, synthesis approaches, modeling or any combination of these. Any figures or tables that are not your own should have their source referenced in the captions or titles. A title page and complete bibliography should accompany your paper and does not count towards the 15-page limit. Care should be taken to not plagiarize the work of others – plagiarism will result in a grade of E for the assignment.
- Exams will closely follow the material covered in class. No cell phones or programmable calculators may be used or be out on your desk during exams. Use of these items will be considered to be violation of exam rules and will result in an E on the exam. Requests for re-grading must be made within one week after an assignment has been returned if the exams are taken in ink. If pencils are used on the exams, no regarding requests will be considered.

16. Honesty Policy:

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

17. Accommodation for Students with Disabilities:

Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

18. UF Counseling Services:

Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.

- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

19. Software Use:

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.