EMA 4145 Physical Ceramics 2
Spring, 2019, Section 0958

1. Catalog Description:

Influence of ceramic microstructure on processing. Chemical bonds, surface phenomena, forming energetics, drying and firing kinetics. Diffusion, nucleation, crystal growth, solid-solid and solid-liquid reactions.

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. John Mecholsky, Jr.

- Office: 100 D Rhines Hall
- Telephone: 846-3313
- E-mail address: jmech@mse.ufl.edu
- Web site: http://mecholsky.mse.ufl.edu/.htm
- Office hours: TBA

7. Teaching Assistant: None

8. Meeting Times: T 3; R 3-4

9. Meeting Location: T – LIT 0221
R - LIT 0223

10. Textbooks Required:

- Title: Ceramic Materials: Science and Engineering
- Authors: C. Barry Carter and M. Grant Norton
- Publisher: Springer
- Second edition
- ISBN number: **9781461435228**

11. Course Outline (tentative):

Class Date	Topic	Chapters
Jan 8	Syllabus review Glass and Glass Ceramics	CN 21
Jan 10 (2H)	Glass and Glass Ceramics	CN 21
Jan 15	Solid State Transformations	CN 25
Jan 17 (2H)	Solid State Reactions	CN 25
Jan 22	Processing Glass and Glass Ceramics	CN 26
Jan 24 (2H)	Processing Glass and Glass Ceramics	CN 26
Jan 29	Coatings and Thick Films	CN 27
Jan 31 (2H)	Coatings and Thick Films	CN 27
Feb 5	Thin Films and Vapor Deposition	CN 28
Feb 7(2H)	Thin Films and Vapor Deposition	CN 28
Feb 12	Growing Single Crystals	CN 29
Fen 14(2H)	Growing Single Crystals	CN 29
Feb19	Mid-Term # 1	CN 21 & 25-29
Feb 21(2H)	Conducting Charge or Not	CN 30
Feb 26	Conducting Charge or Not	CN 30
Feb 28(2H)	Locally Redistributing Charge	CN 31
Mar 12	Locally Redistributing Charge	CN 31
Mar 14(2H)	Interaction with Light	CN 32
Mar 19	Interaction with Light	CN 32
Mar21(2H)	Using Magnetic Fields	CN 33
Mar 26	Using Magnetic Fields	CN 33
Mar 28(2H)	Temperature Change	CN 34
Apr 2	Mid-term # 2	CN 30-34
Apr 4(2H)	Ceramics in Biology & Medicine	CN 35
Apr 9	Ceramics in Biology & Medicine	CN 35
Apr 11(2H)	Minerals and Gems	CN 36
Apr 16	Energy production	CN 37
Apr18(2H)	Industry and Environment	CN 38
Apr 23	**Mid-Term # 3**	CN 35-38
	No Final Examination	

12. Grade Determination

Tests	60 %
Quizzes	10 %
Paper	20 %
Homework	10 %

Grading Scale - The grading scale is indicated below. Grades are not curved.

Percentage	≥92	≥88	≥84	≥80	≥76	≥72	≥68	≥65	≥62	≥59	≥56	<56
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0

13. Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is highly encouraged since significant amount of individual and collaborative work will be performed during the class sessions. Moreover, key explanations and examples that will aid in preparation for the exams will be presented in class. Exams will be open book and in class as scheduled above. Students are allowed to bring the hardcopy of the second edition of the course textbook. Digital versions or home printed versions of the book will not be allowed during the exam. Solution to the exam will not posted. Students can review the exam solution during office hours. **There will be no make-up exams given the advanced exam scheduling**. Exceptions will be made only dueto verified personal emergency supported by written documentation. **There will be no final exam**.

Homework problems will serve as preparation for the exams and are assigned roughly every four weeks with the exercises posted on CANVAS. Homework is to be submitted online on CANVAS as a PDF file and will be due by **10 pm the following Monday.** The availability to submit homework answers online is controlled automatically.

No late homework will be accepted. Group discussions towards homework solving and teamwork are encouraged but all answers that are turned in should be the result of your own work. Four unannounced Quizzes will be distributed throughout the course and will occur on Thursdays. Quizzes will consist of two simple questions about the material covered on Tuesday of that week. Correctly answering one of the two questions will be sufficient to receive full credit. **Students not attending that day will receive a scoreof zero points in that quiz**.

Excused absences are consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation. **Any tests missed will count as zero unless a written excuse is submitted before the test. The make-up test will have to be taken at the earliest possible date. Emergencies that arise will have to be documented by the appropriate authority. Attendance is expected. Quizzes will count as a record of attendance. Thus, the penalty for unexcused absences is a lower grade.**

14. Academic Honesty:
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 student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

15. 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.

16. 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.

17. 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.

18. **Professional Component Content:**

Math and Basic Science:	20%
Engineering Topics	
Engineering Science	50%
Design	10%
General Education	10%
Other	10%

19. **Record keeping** - all materials from this class that students did not pick up (graded exams, etc.) within 1 year of the end of class will be shredded on or after June 30, 2019.

20. **Syllabus Changes** – I reserve the right to make changes in the syllabus as needed. Any changes will be clearly announced on canvas and in class.