

# EMA 4144 Physical Ceramics

## Fall, 2017, Section 1G68

### 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. Wolfgang Sigmund

- Office: 225 Rhines Hall
- Telephone: 846-3343
- E-mail address: [wsigm@mse.ufl.edu](mailto:wsigm@mse.ufl.edu)
- Web site: <http://sigmund.mse.ufl.edu/classes.htm>
- Office hours: T 1-3 pm

**7. Teaching Assistant:**

Hiraku Maruyama

Contact information and office hours TBA on e-learning

**8. Meeting Times:**Tuesday 3<sup>th</sup> period, Thursday 3<sup>rd</sup> and 4<sup>th</sup> periods**9. Meeting Location:**

Weil 0279

**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	Relevant Information or Reading Assignment	Homework
T, 8/22	Introduction	C1	HW 1 out
R, 8/24	History	C1/2	
T, 8/29	Examples	C2	
T, 9/5	Background refresher	C3	
R, 9/7	Atoms and bonding	C3/4	HW 1 due
T, 9/12	Types of bonding	C4	
<b>R, 9/14</b>	<b>Exam 1 – C1-4</b>	C1-4	HW 2 out
T, 9/19	Review	C5-8	
R, 9/21	Furnaces	C9	
T, 9/26	Characterization	C10	
R, 9/28	Characterization	C10	
T, 10/3	Characterization	C10	HW 2 due
R, 10/5	Defects and Dislocations	C11/12	
T, 10/10	Dislocations	C12	
<b>R, 10/12</b>	<b>Exam 2 – C5-12</b>	C5-12	HW 3 out
T, 10/17	Surfaces	C13	
R, 10/19	Nanoparticles	C13	
T, 10/24	Interfaces	C14	HW 3 due
R, 10/26	Interfaces	C14	
T, 10/31	Phase boundaries	C15	
<b>R, 11/2</b>	<b>Exam 3 – C13-C15</b>		HW 4 out
T, 11/7	Phase boundaries	C15	
R, 11/9	Mechanical testing	C16	
T, 11/14	Mechanical testing	C16	
R, 11/16	Plasticity	C17	HW 4 due
T, 11/21	Plasticity	C17	

T, 11/28	Brittleness	C18	
<b>R, 11/30</b>	<b>Exam 4 – C15-18</b>	C15-18	
T, 12/5	Class wrap up		

## 12. Grading:

The course grade is based on numerical scores that include homework, group problems, exams, and a cumulative final according to the following weighting system:

Homework	10%
Class participation	10%
Exam #1	20%
Exam #2	20%
Exam #3	20%
Exam #4	20%

## 13. Grading Scale:

%	≥94	≥91	≥88	≥85	≥82	≥79	≥76	≥72	≥68	≥64	≥60	<60
Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

Grades are not curved. There is no final exam in this class.

*“C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement.” For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx> “*

14. *Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found*

*at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>*

*Homework is due online in e-learning, no late homework will be accepted. If you have trouble with on time submission on e-learning you need to get a trouble ticket from the UF help desk before the deadline and also send an email alerting the instructor about the problem. Late submissions without trouble ticket and email alert will not be considered.*

*Make-up Exam Policy – There is the option of a term paper elective to replace one exam score for either a missed exam or a low score. There is an oral exam option for any of the exams. It needs to be arranged in advance. Term paper due date October 31, 2017.*

*The course will use online quiz system in class.*

15. *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.*

*Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.*

*See <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>*

16. *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.*

17. *UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:  
UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.  
Career Resource Center, Reitz Union, 392-1601, career and job search services.*
18. *Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.*
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.*
20. 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 December 31, 2018.
21. 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.

**Sections in italics are from the UF catalog or from the Herbert Wertheim College of Engineering suggested syllabus.**